

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.

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Abstract

A retrospective analysis of performance during the Rugby Union World Cup 2003 was conducted by comparing data from the top three nations with data from South Africa (SA). Differences were observed between the four teams in three performance variables; number of penalty kicks and drop goals scored, and percentage possession. England scored more points from penalty kicks and drop goals. SA had less percentage possession than either England or New Zealand. SA's scoring opportunities began more frequently from inside the opposition's territory (86% of all scoring movements). Possession was most frequently lost when the movement began inside SA's territory (55% of all movements in which possession was lost). The duration for which possession was retained was greater for movements that resulted in points (21.9 ± 14.5 s), than where possession was turned over (14.8 ± 5.2 s) ($P < 0.05$). Points were scored against SA 24 times, 58% in the second half and 71% of the scores against SA occurred the next play after SA had lost possession. These data suggest that superior performance in World Cup rugby is linked to possession retained, the number of points scored in the second half and the propensity to lose possession in areas of the field from which the opposition is likely to score.

Keywords: Rugby, World Cup, Game analysis

1. Introduction

Although participation in amateur sport achieves many different goals, victory is the ultimate measure of success in professional sport. The most prestigious event in Rugby Union is the Rugby World Cup in which teams representing the top rugby playing nations in the world compete every 4 years for the William Webb Ellis Trophy. The team that wins the tournament is considered the "world champion" for the next four years.

A challenge for all teams is to identify the factors that contribute to the success of the winning team. Comparative studies conducted after previous Rugby World Cups have found that, although successful and unsuccessful teams play a similar style of rugby (Stanhope & Hughes, 1997), there were marked differences in some aspects of play between successful and less successful teams. Thus Stanhope and Hughes (1997) found that successful teams were more effective at rucking and kicking the ball into 'dangerous' areas of the field, allowing them to launch attacks from closer to their opponent's try line. As a result, they scored points more frequently. Successful teams in the 1991 World Cup also won significantly more scrums per match and had a greater variety of line out options (Hughes & White, 1997).

Data from the 1995 Rugby World Cup showed that the mean duration of the sequence of plays that led to a try was 25.3 seconds. The longest and shortest playing times before tries were scored were 84 and 2 seconds respectively (Carter & Potter, 2001). These authors also established that in 26 of the 32 matches (81%), the winning team scored more tries than the losing team; in 4 matches the try count was the same for both sides and in only 2 matches did the team with the least number of tries win the match (Carter & Potter, 2001).

For their analysis of the 1999 World Cup, Hunter and O'Donoghue (2001) divided the field into 3 areas; the attacking third, the midfield third and the defensive third. They found that winning teams in that competition entered the attacking third of the field more frequently and scored more points with each entry than did the losing teams.

The changes in performance at the 1991 and 1995 World Cup Tournaments have been highlighted by Potter and Carter (2001). For example, they found that the ball was in play for longer, passing was more frequent than kicking, and more tries were scored during the 1995 compared to the 1991 tournament. When those authors compared the performances of the winners of those tournaments with their records in previous tournaments, it was noted that increasing the number of passes from one tournament to the next did not predict success in the 1995 tournament. Australia passed less frequently in 1991 when they won the event than in 1995 when they failed to reach the semi finals. Similarly, New Zealand passed much less in 1995 when they finished second, than in 1991 when they came third.

It is unclear what influence the rule changes or the different environmental conditions have on the structure of the game as the separate effects of each factor cannot be distinguished. However, the study of Potter and Carter (2001) did establish that the amount of time a team retains possession of the ball and what they do with that possession, has changed over time. Thus teams kicked away possession on more occasions during the 1991 World Cup than during the 1995 tournament. There was thus a greater emphasis on recycling the ball and second phase possession during the 1995 than during the 1991 tournament.

These studies (Hughes & White, 1997; Stanhope & Hughes, 1997; Carter & Potter, 2001; Hunter & O'Donoghue, 2001; Potter & Carter, 2001) have all been designed to examine the performance of one team against another, a group of successful vs. unsuccessful teams or the different patterns of play that characterize subsequent

tournaments. Work conducted by Jones et al, (2004) and James et al, (2005) focused on determining the performance of a team and squad of players during a whole season. This work investigated club-level rugby throughout a domestic competition and not international rugby performance at a World Cup tournament.

Although it is known and perhaps obvious that teams that score more tries than their opposition are, on average, more likely to win matches (Carter & Potter, 2001), it is unclear why the outcome of one specific movement during a match is a try whereas another similar movement results in the turnover of possession to the opposition. It would therefore seem logical to investigate how a team's performance compares to the other more successful teams and then conduct an in-depth analysis of the areas where the performance of the winning teams is superior and, conversely, where the performance of losing teams is deficient.

Accordingly, the aims of this study were two-fold; i) to conduct a comparative study of the performances of the South African World Cup 2003 team with those of England (World Champions 2003) and the other Tri-nation teams, Australia (2nd) and New Zealand (3rd), and ii) to determine whether there were any distinguishing features between the movements that resulted in points being scored by South Africa and those movements which led to a turnover of possession.

