HUMAN MOVEMENT (ISSN 1899-1955)
2019; 20(2): 50–56

DEFENSIVE POSITIONING ON THE PITCH IN RELATION WITH SITUATIONAL VARIABLES OF A PROFESSIONAL FOOTBALL TEAM DURING REGAINING POSSESSION

original paper
DOI: https://doi.org/10.5114/hm.2019.81019

PEDRO MANUEL SANTOS, CARLOS LAGO-PENAS
University of Vigo, Pontevedra, Spain

ABSTRACT
Purpose. To analyse how the quality of opposition, match location, and match status affect the positioning of the team during ball recovery.
Methods. Overall, 510 ball recovery situations from a professional soccer team were analysed with a tracking system (AmiscoPro). Five compound positional variables (team compactness [TC], compactness behind ball location [CB], compactness forward ball location [CF], team width [TW], and game centre index [GC]) and three situational variables (match location, quality of opposition, and match status) were considered in this study. Data were examined with the use of a linear regression model.
Results. The GC was reduced by 1.391 meters ($p < 0.05$) and TW was advanced by 2.204 meters ($p < 0.05$) when the team was winning and losing, respectively, as compared with when the scores were even. Playing against strong opposition increased CF by 3.055 meters ($p < 0.05$). No effects were detected on TC or CB.
Conclusions. The team modifies the tactics as a consequence of the match conditions. Different field positions emerge in relation with situational variables. This information can be used to better understand the positional behaviour during ball recovery.
Key words: association football, notational analysis, performance indicators, compound positional variables, ball recovery

Introduction

Performance analysis in football aims to increase the knowledge of the teams' and players' match performance. In-game behaviour results in two fundamental attributes, stability and flexibility [1]. Despite the significant variations of soccer performance [2–4], it is assumed that there exist behavioural traits, signatures, or patterns of a particular player and/or team [5–7]. Therefore, in performance, competing teams reveal specific structural and dynamical properties [8]. Soccer performance is a construct based on many different performance components and their interaction at the level of both player and team [9]. To understand the collective game behaviour, embracing the complexity of the match conditions, the search for novel tactical performance indicators is encouraged.

The assessment of match performance has recently been approached through the use of compound positional variables that capture emergent behaviours at the team level [10–12], seeing the need to embrace the dynamic interactions between the opponents [5, 13, 14]. For instance, Yue et al. [15] analysed time series of a soccer match based on the detailed data of the 2D motions of all 22 players and of the ball in the match. The collective measures, such as the surface area, the geometrical centre, the team ranges, etc., integrate the individual positions of each team player into a meaningful description of a collective team pattern [11]. Although some studies focus on compound measures [10–12], there is a paucity of studies regarding the collective positioning during defensive behaviour [16]. Seeing that the context in which the sports behaviours are produced offers important information for game analysis [6, 17], this is more critical. A study by Santos et al. [16] is an exception that examined the effects of match contexts (i.e. match location, match status, and quality of opposition) over the ball recovery location

Correspondence address: Pedro Santos, Faculty of Education and Sport Sciences, University of Vigo, Campus de A Xunqueira s/n. CP: 36005, Pontevedra, Spain, e-mail: pmosantos@gmail.com

Received: April 6, 2018
Accepted for publication: November 20, 2018

Citation: Santos PM, Lago-Penas C. Defensive positioning on the pitch in relation with situational variables of a professional football team during regaining possession. Hum Mov. 2019;20(2):50–56; doi: https://doi.org/10.5114/hm.2019.81019.

and the position of the defensive and the offensive line at that moment. Indeed, several studies on football have reported the influence of situational variables on team's and player's performances [e.g. 18–22]. The importance of these factors is reflected in the changes of the team's strategy in response to game situations [19].

An important issue to consider when measuring team performance behaviours is to discriminate values for compound positional variables during defending and attacking performance phases [11]; therefore, the aim of this study was to examine the influence of situational variables on the defensive collective positioning of a professional football team on the field during ball recovery. In addition, its purpose was to develop a model that predicts the positional behaviour on the basis of situational variables. It was hypothesized that the players of the sample team altered the positioning during ball recovery in accordance with the quality of opposition, match location, and match status.

