A SCIENTIFIC ANALYSIS
OF RUNNING LINES IN RUGBY

by

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Submitted in fulfilment of the requirements for the degree
MAGISTER ARTIUM (HMS)

in the

FACULTY OF HUMANITIES
DEPARTMENT OF BIOKINETICS, SPORT AND LEISURE SCIENCES
UNIVERSITY OF PRETORIA

PRETORIA
FEBRUARY 2003
DEDICATION

This dissertation is dedicated to Leta, Oupa, Nanna, Michelle, my family, and all my friends who have supported me during the last two years.
ACKNOWLEDGEMENTS

I would appreciate the opportunity to thank the following people and institutions for their guidance and help in order to successfully complete this study.

Prof. P.E. Krüger (Promoter): Department Biokinetics, Sport and Leisure Sciences, University of Pretoria). For his time, guidance and continuous support. I have had many years of contact with him and it has been a privilege. I look forward to working with him in the future.

Prof. M. Spamer: Thank you for your input in evaluating this dissertation.

Albert de Wet: Thank you for your help with the statistical input and advice. You have been a wonderful friend and I am grateful that I could share my thoughts and ideas on this study with you knowing that we could together put together the scientific thinking necessary to complete this study. I look forward to your further support in the future.

The Blue Bulls U21 Team: Who have been a wonderful source of enjoyment to me during the last two years and who have been instrumental in the results obtained during the season. It has been a privilege to work with such talented and mature young men who I believe have the ability to reach the highest levels in South African rugby. Also to my coaching staff, thank you for your help and support during this season, our success is in no small manner an indication of your ability and work ethic. The management at the Blue Bulls Company in particular Heyneke Meyer, John MacFarland and Ian Schwartz for your support the last two years.
Willem Boshoff: Thank you for your advice and for making your vast knowledge about this wonderful game available to me. For making all your coaching resources available without ever blinking an eyelid and for being such a wonderful friend. You are a true gentleman and a rugby man through and through!

Riel du Toit: Most of what I know about coaching is due to the time we spent working together as coaches and as friends. Thank you for your support and the coaching path we have taken thus far. Although we might not be coaching together at this stage, I know our paths will meet again on the rugby field. You are the most knowledgeable backline coach I know and I know I will still learn much more about this game from you in the future.

Oom Spiere van Rensburg: Thank you for everything you have done for me in regards to my coaching career since I started coaching in 1997. Your support and input has been greatly appreciated and I owe most of what I know about the “art” of coaching players to you. You are a wonderful man and a great friend.

Michelle Roux: Thank you for all your help with the design of the graphs, the scanning of the pictures for the document and for the detailed final touches of the document. Your support during the whole process of this study has been a wonderful aid and you are greatly appreciated! The amount of time you have spent helping me with the details of this dissertation bears testimony to your unselfish nature and your unending willingness to help. Thank you as well to Gerhard, Haricklia and Jacques for putting up with my many hours in front of your computer and for your support the last two years.

Thomas Stephenson: Thank you for the help with the technical aspects of this dissertation.

Jesus Christ: This has been a year filled with many challenges. The mere fact that I have been able to complete this study is an indication of the wonderful grace that Jesus has bestowed upon me. His continued presence in my life has allowed to achieve and complete those things so often taken for granted and to Him all the glory.
“I have strength for all things in Christ who empowers me, I am ready for anything and equal to anything through Him; I am self-sufficient in Christ’s sufficiency.”

Philippians 4:13
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The game of rugby has been played for over a century and yet its intricacies are still not fully understood. The key ingredient coaches are seeking is what can be added to a team’s make-up that will result in an increase in that teams level of playing success.

The objective of this study is the exploration of the biomechanical aspects of movement in a rugby context specifically looking at the stages before, during and after contact. The hypothesis is that the optimal use of running lines in rugby union will lead to more successful breaches in the opposition’s defensive lines thus an increase in linebreaks will occur.

In order to make a comparison based on scientific research principles, nine matches played during the 2001 season was compared with nine matches played during the 2002 season. For each match played in the 2001 and 2002 seasons the total number of linebreaks achieved in a match was calculated. In addition the total number of linebreaks achieved in the 2002 season was further subdivided into the specific categories of intervention in order to determine which intervention had the biggest impact on the total number of linebreaks achieved.

By means of video footage of the matches played notational analysis was performed and information was gathered in order to gain data for further evaluation. The actions regarding the execution of the linebreaks were evaluated manually in respect of the intervention that was imposed during the coaching of the team during the 2002 season.
Without exception a comparison between similar teams played during both seasons indicated that the total number of linebreaks achieved during the 2002 season was much higher than when the team competed against similar opposition during the 2001 season. The aggregate numbers indicated a significant increase in linebreaks from the 2001 to 2002 season.

This conclusion was achieved by means of a simple T-test. Firstly an applied F-test test was done to determine whether the two samples had equal variances or not. Under the null hypothesis we assume that the variances of the two samples are equal, while the alternative states that the two samples have different variances. A value for the test statistic that is greater than the critical value will lead to a rejection of the null hypothesis.

The test statistic was calculated and evaluated against the $F_{(8,8)} = 2.59$ critical value on a 5% level of significance. The value of 15.921 is greater than the critical value of 2.95 and therefore the null hypothesis cannot be accepted, concluding that the two samples do not have equal variances. We then proceeded to test whether the 2002 average linebreaks are significantly higher than the average linebreaks achieved in the 2001 season.

