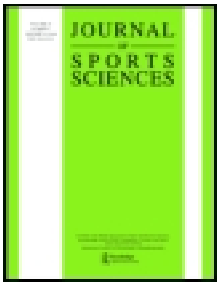

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The influence of match location, quality of opposition, and match status on technical performance in professional association football

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The influence of match location, quality of opposition, and match status on technical performance in professional association football

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Abstract

The aim of this study was to examine the effects of match location, quality of opposition, and match status on the technical aspects of performance within a single professional British football team. Forty matches from the 2002–2003 and 2003–2004 domestic league seasons were notated post-event using a computerized notational analysis system with 13 on-the-ball behaviours and corresponding outcomes (successful or unsuccessful) assessed. Log-linear modelling procedures indicated that the incidences of all on-the-ball technical behaviours, with the exception of "set-pieces", were influenced by at least one of the three situation variables, with both independent and interactive effects found. In contrast, logit modelling suggested that there was no general influence of the situation variables on the outcomes of the on-the-ball behaviours. The findings emphasize the need for notational analysts and coaches to consider the potential independent and interactive effects of match location, quality of opposition, and match status when assessing the technical components of football performance, particularly those relating to behaviour occurrence. Future research should consider the effects of additional situation variables purported to influence the mental, physical, technical, and tactical components of football performance.

Keywords: *Notational analysis, behaviour incidence, behaviour outcomes*

Introduction

Notational analysis is commonly used within research and applied settings to investigate the technical aspects of football performance through recording behaviour incidence and outcomes (Carling, Williams, & Reilly, 2005; Hughes & Bartlett, 2002; Hughes & Franks, 2004). Effective evaluation of these components, however, requires knowledge of the contextual factors that can potentially affect performance, such as the match location and environmental conditions (Carling *et al.*, 2005; Kormelink & Seeverens, 1999). Empirical evidence suggests that the "situation" variables of match location and the quality of the opposition faced are the most important influences on football performance, but these conclusions are based on studies that used global performance-based measures such as win/loss records and tournament rankings (Nevill & Holder, 1999). Consequently, the ability of coaches and notational analysts to account for the effects of these variables at the behavioural level of performance is limited.

Initial insight into the influence of match location on more fine-grained measures of football performance suggests that the effect is present at a behavioural level. For example, Sasaki and colleagues' (Sasaki, Nevill, & Reilly, 1999) case study of a professional British football team found that more goal attempts, shots blocked, shots on-target, shots wide, successful crosses, and goal kicks were performed during home than away matches. Tucker and co-workers (Tucker, Mellalieu, James, & Taylor, 2005) also found that the professional British football team they studied performed a greater number of corners, crosses, dribbles, passes, and shots during home matches, while more clearances, goal kicks, interceptions, and losses of control were evident when playing away. Additional examination of the behaviour outcomes highlighted more successful aerial challenges, crosses, passes, and tackles by the team during home matches.

The quality of opposition has been suggested to be an important influence on performance, at least with regard to global performance measures, yet neither Sasaki *et al.* (1999) nor Tucker *et al.* (2005)

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incorporated this variable into their studies. Indeed, a review of football-based notational analysis literature suggests a general neglect of this particular situation factor, with teams instead categorized as "successful" or "unsuccessful" based on their progress within a particular tournament (e.g. Grant, Williams, & Hocking, 1999; Hook & Hughes, 2001; Hughes & Churchill, 2005). This is problematic, since a team deemed to be successful may not necessarily be of high quality and vice versa (cf. Scoulding, James, & Taylor, 2004). Similarly, as comparisons of successful and unsuccessful teams are commonly carried out in finite events such as World Cups and European Championships, weaker teams may progress to the latter rounds at the expense of stronger teams due to the competition structure and paucity of matches (for discussions and analyses of sport competition structures, see McGarry, 1998; Vukičević, Trninić, & Dizdar, 2006). This type of study design is also limited because many teams' performances are amalgamated to produce the successful and unsuccessful groupings. These aggregate data sets potentially "mask" the factors that determine or contribute to each team's success or failure in the competition. It would therefore appear that case studies of teams over a sustained period represent a more detailed approach to analysis, with comparisons between case studies offering specific insight into the characteristics of interest (e.g. Garganta, Maia, & Basto, 1997).