2. Methodology

Data for the comparative study of the different nations were collected from simple match descriptors displayed on the International Rugby Board's (IRB) official website during the 2003 World Cup played in Australia. All of the games played by South Africa (SA) (n = 5), England (Eng) (n = 7), Australia (Aus) (n = 7) and New Zealand (NZ) (n = 7) were studied. The reliability of the data was assumed to be good as it came from the sport's international governing body. The data collected in these games were the number of points scored; number of tries, conversions, penalties and drop goals; number of scrums; amount of possession and the percentage territory for each team and their opposition. The points scored and conceded were further categorized into 3-point, 5-point and 7-point scores and as well as the time they were scored in either the first or second half of the match. The stability of this data and performance profiles were established using the method described by Hughes et al. (2001).

Videotape recordings of the five matches played by South Africa during the World Cup 2003 were analyzed retrospectively using a digital analysis software program (Sports Code version 3.1, Sportstec, Australia). All of the information recorded from the videotapes of the matches was collected with respect to the match time, i.e. the first try was scored in the 5th minute. The amount of time that SA held possession was recorded for each movement (a period of play until possession changed excluding the time ball was out of play) and then categorized according to; (i) whether points were scored, (ii) whether it was a running movement that resulted in a turnover or (iii) whether the ball was kicked away from outside SA's 25 meter area resulting in a turnover. A running play was defined as a combination of passing, running and / or kicking that culminated in the ball being turned over to the opposition by an error that resulted from either

passing or running. A kicked play was defined as a combination of movements that culminated in the ball being turned over with a final kick that was recovered and controlled by the opposition. The locations on the field from where the movements started and finished were also recorded (see Figure 1). All movements that resulted in a turnover of possession were analyzed further to include the outcome of the opposition's subsequent movement. Special note was taken of the turnover plays that led to the opposition scoring points. The accumulated time in possession and the number of points scored or conceded per ten minute period were also recorded. The reliability of these techniques was established with the intra-observer analysis described by Hughes et al. (2002).

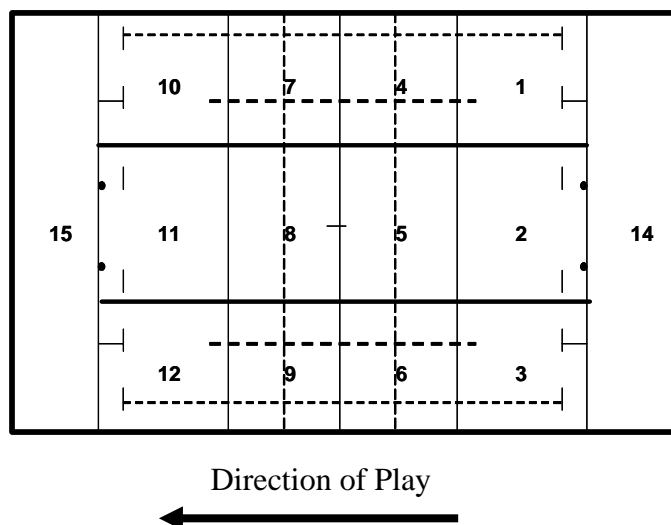


Figure 1: Schematic representation of the rugby field divided into different locations (1-3 & 14 represents the defending 25 m area, 4-9 the midfield area and 10-12 & 15 the attacking 25 m area) for a team attacking from right to left.

Statistical Analysis

The frequency data collected during the comparative study are expressed as median (range of data). The quantitative data are expressed as mean \pm standard deviation. The qualitative data were subjectively classified according to the location of play on the field using the lines painted on the pitch. These data are presented collectively to reflect all five performances by the South African team in the tournament.

The data comparing the performance of the teams of the different nations were analyzed using the Kruskal-Wallis test. The same statistical method was conducted to determine whether there were significant differences for all the measures between the first and second halves of the match. Significance for all statistical results was set at $P < 0.05$.

The video analysis data pertaining to the location of the movement on the field were analyzed for statistical significance using a Chi-Squared test. The time in possession per movement was analyzed using a one-tailed t-test. Spearman's rank order correlation coefficients were calculated to represent the relationship between the accumulated time in possession and the points scored during the same ten-minute period.

3. Results

The data from the IRB website for South Africa (SA), England (Eng), Australia (Aus) and New Zealand (NZ) are presented in Table 1. The Chi square analysis revealed that the majority of the performance indicators presented by the IRB were not significantly different within the same teams in their different matches.

Table 1. Summary of the Median (range) and mean (\pm SD) match data collected from the IRB Rugby World Cup 2003 website for South Africa (SA), England (Eng), Australia (Aus) and New Zealand (NZ).

Measurements/ match.	SA	Eng	Aus	NZ
Tries scored	7 (0 – 12)	1 (0 – 17)	2 (1 – 22)	8 (1 – 13)
Tries conceded	1 (0 – 3)	1 (0 – 3)	1 (0 – 1)	1 (0 – 4)
Conversions scored	4 (0 – 7)	1 (0 – 13)	1 (0 – 16)	5 (1 – 13)
Conversion conceded	1 (0 – 1)	1 (0 – 1)	0 (0 – 1)	1 (0 – 4)
Penalties scored	1 (0 – 3)	4 (0 – 6)	4 (0 – 5)	1 (0 – 3)
Penalties conceded	3 (1 – 4)	2 (0 – 5)	1 (0 – 4)	2 (0 – 5)
Drop goals scored	0 (0 – 1)	1 (0 – 3)	0 (0 – 1)	0 (0 – 1)
Drop goals conceded	0 (0 – 2)	0 (0 – 0)	0 (0 – 1)	0 (0 – 1)
Scrum for	10 (6–18)	9 (4 – 13)	10 (2 – 12)	7 (4 – 15)
Scrum against	12 (7–15)	9 (4 – 12)	7 (5 – 9)	10 (4 – 16)
% Possession for **	49.2 \pm 8.3	61.7 \pm 8.1	54.4 \pm 11.9	59.9 \pm 6.8
% Possession against	50.8 \pm 8.3	38.3 \pm 8.1	45.6 \pm 11.9	40.1 \pm 6.8
% Territory for	54.8 \pm 6.0	55.1 \pm 13.4	47.0 \pm 6.2	56.3 \pm 4.8
% Territory against	45.2 \pm 6.0	44.9 \pm 13.4	53.0 \pm 6.2	43.7 \pm 4.8