Material and methods

Match performance data collection procedures

A total of 510 ball recoveries from 13 matches (7 home and 6 away matches) played by a professional Spanish football team (ranked 15th at the end of the season) were monitored with a multiple-camera match analysis system (Amisco, system version 1.0.2, Nice, France). The movements of the players of the 2 competing teams and of the ball were observed throughout matches by means of 8 stable, synchronized cameras positioned at the top of the stadia (sampling frequency: 25 Hz). Signals and angles obtained by the encoders were sequentially converted into digital data and recorded on 6 computers for post-match analyses. The accuracy of the Amisco system was checked by Zubillaga [23]. Set plays were excluded from the analysis. Data collection was used to gather information for two different papers.

A team has ball possession when one of their players respects one of the following 3 situations [24]: (i) makes at least 3 consecutive contacts with the ball, (ii) makes a positive pass (it may keep ball possession), (iii) makes a shot (finalization). A positive pass is one that allows a player from the same team (following player) shoot at goal (criterion iii) or keep possession of the ball, getting it (criterion i).

Variables

Five team performance variables (team compactness [TC], compactness behind ball location [CB], compactness forward ball location [CF], team width [TW], and game centre index [GC]) and three situational variables (match location, quality of opposition, and match status) were considered in this study. Operational definitions of these variables are displayed in Table 1.

Reliability testing

The reliability of the data was assessed through intra- and inter-observer test procedures. Intra-observer reliability was evaluated by the author coding 5 randomly selected matches. After 6 weeks, to avoid any possible adverse learning effects, the matches were recoded and the 2 data sets compared. Two independent experienced football match analysts, who had received 10 hours of training in data collection, then completed inter-observer reliability testing. The 2 analysts coded each of the 5 matches once, and their data were compared with those of the author's first coding session. Intra- and inter-observer agreement were assessed with the use of the percentage error method, advocated by Hughes et al. [25], with all data found to be within acceptable limits (i.e. < 5% error).

Statistical analysis

To examine how the situational variables affected each performance indicator, a linear regression model was used. When interpreting the statistical results, positive or negative coefficients indicated a greater or lower propensity to increase/decrease the match performance indicators. The model is as follows:

$$\text{team performance variables} = \beta_1 + \beta_2 \cdot \text{match location} + \beta_3 \cdot \text{score-line} + \beta_4 \cdot \text{quality of the opponent} + \varepsilon_i$$

where β_1 is the intercept, β_2, β_3, and β_4 are the impacts of each of the independent variables. Finally, ε_i is the disturbance term.

The linear regression model was performed with STATA for Windows, version 10.0 (Stata Corp., Texas, USA). For all analyses, statistical significance was set at $p < 0.05$.

Ethical approval

The research related to human use has been complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the authors' university human research ethics committee.

