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Home advantage in elite soccer matches. A transient effect?

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ABSTRACT

The aim of the current study was to identify how the performances of home and away teams evolve during the first half of matches and to investigate whether or not the home advantage effect disappears or weakens as the game goes on. The sample consisted of 90 matches during the season 2015/2016 from the English FA Premier League ($n = 19$), French Ligue 1 ($n = 21$), Spanish La Liga ($n = 18$), Italian Serie A ($n = 19$) and German Bundesliga ($n = 13$) in which the first half ended with a score of 0–0. Data were examined using the autocorrelation function and linear regression analysis. Ball possession ($p < .01$), successful passes ($p < .05$), short passes ($p < .01$) and touches ($p < .01$) achieved their greatest values in the 0–5 min period compared with other match periods. However, as the first half went on, the home teams exhibited lower performances compared with those shown at the beginning of the match. This was particularly evident from the 16–20 min period until the end of the first half. This transient effect was enhanced or attenuated, depending on the quality of the opponent ($p < .01$). The better the opponent the lower the home teams' performances at the beginning of the match. These variables can be used to develop a model to simulate team performance of home and away teams during the first half of a match.

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Performance analysis;
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1. Introduction

At the highest level of competition, the performances of opposing teams are highly balanced so that every small detail in a match has the potential to give a decisive advantage in achieving success. The home advantage effect is one of these aspects that can change matches and modify the tactics and the style of play proposed by teams (Pollard, 2008; Pollard & Gómez, 2014). It has been suggested that home teams use tactics that are more offensive, dominant and aggressive at the beginning of the game, the implication being that in these opening minutes players are actively seeking to score a goal when their team is playing at home (Collet, 2013; Duarte et al., 2013). However, the combination of fatigue, tactical decisions and psychological states of players during the first half may reduce the effect of playing

at home as the game evolves with match status as a goal-less draw (Staufenbiel, Lobinger, & Strauss, 2015). Specifically, Harper, West, Stevenson, and Russell (2014) identified that decrements of short passing sequences and ball possession (%) were related to self-pacing strategies, tactical modifications and the accumulated effects of fatigue after high intensity beginnings of a match.

From the point of view of coaches, Staufenbiel et al. (2015) interviewed 297 soccer coaches about their internal and external expectations, their goal settings and their tactical decisions when playing away and at home. Their results showed that home and away teams played differently as a result of the home players' motivation, the coaches' tactical decisions and the evolution of the match. Along these lines, Duarte et al. (2013) found that during the first half of the match the home teams played with high level of depth displacements and collective behaviours and the away teams more with lateral spread. According to these findings, the home advantage effect is both time- and opponent-dependent, where complex trends are shown by home and away teams during the match.

Despite these findings, additional information is needed to analyse how the home advantage effect varies during the match and if it tends to disappear as the game progresses. Given that the match status may affect the behaviours of teams and players (Duarte et al., 2013), the present study is focussed on the use of controlled scenarios (home and away teams' performance throughout the nine five-minute periods of the first half), eliminating the confounding variable of scoring or conceding a goal during a match. Consequently, only the first halves of the matches that ended with a drawn score of 0–0 were selected. This approach allows a better understanding and interpretation of the home advantage effect and its evolution during the match.

Thus, the aim of this study was: (i) to examine how the performances of home and away teams evolve during the first half of matches that ended with a score of 0–0; and (ii) to establish whether or not the home advantage effect disappears or weakens as the games goes on.

2. Method

2.1. Sample

In order to investigate the effects of home advantage in different periods of the first half of a match, 90 matches of the season 2015/16 from the English FA Premier League ($n = 19$), French Ligue 1 ($n = 21$), Spanish La Liga ($n = 18$), Italian Serie A ($n = 19$) and German Bundesliga ($n = 13$) that ended with a score of 0–0 were analysed. For every match, both teams were examined. We choose these matches in order to cancel the well-known effect of the score-line on team's and player's behaviour (Gómez, Lago-Peñas, & Pollard, 2013; Lago, Casais, Dominguez, & Sampaio, 2010). Measures of performance were compared across nine periods in the first half of the games: 0–5, 6–10, 11–15, 16–20, 21–25, 26–30, 31–35, 36–40 and 40–45 min. For every match, both teams were analyzed. These leagues are the five major European Championships and consist of 18 (Bundesliga) or 20 teams (English FA Premier League, Ligue 1, La Liga and Serie A), playing 34 or 38 matches, respectively, over the season. All teams played a balanced home and away schedule. The analyses were in agreement with all ethics guidelines of the local university.