A further situation factor that has received recent research interest at a behavioural level in football is match status, as determined by whether a team is winning, drawing, or losing at the time a particular behaviour is recorded (Bloomfield, Polman, & O'Donoghue, 2005a, 2005b; Jones, James, & Mellalieu, 2004; O'Donoghue & Tenga, 2001; Shaw & O'Donoghue, 2004). Although studies have considered match status in relation to the physical and tactical aspects of performance (e.g. Bloomfield *et al.*, 2005a, 2005b; O'Donoghue & Tenga, 2001; Shaw & O'Donoghue, 2004), little attention has been devoted to the technical elements. Jones *et al.* (2004) did, however, report variations in ball possession durations according to score-line, with possessions being longest when teams were losing and shortest when winning. Lago and Martin (2007) also found variations in ball possession durations as a function of match location and the identities of the teams playing. A novel aspect of Lago and Martin's (2007) study was the examination of the interaction between the match location and match status variables, with home teams having more possession when drawing than away teams. However, no rationale was provided for studying this particular relationship at the expense of other possible situation variable interactions.

The highlighted studies (Bloomfield *et al.*, 2005a, 2005b; Jones *et al.*, 2004; Lago & Martin, 2007; O'Donoghue & Tenga, 2001; Sasaki *et al.*, 1999; Shaw & O'Donoghue, 2004; Tucker *et al.*, 2005) provide evidence to support the notion that situation variables require consideration when evaluating football performance at a behavioural level. Nonetheless, with the exception of Lago and Martin (2007), the existing notational analysis literature has examined situation factors independently, thereby neglecting to account for the complex and dynamic nature of football performance (McGarry & Franks, 2003; Reed & O'Donoghue, 2005). Based on the limitations of the extant research, the purpose of the current study was to investigate the independent and interactive effects of match location, quality of the opposition, and match status on the technical components of football performance through a case study of a professional team.

Methods

Match sample

Forty matches played by a professional football team during the 2002–2003 and 2003–2004 domestic league seasons were sampled from available match footage. The match sample was balanced with respect to match location and quality of the opposition (i.e. 10 matches were played at home against strong opposition, 10 matches at home against weak opposition, 10 matches away against strong opposition, and 10 matches away against weak opposition). These matches included 14 wins, 8 draws, and 18 losses, with 57 goals scored and 59 goals conceded by the sampled team. The team's overall record for the sampled seasons were 27 wins, 27 draws, 38 losses, 106 goals scored, and 126 goals conceded.

Measures: Identification of on-the-ball performance indicators

Football-specific technical performance indicators were developed in three stages (Hughes & Bartlett, 2002). First, a review of the extant football-based notational analysis literature was conducted to establish an exhaustive list of previously analysed technical behaviours. Behaviours relating to the goalkeeper were excluded as many, such as catches, saves, and throws, are unique to this playing position (cf. Hughes & Probert, 2006). This resulted in 13 on-the-ball behaviours: aerial challenges, clearances, crosses, dribbles, interceptions, losses of control, passes, shots, tackles, times tackled, corners, free kicks, and throw-ins. Next, each behaviour was given two operational definitions, the first to aid in the identification of each behaviour type (e.g. a pass was an attempt to play the ball to a team-mate) and the second to determine what constituted a successful or unsuccessful outcome (e.g. a pass was successful if the ball went to a team-mate and unsuccessful if the ball went to an opposition player or out-of-play). The technical performance indicators (i.e. behaviour and outcome) were then presented to the manager and assistant manager of the sampled team with the corresponding operational definitions for the purpose of content validation.