** indicates that there is a significant difference between the teams at $P = 0.01$.

% Possession for – $P = 0.01$ SA vs. Eng, NZ.

Table 2. Summary of the Stability Profile calculations from the IRB Rugby World Cup 2003 performance indicators displayed on the website, for South Africa (SA), England (Eng), Australia (Aus) and New Zealand (NZ).

Stable profile exists (χ^2) & number of matches	SA (n= 5)	Eng (n= 7)	Aus (n= 7)	NZ (n= 7)
Tries scored	X	X	X	X
Tries conceded	✓ (>5)	✓ (>7)	✓ (6)	✓ (5)
Conversions scored	X	X	X	X
Conversion conceded	✓ (4)	✓ (>7)	✓ (>7)	✓ (5)
Penalties scored	✓ (>5)	✓ (6)	✓ (>7)	✓ (>7)
Penalties conceded	✓ (4)	✓ (6)	✓ (6)	✓ (>7)
Drop goals scored	✓ (>5)	✓ (>7)	✓ (>7)	✓ (>7)
Drop goals conceded	✓ (>5)	✓ (1)	✓ (>7)	✓ (>7)
Scrum for	✓ (3)	✓ (>7)	✓ (6)	✓ (5)
Scrum against	✓ (>5)	✓ (4)	✓ (4)	✓ (5)
% Possession	✓ (>5)	✓ (3)	X	✓ (5)
% Territory for	✓ (1)	X	✓ (4)	✓ (1)

X indicates that χ^2 calculation found the data to vary between the different matches played by each individual team.

✓ indicates that χ^2 calculation found the data did not vary between the different matches played by each individual team.

(>n) indicates that although the χ^2 calculation found that the data did not vary between the matches analyzed there were insufficient data to form a stable profile.

The exception for all four teams was the number of tries and conversions scored (Table 2). There were no significant differences between the countries for any of the performance indicators analyzed by the Kruskal-Wallis test. However, there were observable differences in the percentage of possession between the teams (Table 1). South Africa (49.2% possession) had substantially (>10%) less than the possession of either England (61.7 %) or New Zealand (59.9%).

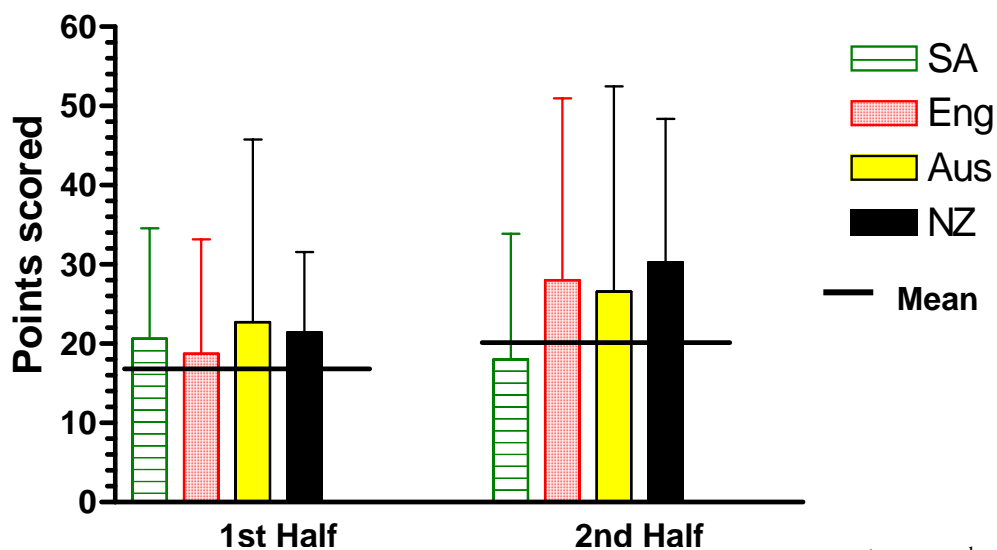


Figure 2: Mean points scored by SA, Eng, Aus and NZ during the 1st and 2nd halves.