2.2. Procedure

Seven Team Performance Variables (TPV) and two situational variables were used in this study. Operational definitions of these variables are as follows (Bateman, 2010; Gómez et al., 2013; Lago, 2009; Liu, Hopkins, Gómez, & Sampedro, 2013; OPTA, 2012):

- *Shot*: an attempt to score a goal, made with any (legal) part of the body, either on or off target
- *Ball Possession (%)*: the duration when a team takes over the ball from the opposing team without any clear interruption as a proportion of total duration when the ball was in play
- *Pass*: an intentional played ball from one player to another
- *Pass Success (%)*: percentage of attempted passes that successfully found a teammate
- *Long Pass*: an attempted pass of 25 yards or more
- *Short Pass*: an attempted pass of less than 25 yards
- *Defence*: Clearances + Fouls + Interceptions + Tackles
 - Clearance: Action by a defending player that temporarily removes the attacking threat on their goal/that effectively alleviates pressure on their goal
 - Foul: any infringement that is penalised as foul play by a referee
 - Interception: Preventing an opponent's pass from reaching their teammates
 - Tackle: the action of gaining possession from an opposition player who is in possession of the ball
- Match location, that is, if the game was played at home or away (Playing at home = 1, Playing away = 0).
- Quality of opposition, the difference in the final ranking (in the current season) between the home team and the visitor, i.e.

$$\text{Quality of opposition} = P_A - P_B$$

where P_A is the final ranking of the home team and P_B is the final ranking of the away visitor.

Data resource of the website is OPTA Sportsdata Company. The inter-operator reliability of the company's tracking system (OPTA Client System) used to collect football match statistics was identified to have reached an acceptable level (Liu et al., 2013).

2.3. Statistical analysis

Firstly, the descriptive statistics (mean and standard deviation) were presented for minute-periods and game location. Secondly, the autocorrelation function (ACF) was used in order to estimate the persistency of each game indicator throughout the match for home and away teams. In addition, the pairs of comparisons through the game between opposing teams (home and away teams) and between home/away teams and quality of opposition were assessed using the cross-correlation function (CCF). For each comparison, the lag = 1 was considered for the ACF and the lag = 0 for the CCF. The ACF results show persistency in the performance of each indicator (positive values) or the decrement of the persistency of the performance (negative values). The CCF results show positive values with correlations between performances or negative values with decrements of performance.

Secondly, to examine how situational variables affect each performance indicator a linear regression model was used. When estimating the regression models, we found no evidence of heteroscedasticity in residuals or multicollinearity among regressors. When interpreting the statistical results, positive or negative coefficients indicate a greater or lower propensity to increase/decrease the match performance indicators. The model is as follows:

$$\text{Team Performance} = \beta_1 + \beta_2 \times \text{Match location} + \beta_3 \times \text{Quality of the Opponent} \\ + \beta_4 \times \text{Match Period} + \beta_5 \times (\text{Match location} \times \text{Match Period}) + \varepsilon_i$$

where β_1 is the intercept, β_2 , β_3 , β_4 and β_5 , are the impacts of each of the independent variables. Finally, ε_i is the residual term.

The ACF and CCF functions were calculated in the data package of IBM SPSS statistics for Windows, version 20.0 (SPSS Inc., Chicago IL). The linear regression model was performed using STATA for Windows, version 10.0 (Stata Corp., Texas, USA). For all analyses, statistical significance was set at $p < .05$.

3. Results

The descriptive values for each performance indicator and each match period are shown separately for home and away teams in Table 1.

The results from the ACF and CCF analyses are presented in Table 2. The ACF showed non-significant negative values for home and away teams (no persistency of the team's performance) for all of the variables studied. The results of the cross-correlation function showed significant values for home and away correlated performances for ball possession (CCF = -1.0), total passes (CCF = .82), long passes (CCF = .93), short passes (CCF = .77) and total touches (CCF = .64). The cross-correlations between both the home and away team's performance and quality of opposition were significantly negative for ball possession, total passes, successful passes, short passes and total touches, indicating the stronger the opponents the lower the values on these variables.