Table 1. Variables considered in the study

Variable	Description
Team compactness (TC)	Length distance, in meters, between the location on the pitch of the last player from the observed team defensive line (team player closer to its goal line of the sampled team; the goalkeeper is not considered) and the ahead player from the observed team offensive line (team player closer to the opponent's goal line of the sampled team; the goalkeeper is not considered), measured in the *x* axis of a coordinate system (*x*, *y*)
Compactness behind ball location (CB)	Length distance, in meters, between the location on the pitch of the last player from the observed team defensive line (team player closer to its goal line; the goalkeeper is not considered) and the ball recovery location in the field (i.e. length distance, in meters, between the goal line of the sampled team and the ball recovery location on the pitch of the observed team at that instant) of the observed team, measured in the *x* axis of a coordinate system (*x*, *y*)
Compactness forward ball location (CF)	Length distance, in meters, between the ball recovery location on the pitch of the observed team and the ahead player from the observed team offensive line (team player closer to the opponents' goal line; the goalkeeper is not considered), measured in the *x* axis of a coordinate system (*x*, *y*)
Team width (TW)	Width distance, in meters, between the team players closest to each sideline, measured in the *y* axis of a coordinate system (*x*, *y*). The goalkeeper is not considered
Game centre index (GC)	The team positional approach in relation to the position of the ball, being calculated from the average of the closer distance, in meters, to the ball of the 11 players of the observed team, at a particular instant. A lower index value in the game centre represents an average closer approximation of the observed team players to the ball, at that instant
Match location	Venue of the game. Team possessions were classified as either at home or away
Quality of opposition	Competitive level of the opposing team according to the final league table, adjusted by a qualitative inspection based on the point difference of each team to the sample team. The comparison groups were: similar-opponent (involves teams that have from less than 5 points to more than 5 points to the sampled team; corresponds to a ranking from 19th to 11th place, with sampled team been the 15th classified) and top-opponent (involves teams that have between more than 23 and 29 points to the sampled team; corresponds to a ranking from 6th to 2nd place)
Match status	Determined by whether the team was winning, drawing, or losing at the time of each ball recovery recorded

In the coordinate system (*x*, *y*), *x* represents the length and *y* the width of the pitch.

Informed consent

Written permission was received from the club to record and analyse the data.

Results

Table 2 includes the descriptive statistics for the 510 ball recoveries in the different match contexts.

Table 3 presents the influence of match location, match status, and quality of opposition on the team performance variables. GC was reduced by 1.391 meters ($p < 0.05$) and TW was advanced by 2.204 meters ($p < 0.05$) when the team was winning and losing, respectively, as compared with when the scores were even. The TC, CB, and CF were unaffected by the score-line. Playing against strong opposition increased CF by 3.055 meters ($p < 0.05$) compared with playing against similar opponents. However, the TC, CB, GC, and TW were not affected by the quality of the opposition. The TC, CB, CF, GC, and TW were unaffected by match location.

In order to figure out the influence of the situational variables on the teams' performance, Table 4 displays the simulated TC, CB, CF, GC, and TW for a team playing in different score-lines, at home or away, and against similar or better opponents. These simulations illustrate how the TC, CB, CF, GC, and TW increased/decreased depending on the match conditions.

Discussion

The aim of the current study was to examine the influence of the quality of opposition, match status, and match location on the positioning adopted by a profes-

Table 2. Number of ball recoveries depending on the match contexts

Situation	Match location		Quality of opposition		Match status		
	Home	Away	Similar	Top	Drawing	Winning	Loosing
Total	259	251	319	191	353	65	92
Playing home	–	–	138	121	182	27	50
Playing away	–	–	181	70	171	38	42
Similar-opponent	138	181	–	–	258	48	13
Top-opponent	121	70	–	–	95	17	79
Drawing	182	171	258	95	–	–	–
Winning	27	38	48	17	–	–	–
Loosing	50	42	13	79	–	–	–

Table 3. The influence of situational variables on team compactness (TC), compactness behind ball location (CB), compactness forward ball location (CF), game centre index (GC), and team width (TW) variables (in meters)

Model	TC	CB	CF	GC	TW
Winning	–0.380 (1.052)	2.387 (1.350)	–2.781 (1.985)	–1.391* (0.704)	–0.831 (0.804)
Losing	0.982 (1.022)	2.148 (1.190)	–1.169 (1.747)	0.555 (0.685)	2.204* (0.911)
Away	0.690 (0.748)	–1.384 (0.893)	2.052 (1.331)	–0.036 (0.554)	0.123 (0.622)
Top opponent	1.204 (0.869)	–1.870 (0.972)	3.055* (1.489)	–0.453 (0.631)	–1.125 (0.788)
Intercept	35.451 (0.665)	6.279 (0.793)	29.202 (1.187)	20.554 (0.500)	34.604 (0.502)
R^2	0.011	0.016	0.015	0.008	0.016