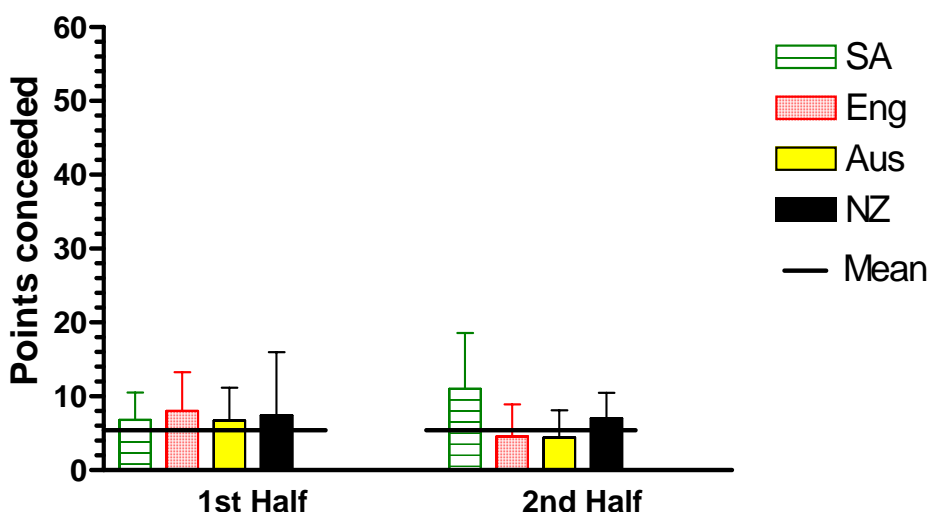


Figure 3: Mean points conceded by SA, Eng, Aus and NZ during the 1st and 2nd halves.

Further analysis of the data for points scored and conceded revealed that there was an increase in the number of points scored in the second half of the match (Figure 2). This trend is apparent for 3 of the 4 teams (Eng 18.7 ± 14.5 points first half vs. 28.0 ± 23.0 points second half, Aus 22.7 ± 23.0 vs. 26.6 ± 25.9 points and .4 ± 10.1 vs. 30.3 ± 18.1 points). However, only SA scored fewer points in the second half (20.6 ± 14.0 vs. 18.0 ± 15.9 points) (Figure 2). The points conceded showed the reverse trend; fewer points were conceded by these teams during the second half but this reduction was not as obvious (Figure 3). Thus the mean points conceded by the different teams were the following: Eng (8.0 ± 5.3 points first half vs. 4.6 ± 4.4 points second half), Aus (6.7 ± 4.5 vs. 4.4 ± 3.7 points) and NZ (7.4 ± 8.6 vs. 7.0 ± 3.5 points). SA again reversed the

trend and conceded more points in the second half (11.0 ± 7.5 points) than in the first half (6.8 ± 3.7 points) (figure 3).

Eng scored more 3-point scores (drop goals and penalties) than SA or NZ (Table 3) but significant differences were only observed between the number of 5-point or 7-point scores between the different nations ($P=0.04$). NZ had a tendency to record more 7-point scores than the other 3 nations (Table 3). There were no significant differences between the breakdown of the points conceded by the four teams although SA conceded on average, two more 3-point score per match than the three other teams (Table 4).

Table 3. Summary of the median data for the breakdown of points scored by the 4 different nations. The range is in brackets.

	SA	Eng	Aus	NZ
3-point scores	2 (0 - 3)	5 (0 - 8)	4 (0 - 5)	1 (0 - 4)
5-point scores**	1 (0 - 6)	1 (0 - 4)	1 (0 - 6)	1 (0 - 4)
7-point scores	4 (0 - 7)	1 (0 -13)	1 (0 -16)	5 (1 -12)

** indicates that there is a significant difference between median of 5-point and 7-point scores ($P>0.05$).

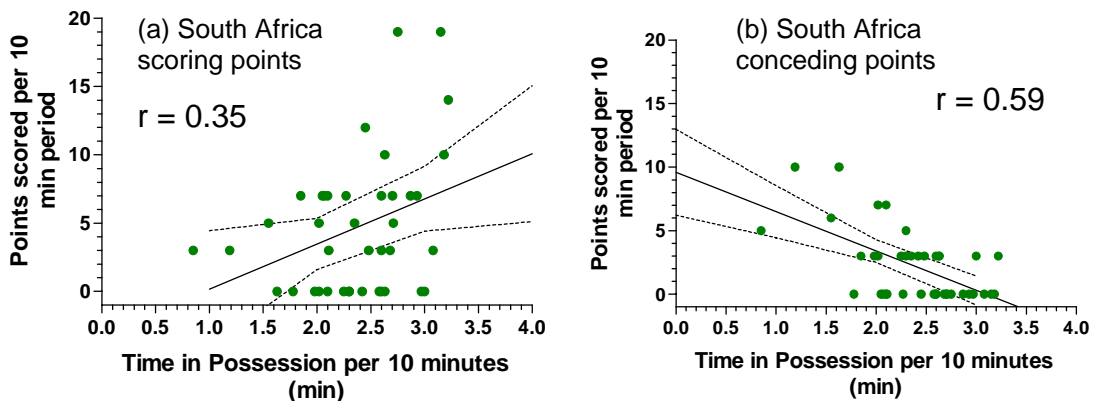
Table 4. Summary of the mean data for the breakdown of points conceded by the 4 different nations. The range is in brackets.