Table 3 presents the influence of match location, quality of the opponent and match period on match performance indicators. Ball possession was explained by the variables match location, quality of the opponent and the interaction between the variables match period and match location. Playing at home increased possession by 7.26 percentage points compared with playing away ($p < .01$). Playing against strong opposition was associated with a decrease in time spent in possession ($p < .01$). Each position in the end-of-season ranking between competing teams increased/decreased the team's possession by .77 percentage points. Finally, the interaction between the variables match location and match period had a strong effect on team possession. As the game evolved, home teams spent less time in possession ($p < .05$): each five-minute period decreased team possession by .six percentage points. Total passes, short passes, total touches and successful passes were influenced by the variables match location ($p < .05$) and quality of the opponent ($p < .01$). Home teams had values that were an estimated 2.78, 2.83, 3.03 and 3.91 higher than the away team. Each position in the end-of-season ranking between competing teams increased or decreased by .47, .48, .52 and .52 the number of total passes, short passes, total touches and the percentage of successful passes. The variable match period had a significant effect on total passes, short passes and total touches. Teams had higher values in the 0–5 min period compared with the other match periods. The percentage of successful passes was not affected by the

Table 1. Descriptive statistics (mean and standard deviations) for each variable according to match period.

	Match period															
	0–5 min		6–10 min		11–15 min		16–20 min		21–25 min		26–30 min		31–35 min		36–40 min	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
<i>Away team</i>																
Ball possession	45.10	16.05	49.08	15.32	48.38	16.22	45.70	17.19	54.42	18.59	45.45	17.61	49.58	15.19	47.40	16.71
Total passes	29.59	15.67	23.69	14.21	26.01	14.85	22.88	13.36	24.13	13.42	21.97	10.67	24.27	11.53	22.01	11.63
Successful passes	75.18	12.48	71.89	14.70	74.13	14.57	74.76	15.05	74.47	16.71	71.81	18.63	74.60	14.48	72.23	18.28
Long passes	4.37	1.78	3.77	1.72	3.69	1.48	3.04	1.59	3.45	1.55	3.42	1.85	3.84	1.69	3.45	1.77
Short passes	25.21	15.01	19.92	13.70	22.31	14.44	19.83	13.09	20.68	13.32	18.54	10.38	20.43	11.54	18.56	11.19
Total touches	37.26	14.93	32.07	12.62	34.46	13.57	30.56	12.15	31.53	13.13	29.74	10.25	32.55	10.06	29.80	10.81
Total shots	.46	.73	.45	.62	.51	.72	.56	.73	.56	.72	.60	.80	.56	.81	.65	.85
Defence	4.08	2.08	4.99	2.46	4.23	2.37	3.63	2.14	3.53	1.89	3.91	2.31	3.96	1.75	3.62	1.92
<i>Home team</i>																
Ball possession	54.90	16.42	50.92	10.91	51.62	19.45	54.30	17.80	45.58	23.23	54.55	20.54	50.42	15.71	52.60	15.48
Total passes	30.22	13.60	28.55	12.59	27.22	12.70	24.24	10.28	24.41	11.78	23.52	10.81	24.24	11.34	23.04	13.30
Successful passes	75.43	15.31	78.48	17.54	76.37	14.78	77.58	17.40	75.74	16.18	73.71	14.26	75.33	15.60	72.68	19.42
Long passes	4.24	2.19	3.60	1.72	3.68	1.65	3.19	1.72	3.45	1.97	3.42	1.62	3.56	1.63	3.22	1.50
Short passes	25.97	13.66	24.94	12.16	23.51	12.48	21.05	10.05	20.95	11.68	20.09	10.61	20.68	11.04	19.82	13.05
Total touches	37.75	12.88	37.52	13.02	35.31	12.57	32.69	11.18	32.09	10.74	35.04	13.55	32.43	10.71	31.37	11.65
Total shots	.40	.58	.63	.77	.69	.89	.71	.90	.64	.88	.57	.82	.58	.75	.74	.96
Defence	3.65	1.95	3.89	2.12	3.54	1.99	3.80	1.85	3.67	2.28	3.58	2.02	3.74	1.70	3.88	1.98

Table 2. Values for autocorrelation coefficient functions.