Under the null hypothesis the two sample averages are equal. Under the alternative, the 2002 average is higher than the 2001 average. In contrast to normal T-tests this specific test was a one-sided upper or right hand test due to the fact that we are testing whether the one average is greater and not equal to the other. Therefore, we would only reject the null hypothesis of equal sample averages if the test statistic were greater than the appropriate critical value.

The calculated test statistic is 4.4827 and was evaluated against the $t_{0.05,9} = 1.833$ critical value. Once again we cannot accept the null hypothesis. Therefore we can conclude that the average of the total linebreaks made during the 2002 season is statistically greater than the average of the total linebreaks made during the 2001 season.
The results of this study therefore indicate that the new techniques incorporated into the coaching of the team in 2002 did positively influence the number of linebreaks when compared to the 2001 season.

**KEY WORDS:** Rugby, coaching, biomechanics, running lines, defensive lines, linebreaks, video footage, notational analysis, null hypothesis.
SAMEVATTING

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Rugby word reeds vir langer as ‘n eeu gespeel dog word die fyner aspekte van die spel nog nie heetemal verstaan nie. Die belangrikste uitvindsel waarna afrigters strewe is dit wat sal veroorsaak dat daar ‘n verbetering is in die gehalte spel wat ‘n span kan speel.

Die doelwit van hierdie studie is die strewe na daardie biomekaniese aspekte van beweging in ‘n rugby konteks, en meer in besonder die verskillende fases voor, gedurende en na-kontak situasies. Die hipotese is dat die optimale gebruik van hardloop lyne in rugby sal veroorsaak dat daar meer suksesvolle breuke in die verdedigings lyne sal wees en dus sal daar ‘n hoë getal lynbreuke wees.

Ten einde ‘n vergelyking te kan maak wat gebaseer is op wetenskaplike beginsels, is nege wedstryde wat gedurende die 2001 seisoen gespeel is, vergelyk met nege wedstryde gedurende die 2002 seisoen. Vir elke wedstryd wat gespeel is gedurende die 2001 en 2002 seisoene is die totale lynbreuke in elke wedstryd gedefiniseer en bymekaar getel. Daarna is die lynbreuke van 2002 verder opgedeel in spesifieke kategorieë van intervensie ten einde te bepaal welke intervensie die grootste invloed gehad het op die totale getal lynbreuke wat suksesvol was.

Deur middel van video opnames van die wedstryde wat gespeel is, was daar statistieke geneem en inligting bymekaar gemaak ten einde data te versamel vir verdere evaluasie. Die aksies wat gedurende die uitvoering van die lynbreuke
toegepas was, is met die hand geevalueur om vas te stel watter van die intervensies
toegepas was in wedstrydsituasies gedurende die 2002 seisoen.

Sonder twyfel bewys ‘n vergelyking waar spanne wat gedurende die twee seisoene
gespeel het, dat die totale hoeveelheid lynbreuke wat suksesvol bereik was gedurende
die 2002 seisoen beduidend meer was as in die gevalle waar daar teen dieselfde
opposisie gespeel is gedurende die 2001 seisoen. Die somtotaal toon ‘n beduidende
verhoging in lynbreuke sedert die 2001 tot 2002 seisoen.

Hierdie aannem was bereik deur middel van ‘n eenvoudige T-toets. Eerstens was
daar gebruik gemaak van ‘n toegepaste F-toets om vas te stel of die twee steekproewe
gelyke afwyking het al dan nie. Onder die nul hipotese word daar aangeneem dat die
afwyking van die twee steekproewe gelyk is, terwyl die alternatief toon dat die twee
steekproewe verskillende afwykings het. ‘n Statistiese waarde vir die toets wat groter
is as die kritiese waarde sal beteken dat die nul hipotese verwerp word.

Die toets statistiek is uitgewerk en geevalueur volgens die \( F_{(8,8)} = 2.59 \) kritiese waarde
op ‘n 5% vlak van beduidendheid. Die waarde van 15.921 is meer as die kritiese
waarde van 2.59 en dus die onaanvaarbaarheid van ‘n nul hipotese, met ‘n
gevolgtrekking dat die twee steekproewe nie dieselfde afwyking het nie. Daarna is
voortgegaan om te toets of die gemiddelde lynbreuke vir 2002 beduidend hoër is as
die gemiddelde lynbreuke wat in 2001 bereik was.

As die nul hipotese gebruik is moet die twee gemiddelde steekproewe gelyk wees. In
die geval van die alternatief, was die 2002 gemiddeld hoër as dié van 2001. In kontras
met die normale T-toetse was hierdie spesifieke toets ‘n een kant regter hand toets as
gevolg van die feit dat daar getoets word welke die een gemiddeld groter en nie gelyk
is aan die ander nie. Derhalwe sou ons die nul hipotese van gelyke steekproef
gemiddeldes verwerp indien die toets statisties groter was as die toepaslike kritiese
waarde.

Die berekende statistiek is 4.4827 en was vergelyk met die \( t_{0.05,9} = 1.833 \) kritiese
waarde. Weereens kan ons nie die nul hipotese aanvaar nie. Daar kan derhalwe tot die
gevolgtrekking gekom word dat die gemiddeld van die totale aantal lynbreuke wat gedurende die 2002 seisoen gemaak is, statisties beduidend groter is as die gemiddeld van dié wat gedurende die 2001 seisoen gemaak is.

Die resultate van hierdie studie het dus aangetoon dat die nuwe metodes wat toegepas is in die afrigting van die span in 2002 'n positiewe invloed gehad het op die aantal lynbreuke in vergelyking met die 2001 seisoen.

SLEUTEL WOORDE: Rugby, afrigting, biomekanika, hardloop lyne, verdedigings lyne, lynbreuke, video opnames, statistiese analise, nul hipotese.
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