	SA	Eng	Aus	NZ
3-point scores	4 (0 - 6)	2 (0 - 5)	1 (0 - 5)	2 (0 - 5)
5-point scores	0 (0 - 2)	0 (0 - 2)	0 (0 - 1)	0 (0 - 0)
7-point scores	1 (1 - 6)	1 (0 -1)	0 (0 -1)	1 (0 - 4)

The technique used to calculate the amount of time in possession was found to be reliable and have an acceptable intra-observer error of only 1.7% (Hughes et al 2001). The technique for evaluating the location on the field was also tested for reliability and was found to be 100% reliable intra-observer (Hughes et al 2001).

Analysis of the video footage from SA's five games in the tournament showed that the mean total time SA held possession of the ball during each half was 9.4 ± 1.2 minutes in the first half and 9.6 ± 1.3 minutes in the second half. Their opposition (Opp) were in possession of the ball for 9.1 ± 1.7 minutes in the first half and 11.2 ± 2.6 minutes in the second half which were not significantly different from values for the SA team. There appears to be a trend that the ball is in play for longer in the second half (SA possession_{2nd} + Opp possession_{2nd}: 9.6 ± 1.3 minutes + 11.2 ± 2.6 minutes) – (SA possession_{1st} + Opp possession_{1st} 9.4 ± 1.2 minutes + 9.1 ± 1.7 minutes), and that the extra time in possession was dominated by the teams opposing SA (11.2 ± 2.6 minutes compared to 9.6 ± 1.3 minutes).

South Africa in Possession



Opposition in Possession

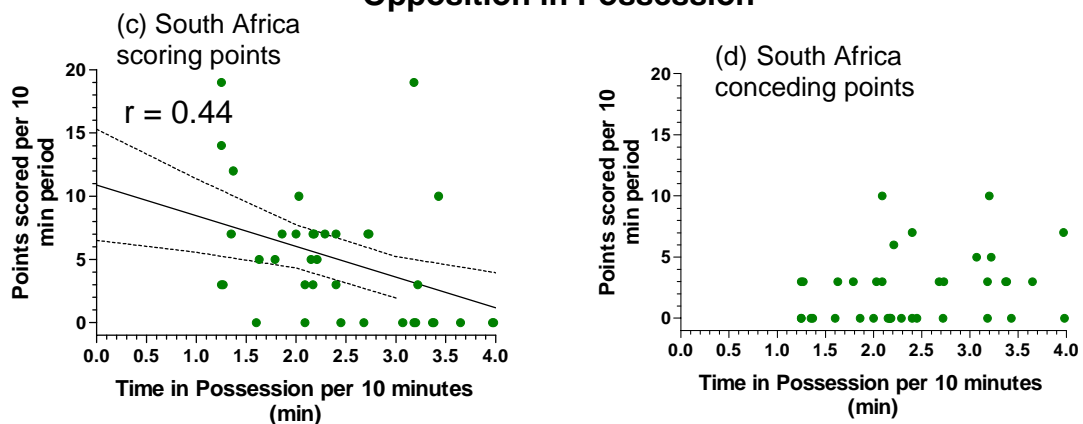


Figure 4: The accumulated time in Possession for SA vs. the number of points scored in the same time period (a) for SA and (b) for the Opposition. The accumulated time in Possession for teams opposing SA vs. the number of points scored in the same time period (c) for SA and (d) for the Opposition.

..... Represents 95% confidence intervals around the line of best fit.

The relationship between the accumulated time of SA in possession per 10-minute period and the number of points scored by SA in each 10- minute period is shown ($r = 0.35$; $p = 0.03$) in Figure 4a and the relationship between the accumulated time of SA in possession per 10-minute period and the number of points scored by the opposition in each 10- minute period is shown ($r = 0.59$; $p = 0.001$) in Figure 4b. The relationship between the accumulated time the opposition were in possession per 10-minute period and the number of points scored by SA in each 10- minute period is shown ($r = 0.44$; $p = 0.004$) in Figure 4c. There were no trends in the relationships between the amount of time the Opposition were in possession per 10-minute period and the score change for the Opposition ($p = 0.31$) (Figure 4d). This indicates that the number of points scored

(5a) or conceded (4b) in SA's matches was more closely related to the amount of possession that SA had. In contrast, the number of points scored in each 10-minute period by the opposition playing against South Africa appeared to be less dependent on the duration that the opposition controlled possession (4d).

There were significant differences between the areas of the field from where movements began that resulted in points being scored ($P < 0.01$). Scoring opportunities began more frequently from the attacking midfield area (zones 7-9; figure 1) 50%, defensive midfield 26%, attack 18% and the defense 5% (see Figure 5a). The area of the field from where possession began that led to points being scored was inside the opposition's 25 m area (86%) with the two wings accounting for 34% (right) and 31% (left) of the final play areas (Figure 5b).