Variables	ACF		CCF		
	Home team	Away team	H-A	H-QO	A-QO
Ball possession	-.26	-.11	-1.0*	-.80*	-.82*
Total passes	-.19	-.21	.82*	-.72*	-.70*
Successful passes	-.21	-.19	.37	-.74*	-.64*
Long passes	-.27	-.26	.93*	.37	.31
Short passes	-.18	-.21	.77*	-.64*	-.61*
Total touches	-.22	-.30	.64*	-.66*	-.74*
Total shots	-.18	-.21	.50	-.38	-.33
Defence	-.21	-.27	.15	.31	-.22

Notes: H-A: cross correlation function between home and away teams; H-QO: cross correlation function between quality of opposition and home teams; A-QO: cross correlation function between quality of opposition and away teams.

ACF: home and away teams) and cross correlation functions (CCF: between home and away teams and home-away teams with quality of opposition.

* $p < .05$.

Table 3. The effect of match location, quality of the opponent and match period on match performance indicators.

Dependent Variables	Ball possession	Total passes	Short passes	Total touches	Successful passes
Match Location	7.26 (1.69)**	2.78 (1.33)*	2.83 (1.30)*	3.03 (1.62)*	3.91 (1.69)*
Quality of the Opponent	-.77 (.04)**	-.47 (.03)**	-.48 (.04)**	-.52 (.04)**	-.52 (.04)**
Match Period					
6–10 min	.30 (1.66)	-3.40 (1.30)**	-2.82 (1.27)*	-2.35 (1.58)	-.18 (1.65)
11–15 min	.66 (1.68)	-3.29 (1.32)**	-2.64 (1.29)*	-2.68 (1.60)	.50 (1.67)
16–20 min	.84 (1.71)	-5.91 (1.35)**	-4.75 (1.32)**	-5.51 (1.64)**	1.62 (1.71)
21–25 min	1.20 (1.76)	-5.22 (1.38)**	-4.43 (1.35)**	-5.37 (1.68)**	.18 (1.75)
26–30 min	1.54 (1.81)	-6.39 (1.43)**	-5.55 (1.39)**	-4.51 (1.73)*	-1.51 (1.80)
31–35 min	1.84 (1.88)	-4.96 (1.48)**	-4.30 (1.44)**	-4.52 (1.80)*	.96 (1.87)
36–40 min	2.25 (1.95)	-6.25 (1.54)**	-5.41 (1.50)**	-6.22 (1.87)**	-2.14 (1.95)
41–45 min	2.38 (1.04)	-5.19 (1.60)**	-4.30 (1.56)**	-6.09 (1.95)**	-.68 (2.03)
Match location \times Match Period	-.60 (.30)*	-.25 (.23)	-.24 (.23)	-.17 (.54)	
Constant	46.70 (1.37)*	28.66 (.24)**	24.34 (1.05)	36.08 (.29)	73.49 (1.36)**
R^2	.18	.13	.12	.11	.09
Observations	1620	1620	1620	1620	1620

** $p < .01$; * $p < .05$.

match periods. Finally, the interaction between match location and match period was not significant for all but one of the performance indicators.

4. Discussion

The aim of this study was to analyse the impact of the home advantage effect on team performance profiles of home and away teams and to investigate whether this effect disappears or weakens as the match goes on. In general, the home teams exhibited slightly higher performance values than the visitors throughout the first half of the match. The effects were particularly evident for ball possessions (%), total passes, successful passes, short passes and touches. These findings are in accordance with the available literature which has generally shown superior performances displayed by the home teams in comparison with the visitors (Castellano, Casamichana, & Lago, 2012; Lago-Peñas & Lago-Ballesteros, 2010; Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010).