Parentheses include standard errors.
* $p \leq 0.05$

Table 4. Predictions for team compactness (TC), compactness behind ball location (CB), compactness forward ball location (CF), game centre index (GC), and team width (TW) variables (in meters) depending on situational variables

Variable	Match status	Home		Away	
		Similar	Top	Similar	Top
TC	Drawing	35.5	36.7	36.1	37.3
	Winning	35.1	36.3	35.8	37.0
	Losing	36.4	37.6	37.1	38.3
CB	Drawing	6.3	4.4	4.9	3.0
	Winning	5.9	4.0	4.5	2.6
	Losing	7.3	5.4	5.9	4.0
CF	Drawing	29.2	32.3	31.3	34.3
	Winning	26.4	29.5	28.5	31.5
	Losing	28.0	31.1	30.1	33.1
GC	Drawing	20.6	20.1	20.5	20.1
	Winning	19.2	18.7	19.1	18.7
	Losing	21.1	20.7	21.1	20.6
TW	Drawing	34.6	33.5	34.7	33.6
	Winning	33.8	32.6	33.9	32.8
	Losing	36.8	35.7	36.9	35.8

sional soccer team during ball recovery. In general, and as was hypothesized, the sampled team altered the tactics as a consequence of the match conditions. However, the defensive positioning of the team was unaffected by match location. These findings are similar to those provided by Bloomfield et al. [26], Castellano et al. [27], and Lago-Ballesteros et al. [28], despite contrasts with the evidence that home teams tend to defend in more advanced pitch zones as compared with away matches [16, 29]. This could be explained by the fact that situational variables, such as match location, would have unique effects on individual teams [19, 28, 30], producing selective impacts over each performance indicator. This may also explain the unexpected lack of effects of the situational variables on TC or CB. In addition, the effective assessment of soccer performance needs to consider independent and interactive potential effects of situational variables [19, 21, 29, 31].

The team was losing moves towards a wider space occupation as a response to a status different and more demanding than an even score. This may be explained by the effort to facilitate the movement of the ball during offensive play. When the team was winning, there was a greater approach between players and the ball than if the scores were even. This demonstrates a greater defensive caution in order to avoid conceding a goal. These results are in line with previous studies suggesting that a more offensive style of play appears when losing [18, 28, 32], with a tendency to defend in a more advanced pitch zone [16, 29], accompanied with a quickest ball recovery [33], less possession in the defensive zone, and more in the attacking zone [19]. The particular behaviour of each team should be noted as different teams implement different strategies when they are tied, winning, or losing [20, 34, 35].

As for the impact of the quality of the opposition, the results were similar to those provided by other research [e.g. 16, 19, 21, 22] and showed that the team positional behaviour in ball recovery situations was affected by the opponent. Playing against strong opposition indorses a significant advance in CF. A superior distance between the ball and the forward player when recovering possession has consequences for the future management of the offensive phase. Future research needs to ascertain the relative modifications in offensive line and ball recovery location and the style of play to understand the advantage taken.

This research focuses on a single team, which places limitations on the generalization of results, but elucidates the unique solutions of the style of play of the sample team [21, 31]. It would also be important to verify the results across different teams and levels of play (amateurs, youth soccer, or women's soccer) or in competitions with other formats (i.e. knockout tournaments). Further, the effect of match location, match status, and the quality of the opponent on the defensive positioning adopted by teams should be examined depending on the quality of the teams. It is also suggested to consider other variables related to ball recovery. New research should also be encouraged around the teams' positional behaviour.

Conclusions

The results evidenced that the players of the sample team regulated the positioning on the pitch during ball recovery depending on situational variables. Such behaviours are a response to the requirements of the game. They simultaneously constitute an example of the complex web of influence exerted over the positional behaviour of the team. When the team was losing moves towards a wider space occupation and it was winning, a greater approach between players and the ball was observed compared with the even scores. There are changes in the distance between the ball recovery location and the forward player associated to the quality of opposition. The match location did not affect the analysed positional performance indicators. The findings of this study, together with other results, such as those on ball possession [19], pass incidence and distribution [31], defensive positioning [16], and work rate [22], emphasize the diverseness of the situational variables influence despite the consensus about their impact on the team performance at a behavioural level. These variables should be considered in the tactical performance assessment in football. The information could be used by coaches to be integrated in the match strategic adjustment of their teams. A central question is whether these behavioural changes associated to situational variables are favourable to promote competitive success in accordance with the style of play employed.

Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

References

1. Warren W. The dynamics of perception and action. Psychol Rev. 2006;113(2):358–389; doi: 10.1037/0033-295X.113.2.358.

2. Gregson W, Drust B, Atkinson G, di Salvo V. Match-to-match variability of high-speed activities in premier league soccer. Int J Sports Med. 2010;31(4):237–242; doi: 10.1055/s-0030-1247546.
3. Liu H, Gómez M, Gonçalves B, Sampaio J. Technical performance and match-to-match variation in elite football teams. J Sports Sci. 2016;34(6):509–518; doi: 10.1080/02640414.2015.1117121.
4. Rampinini E, Coutts AJ, Castagna C, Sassi R, Impellizzeri FM. Variation in top level soccer match performance. Int J Sports Med. 2007;28(12):1018–1024; doi: 10.1055/s-2007-965158.
5. McGarry T, Anderson DI, Wallace SA, Hughes MD, Franks IM. Sport competition as a dynamical self-organizing system. J Sports Sci. 2002;20(10):771–781; doi: 10.1080/026404102320675620.
6. McGarry T. Applied and theoretical perspectives of performance analysis in sport: scientific issues and challenges. Int J Perform Anal Sport. 2009;9(1):128–140; doi: 10.1080/24748668.2009.11868469.
7. McGarry T, Franks IM. The science of match analysis. In: Reilly T, Williams AM (eds.), Science and soccer, 2nd ed. London: Routledge; 2003; 265–275.
8. Ribeiro J, Silva P, Duarte R, Davids K, Garganta J. Team sports performance analysed through the lens of social network theory: implications for research and practice. Sports Med. 2017;47(9):1689–1696; doi: 10.1007/s40279-017-0695-1.
9. Drust B, Atkinson G, Reilly T. Future perspectives in the evaluation of the physiological demands of soccer. Sports Med. 2007;37(9):783–805; doi: 10.2165/00007256-200737090-00003.
10. Duarte R, Araújo D, Folgado H, Esteves P, Marques P, Davids K. Capturing complex, non-linear team behaviours during competitive football performance. J Syst Sci Complex. 2013;26(1):62–72; doi: 10.1007/s11424-013-2290-3.
11. Duarte R, Araújo D, Correia V, Davids K. Sports teams as superorganisms: implications of sociobiological models of behaviour for research and practice in team sports performance analysis. Sports Med. 2012;42(8):633–642; doi: 10.2165/11632450-000000000-00000.
12. Araújo D, Silva P, Davids K. Capturing group tactical behaviors in expert team players. In: Baker J, Farrow D (eds.), Routledge handbook of sport expertise. London: Routledge; 2015; 200–220.
13. Lames M, McGarry T. On the search for reliable performance indicators in game sports. Int J Perform Anal Sport. 2007;7(1):62–79; doi: 10.1080/24748668.2007.11868388.
14. Lames M. Modelling the interaction in game sports – relative phase and moving correlations. J Sports Sci Med. 2006;5(4):556–560.
15. Yue Z, Broich H, Seifriz F, Mester J. Mathematical analysis of a soccer game. Part I: Individual and collective behaviors. Stud. Appl. Math. 2008;121(3):223–243; doi: 10.1111/j.1467-9590.2008.00413.x.
16. Santos P, Lago-Peñas C, García-García O. The influence of situational variables on defensive positioning in professional soccer. Int J Perform Anal Sport. 2017;17(3):212–219; doi: 10.1080/24748668.2017.1331571.
17. Mackenzie R, Cushion C. Performance analysis in football: a critical review and implications for future research. J Sports Sci. 2013;31(6):639–676; doi: 10.1080/02640414.2012.746720.
18. Bradley PS, Lago-Peñas C, Rey E, Sampaio J. The influence of situational variables on ball possession in the English Premier League. J Sports Sci. 2014;32(20):1867–1873; doi: 10.1080/02640414.2014.887850.
19. Lago C. The influence of match location, quality of opposition, and match status on possession strategies in professional association football. J Sports Sci. 2009;27(13):1463–1469; doi: 10.1080/02640410903131681.
20. Lago-Peñas C, Dellal A. Ball possession strategies in elite soccer according to the evolution of the match-score: the influence of situational variables. J Hum Kinet. 2010;25(1):93–100; doi: 10.2478/v10078-010-0036-z.
21. Taylor JB, Mellalieu SD, James N, Shearer DA. The influence of match location, quality of opposition, and match status on technical performance in professional association football. J Sports Sci. 2008;26(9):885–895; doi: 10.1080/02640410701836887.
22. Lago C, Casáis L, Domínguez E, Sampaio J. The effects of situational variables on distance covered at various speeds in elite soccer. Eur J Sport Sci. 2010;10(2):103–109; doi: 10.1080/17461390903273994.
23. Zubillaga A. The activity of the soccer player in high competition: analysis of variability [in Spanish] (doctoral dissertation). Málaga: Facultad de Psicología, Universidad de Málaga; 2006.
24. Garganta J. Tactical modelling of the football game: a study of the organization of the offensive phase in high performance teams [in Portuguese] (doctoral dissertation). Porto: Faculdade de Ciências do Desporto e de Educação Física, Universidade do Porto; 1997.
25. Hughes M, Cooper SM, Nevill A. Analysis of notation data: reliability. In: Hughes M, Franks IM (eds.), Notational analysis of sport, 2nd ed. London-New York: Routledge; 2004; 189–204.
26. Bloomfield J, Polman R, O'Donoghue P. Effects of score-line on intensity of play in midfield and forward players in FA Premier League. J Sports Sci. 2005;23(2):192–193.
27. Castellano J, Blanco-Villaseñor A, Álvarez D. Contextual variables and time-motion analysis in soccer. Int J Sports Med. 2011;32(6):415–421; doi: 10.1055/s-0031-1271771.
28. Lago-Ballesteros J, Lago-Peñas C, Rey E. The effect of playing tactics and situational variables on achieving score-box possessions in a professional soccer team. J Sports Sci. 2012;30(14):1455–1461; doi: 10.1080/02640414.2012.712715.
29. Almeida CH, Ferreira AP, Volossovitch A. Effects of match location, match status and quality of opposition