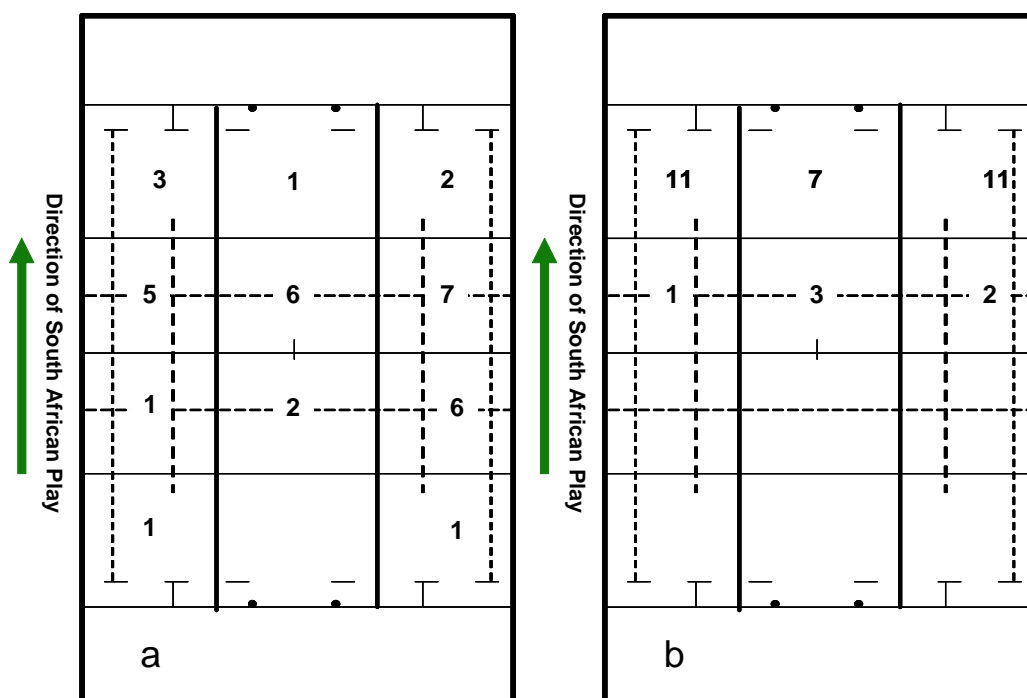


Figure 5: The numbers on the field indicate the locations on the field where (a) Movements started and (b) the final position before the ball crossed the line before tries or penalties were scored by South Africa. Points scored from the attacking midfield zones in (b) represent scores from penalties.

The movements that resulted in turnovers in particular running plays and kicked ball, were also analyzed. It was found that the locations across the field from where the movements started, for both running play and kicked ball were significantly different ($P < 0.01$). The movements began most frequently from the defensive midfield area (zones 4-6 in figure 1), 42% for running play (RP) and 54% for kicked play (KP), attacking midfield area 30% (RP) and 40% (KP), attack 14% (RP) and 6% (KP) and the defense 14% for RP only.

The areas of the field in which possession was lost through errors during RP were significantly different ($P < 0.01$). The ball was most frequently lost in the attacking midfield area (37%), defending midfield area (29%), attacking area (28%) and defending area (6%). The location on the field where the ball landed after being kicked resulting in a turn-over of possession, were significantly different between the kicks ($P < 0.01$). Possession was most frequently lost during KP in the attacking area of the field (zones 10, 11, 12 and 15 in figure 1) (61%), the attacking midfield area (37%) and defending midfield area (2%).

Of the 24 times that the Opposition scored against SA, 71% resulted from errors during SA RP (14) or KP (3) movements. The locations on the field at which possession was lost and which led to points being scored against SA, are shown in figure 6.

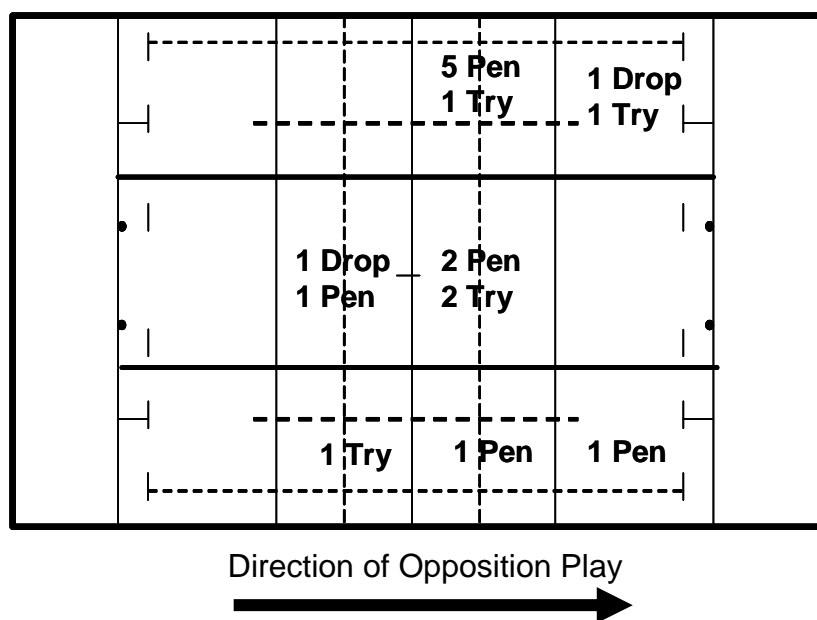


Figure 6: Schematic representation of the location where possession was lost by SA due to Running Play Errors and Kicked Play which led to points being scored by the Opposition. (Key: – Pen = Penalty, Drop = Drop goal).

The mean amount of playing time in possession of the ball before points were scored was significantly longer for first half movements (25.5 ± 6.5 s) than for second half movements (18.3 ± 12.4 s) (Table 5 and Figure 7) ($P = 0.05$). The mean amount of playing time in possession during RP before the turnover was not significantly different between the 1st and the 2nd half (17.9 ± 6.4 s 1st half and 16.5 ± 5.3 s 2nd half). The mean time in possession was significantly lower during RP than the time in possession before points were scored (17.2 ± 14.25 vs. 21.9 ± 14.51 s respectively) ($P = 0.05$) (see table 5).