However, the home advantage effect varied during the match and it tended to disappear as the first half of the match progressed. Ball possession, short passes and touches achieved their greatest values in the 0–5 min period compared with other match periods. As the match evolved, the home teams tended to exhibit lower performance values compared with those shown at the beginning of the match. This was particularly evident from the 16–20 min period until the end of the first half. The present findings suggest that the technical and tactical responses (i.e. passing sequences, number of touches and passing success) are not uniform during a match. This may be due to the fact that home teams use tactics that are more offensive, dominant and aggressive at the beginning of the game, suggesting that they attempt to “control” the match by dictating play (Collet, 2013; Duarte et al., 2013). These findings challenge the view that at the start of a game players are actively seeking to score a goal when their team is playing at home. Instead they are giving primary emphasis on gaining control. It should also be noted that the average number of shots (the pre-cursor of a goal) per 5 min period for home teams is actually at its lowest in the opening 5 min of a game. As the first half of match progress, these higher opening performance values decline, probably because of the heightened effect of tactical decisions and fatigue (Rampinini et al., 2010), as well as a possible decrease in the excitement and involvement of the home crowd (Courneya, 1990). Conversely, at the beginning of the match, players when playing away may adopt a more defensive strategy. Not surprisingly, playing away decreased the time spent in possession, the number of total passes, short passes, total touches and the percentage of successful passes in the 0–5 to 10–15 min periods. These findings suggest that the home advantage effect may be transient during the game (the so-called gas effect) because its impact varied from the beginning to the end of the first half of the matches. Duarte et al. (2013) found that a team's accumulated fatigue during the first half showed a stabilisation in their organisational shape, with less complex performance activities and regular team-behaviours which increases the predictability of offensive and defensive situations. Specifically, Harper et al. (2014) identified decrements of short passing sequences and ball possession (%) that were related to self-pacing strategies, tactical modifications and the accumulated effects of fatigue after high intensity starts to a match. In fact, the combination of fatigue, tactical decisions and psychological states of players during the first half may reduce the effect of playing at home as the match continues goal-less during the first half (Staufenbiel et al., 2015).

This transient effect may be handed or attenuated depending on the quality of the opponent. The worse the opponent, the better the home teams' performances at the beginning of the match. Conversely, the better the opponent, the worse the home teams' performances at the beginning of the match. These results confirm previous findings, suggesting that strong and weak teams do not experience the same home advantage effect. In particular, the home teams should be positively influenced when playing at home, experiencing an advantage over the opponents (i.e. dominant, assertive behaviours, familiarity or team cohesion) (Bray, Jones, & Owen, 2002; Pollard & Gómez, 2012). On the one hand, the strong teams probably increase their physical intensity and technical effectiveness during the first half of match in an attempt to outperform their opponents and score first during the match (i.e. both increasing the intensity playing at home and avoiding the negative feelings when playing away). On the other hand, the weak teams are more affected by the match location with more stress and pressure reflected in terms of poorer performances (Ruano et al., 2016).

Concerning the limitations of the study, the present results need to be confirmed at different levels of play (amateurs, youth soccer or women's soccer) or in competitions with other formats (round-robin tournament or knockout tournaments). Finally, the effect of home advantage on the team performance profiles of home and away teams and on the tactics and the style of play adopted should be examined taking into account the quality of the teams. It has already been suggested, that the pattern of play of successful teams is more stable than unsuccessful teams and that they are able to impose and maintain their pattern of play despite the change of some variables during the match (e.g. the evolving score) and between matches (e.g. playing at home or away).