on regaining possession in UEFA Champions League. J Hum Kinet. 2014;41:203–214; doi: 10.2478/hukin-2014-0048.
30. Clarke SR, Norman JM. Home ground advantage of individual clubs in English soccer. J R Stat Soc Series D. 1995;44(4):509–521; doi: 10.2307/2348899.
31. Taylor BJ, Mellalieu DS, James N, Barter P. Situation variable effects and tactical performance in professional association football. Int J Perform Anal Sport. 2010; 10(3):255–269; doi: 10.1080/24748668.2010.11868520.
32. Manzur A, Jones G. The impact of game status on the performance of a Premier League football reserve team: implications for coaches. Int J Perform Anal Sport. 2012;12(3):792.
33. Vogelbein M, Nopp S, Hökelmann A. Defensive transition in soccer – are prompt possession regains a measure of success? A quantitative analysis of German Fußball-Bundesliga 2010/2011. J Sports Sci. 2014; 32(11):1076–1083;doi:10.1080/02640414.2013.879671.
34. Bloomfield J, Polman R, O'Donoghue P. Effects of scoreline on team strategies in FA Premier League soccer. J Sports Sci. 2005;23(2):192–193.
35. Lago C, Martín R. Determinants of possession of the ball in soccer. J Sports Sci. 2007;25(9):969–974; doi: 10.1080/02640410600944626.