The mean amount of playing time in possession during KP before the turnover was not significantly different between the 2 halves (12.7 ± 1.9 s 1st half and 11.9 ± 8.2 s 2nd half). It was however, significantly shorter than the time in possession before points

were scored (12.3 ± 5.6 vs. 21.9 ± 14.5 s respectively) ($P = 0.01$) and lower than the amount of time in possession before possession was lost during RP ($P = 0.01$) (see Table 5).

Table 5. Summary of the time in possession of the ball before points were scored or possession was lost following running or kicked play.

	Possession lost following:		
	Points Scored (s)	Running Play (s)	Kicked Play (s)
1 st Half	$25.5 \pm 6.5\#$	17.9 ± 6.4	12.7 ± 1.9
2 nd Half	18.3 ± 12.4	16.5 ± 5.3	11.9 ± 8.2
Mean	21.9 ± 14.5	$17.2 \pm 4.7^*$	$12.3 \pm 5.6^{**}$

* indicates a significant difference between the time in possession before points were scored and when possession was lost through running play errors ($P = 0.05$).

** indicates a significant difference between the time in possession before points were scored and when possession was lost through kicking play ($P = 0.01$).

indicates a significant difference between the time in possession before points were scored between the 1st and 2nd Half ($P = 0.05$).

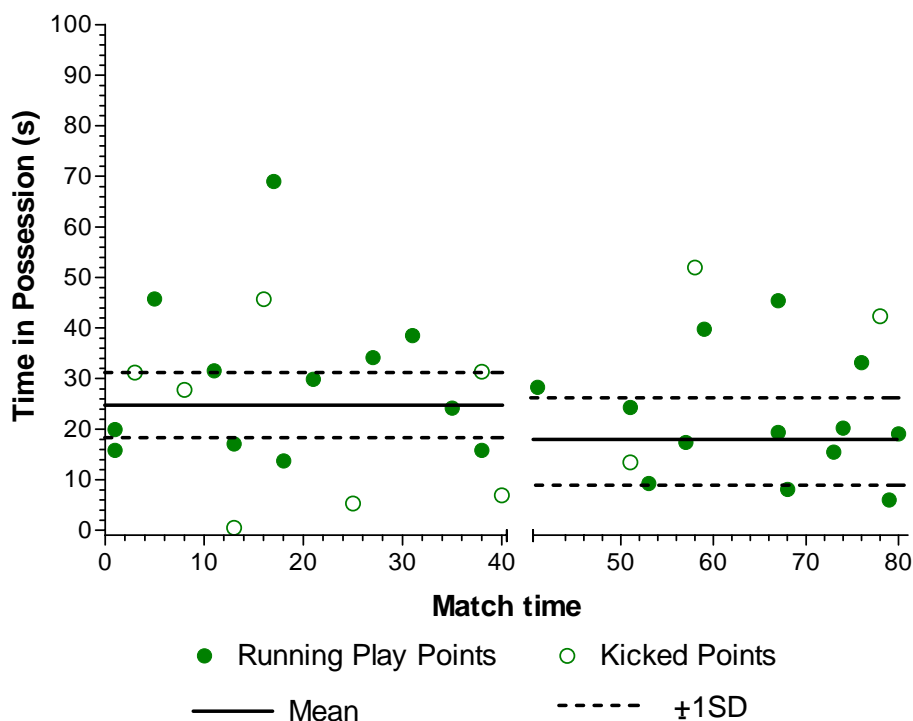


Figure 7. Distribution of the amount of time in possession (s) of the ball before points were scored, according to whether they were scored during the 1st or 2nd half.

4. Discussion

The purpose of this study was to compare simple statistical descriptions of the performance of South Africa with those of England, Australia and New Zealand, during the World Cup 2003 and to link the findings with an in-depth analysis of all of South Africa's matches. Of the four teams South Africa performed the least well with England winning the tournament, Australia finishing second and New Zealand third. An important limitation of the study was that the teams did not play the identical schedules, so that whereas England played South Africa and Australia, they did not play New Zealand, whereas Australia played New Zealand but not South Africa. In addition the quality of the other teams that each nation played in the 2003 World Cup were likely not equal. But since no World Cup competition in the current structure will occur in which all teams play all the other teams, it will therefore not be able to match the quality of the opposition played by the leading rugby teams. Nevertheless, we believe that, despite this obvious limitation, this analysis may provide insights that could guide future more, definitive analyses.

The main findings from the comparative study were that the general match descriptors, for example the number of tries scored, conversions and scrums, were similar between the 4 national rugby teams. A possible explanation for the lack of significant difference between the match descriptors could be that all of the teams in this study reached the quarter finals of the World Cup, whereas previous studies (Hughes & White 1997 and Stanhope & Hughes 1997) have classified the teams into successful and unsuccessful groups based on whether or not they reached the quarter finals. In those studies significant differences in these descriptors were indeed found.