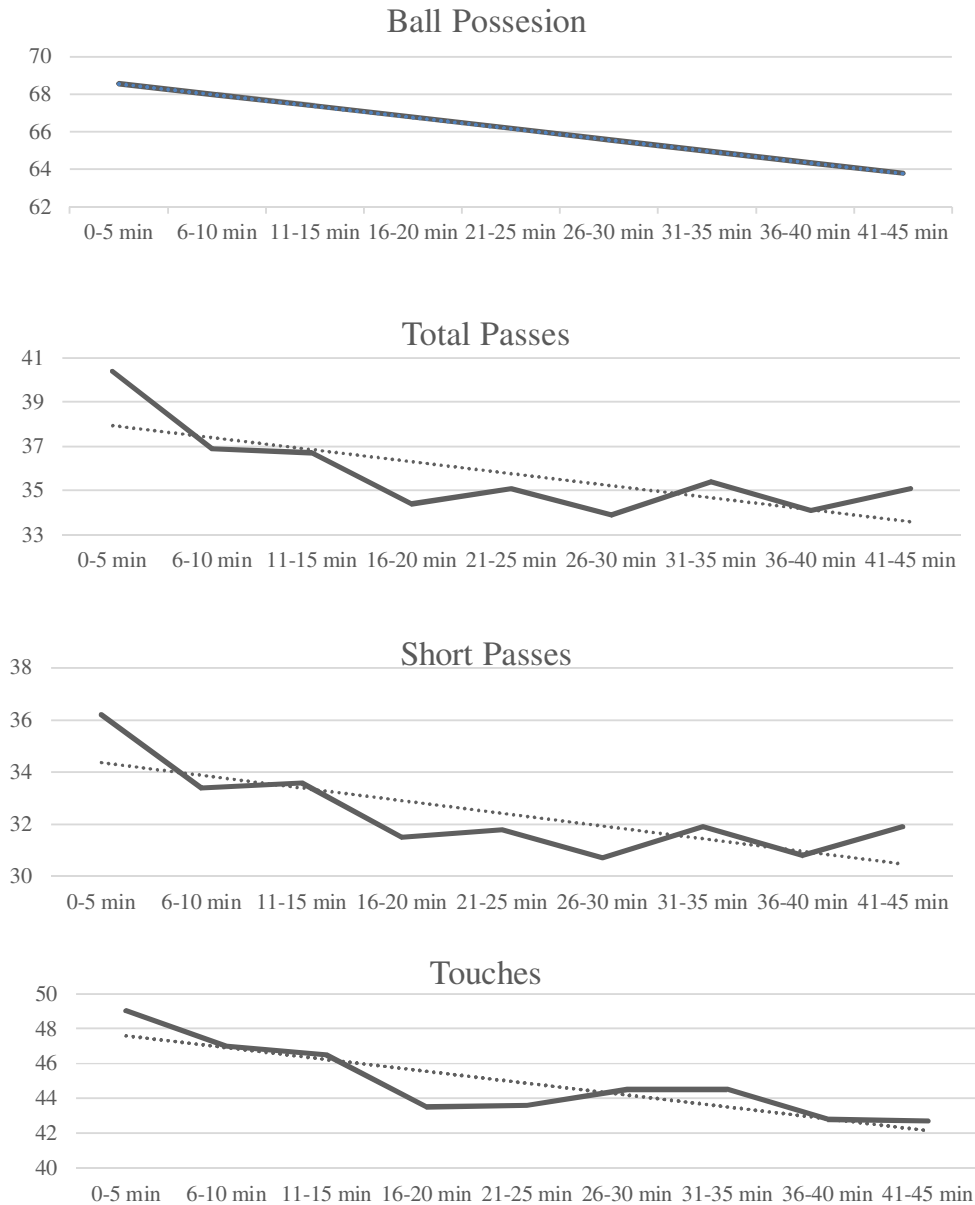


Figure 1. Simulated Ball Possession, Total Passes, Short Passes and Touches for the home team in different match periods in a game between the first (1st) and the last classified (20th).

Coaches can use this information to establish objectives for players and teams during practices and matches and they can be prepared for these different scenarios during the first half of the matches. In order to display the transient influence of playing at home on team performance, Figure 1 displays the simulated ball possession, total passes, short passes and total touches for the home team in different five-min periods in a match if played between the first (1st) and the lowest classified (20th) teams, in accordance with the results shown in the Table 3. These simulations illustrate how the home team's performance values decreased across the match periods. From a coach's perspective, the proposed simulations would give a range of information to improve the management of competition.

5. Conclusions

In conclusion, the current investigation demonstrates that the home teams exhibited higher performance values than the visitors. However, this home advantage effect may be transient given that it tended to disappear as the first half of the matches progressed. Ball possession, short passes and touches achieved their greatest values during the 0–5 min period compared with other match periods. As the game evolved, home teams exhibited lower performance values compared to those shown at the beginning of the match. This was particularly evident from the 16–20 min period until the end of the first half. Although this information could be important for coaches, more work should still be done to address the overall impact of the home advantage effect on the specific performance indicators of professional soccer teams.

Disclosure statement

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