For example Stanhope and Hughes (1997) found that more tactically astute attacking kicks by successful sides in the 1991 Rugby World Cup brought them closer to the try line and as a result those successful teams scored more tries and penalties. However, there were differences in the scoring outcomes for the teams in this study. England scored more penalties and drop goals whereas New Zealand scored more tries than the other teams. These findings are consistent with the historical performances of those two teams. Indeed it is of interest that the outcome of the last 3 World Cups has been determined or strongly influenced by drop goals (J. Stransky – SA vs. NZ, World Cup Final 1995; S. Larkham – Aus vs. SA, World Cup Semi-Final 1999; J. Wilkinson – Eng vs. Aus, World Cup Final 2003).

There was also a consistent increase in the number of points scored in the second half of the matches for all of the nations except the least successful, South Africa. It appears from this that play was dominated, especially during the second half by England, Australia and New Zealand. This is also supported by the mean total percentage of possession recorded for these teams being above 50% for the total game time. South Africa, however, did not follow that trend; they scored fewer points during the second half than they did in the first half. A similar but reverse trend was noted for the number of points conceded per half.

It is conceivable that the decrease in points scored and the increase in the number of points conceded by South Africa during the second half is related to the amount of possession that the team had which was less than 50% (Table 1). This was substantially lower than that of England and New Zealand, by at least 10%, in the matches they played. It is not clear from the statistics presented (IRB 2003) whether there is a change in percentage possession between the 1st and 2nd halves. However, the in-depth analysis of SA performance during the World Cup matches shows that the mean absolute amount of time in possession by SA was not significantly different between the two halves (9.4 ± 1.2 minutes 1st half and 9.6 ± 1.3 minutes 2nd half).

Although relationships between the amount of time that SA had possession and the number of points scored or conceded were observed (figure 5), this did not appear to be true when comparisons were made between the amount of time the opposition was in possession and the number of points that the opposition or SA scored. South Africa were more likely to score more points and concede fewer points the longer time they had in possession of the ball per 10 minutes. It was also true that South Africa were more likely to score more points per 10 minutes when the opposition had less time in possession. However, the opposition would score points irrespective of the amount of time they accumulated in possession per 10-minute period. This implies that, in their games, the time that South Africa maintained in possession had a greater impact on the result of the match than the amount of possession that any of their opposition had. The explanation for this anomaly is not immediately clear.

The location on the field from where a movement started also appeared to have an impact on whether points were scored or possession of the ball was lost by South Africa. Movements that created point scoring opportunities most frequently started from the attacking midfield area of the pitch (zones 7-9) whereas all the other movements, where possession was turned over, started more frequently from the defensive midfield area of the pitch (zones 4-6). An analysis of all the movements that resulted in i) points being scored, ii) running play errors or iii) kicking play into either the attacking (zones 7-12 & 15) or defending parts of the field (zones 1-6 & 14) shows that points were more frequently scored when possession was secured inside the attacking half of the field than when the ball had to be carried over the halfway line (Figure 5a). This would then suggest that, to increase the frequency of point scoring movements, SA would have to regain possession of the ball before their opposition had a chance to cross over the halfway line, into their territory.

It can also be seen that SA lost more of their possession in the attacking half of the field than in the defending half. However, the opposition more frequently scored points from movements that began when possession was lost by SA in the defending area of the field and less frequently when it was lost in the attacking area of the field. This mirrors the converse situation described above: SA were more likely to score points when possession was regained in the opposition's half of the field.

The mean time in possession of the ball in this study before a try was scored (21.9 ± 14.51 s) was similar to the mean time recorded (25.3 s) (Carter & Potter, 2001) during the 1995 World Cup. The amount of time in possession of the ball between the 3 movement categories (points scores, running play, kicked play) was however

significantly different. Movements that led to points being scored took longer to execute than the movements that resulted in turnovers. Thus RP movements were on average 4 s shorter than point scoring movements and KP movements were on average 10 s shorter than point scoring movements. This indicates that, on average, the more time a team is in possession of the ball per movement, the higher is the probability of points being scored from that movement. This however, does not explain why some of the RP and KP movements that were longer than 22 seconds did not result in points being scored.

Closer analysis of these data shows that of the 26 RP movements that were longer than 22 seconds, 13 movements started in the defensive midfield area of the pitch whereas only 10 movements started from the attacking half of the field (zones 7-12 & 15). From the 10 movements that started in the attacking half of the field, possession was lost 7 times in the attack area (zones 10-12 & 15). Ten KP movements were longer than 22 seconds and 6 of these kicks were made from within the attacking half of the field and landed in the attack area. The video footage pertaining to these movements (7 RP and 6 KP) require further analysis to determine the actual reasons for the turnovers during these passages of play.

In summary this study found that there are measurable differences in certain key performance variables between the teams that reach the quarter final stages of the World Cup. There were two distinct scoring styles with England scoring more points from 3-point kicks and New Zealand scoring more tries, being at opposite ends of the scale. Australia and South Africa were towards the middle of the continuum. The amount of time in possession of the ball per movement had a significant effect on whether that possession would lead to points being scored; increasing the duration of possession increased the frequency of points being scored. The location on the field where the movement started also had a significant impact on the probability of points being scored. If possession was secured in the attacking half of the field then possession more frequently turned into points. However when movements started in the defending half of the field, possession was more frequently lost and the opposition were more likely to capitalize by scoring points from turnover of possession in the opposition's half of the field.

Future such analyses along the lines developed in this study should contribute further to a better understanding of factors predicting success in international rugby.

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