Data collection procedures

Footage of each sampled match was notated using the Noldus Observer Video Pro 4.1 behavioural measurement package (Noldus Information Technology, 2002) with data collection being based upon the pre-defined technical performance indicators. Data were only collected for the sampled team and entry into the computerized system followed a cyclic sequence of technical performance indicator (behaviour and outcome), match location, quality of opposition, and current match status. Match location was recorded as "home" or "away" depending on whether the sampled team was playing at its own ground or that of its opponent (Sasaki *et al.*, 1999; Tucker *et al.*, 2005). Quality of opposition was dichotomized into "strong" and "weak" categories based on whether the opponent finished in the top or bottom half of the division (positions 1–12 or 13–24 respectively) within the season from which the data were obtained. Match status was defined as "winning", "drawing", or "losing" in relation to the number of goals scored and conceded by the sampled team at the time of data entry (Bloomfield *et al.*, 2005b; Jones *et al.*, 2004). Data were collected for the duration of each match, including injury time.

Reliability testing

Data reliability was assessed through intra- and inter-observer testing procedures (James, Taylor, & Stanley, 2007). Intra-observer reliability testing was conducted via the lead author coding behaviours and outcomes from five additional matches supplied by the participating football team. Following a 6-week period, to negate any learning effect, the matches were re-analysed with the data being compared with those of the original coding sessions. Two independent experienced football notational analysts who had received 10 hours training in data collection then completed inter-observer reliability testing. The two analysts coded each of the five matches once with their data being compared with those of the lead author's first coding session. Intra- and inter-observer agreement were assessed via the percentage error method advocated by Hughes and co-workers (Hughes, Cooper, & Nevill, 2004), with all data found to be within acceptable levels (i.e. $<5\%$ error).

Data analysis

Although a balanced sample of matches was obtained with regard to match location and quality of opposition, discrepancies were evident in the duration of winning, drawing, and losing match status. For example, in away matches against weak opposition, the team spent 68 min winning, 498 min drawing, and 334 min losing. The raw data were therefore transformed to the standard period of a match (i.e. 90 min) using the formula:

$$\text{Transformation} = F(n/90),$$

where F equals the observed frequency of the performance indicator and n is the number of minutes played. Following transformation of the raw data, log-linear and logit modelling were used to analyse behaviour incidence (Stage 1) and behaviour outcomes (Stage 2) as a function of match location, quality of the opposition, and match status respectively. The suitability of the transformed data for log-linear and logit analyses was examined in accordance with the recommendations of Tabachnick and Fidell (2001). No issues were evident during Stage 1, but corners, losses of control, and free kicks were excluded in Stage 2 due to problems with the ratio of cases to variables and the inadequacy of expected frequency counts.

Stage 1: The influence of situation variables on behaviour incidence

Log-linear modelling procedures

The independent and interactive effects of the situation variables on behaviour incidence were examined through log-linear modelling (Knoke & Burke, 1980; Nevill, Atkinson, Hughes, & Cooper, 2002; Norušis, 1993; Tabachnick & Fidell, 2001). Initially, a cross-tabulation of the categorical variables of interest (i.e. match location, quality of opposition, and match status) was constructed for each of the behaviours and the transformed frequency within each cell established. The log-linear modelling procedure attempts to fit the natural logarithm of cell frequencies via an additive model consisting of main effects and interactions between the categorical variables (Norušis, 1993). Within this study, the full, or saturated, log-linear model takes the form:

$$\ln(F_{ijk}) = \theta + \lambda_i^L + \lambda_j^Q + \lambda_k^S + \lambda_{ij}^{LQ} + \lambda_{ik}^{LS} + \lambda_{jk}^{QS} + \lambda_{ijk}^{LQS},$$

where for each contingency table cell the natural logarithm of the expected frequency, ln(F), is the summation of the overall grand mean of the cell log frequencies, θ, and parameter estimates, λ, for the main effects and interactions of match location (L), quality of opposition (Q), and match status (S). As the full model always fits the data perfectly, hierarchical backwards elimination was used to identify the simplest model that would accurately predict the observed cell frequencies (Nevill *et al.*, 2002; Norušis, 1993; Tabachnick & Fidell, 2001). Specifically, at each step the highest-order terms within the model were tested and the one resulting in the least significant change in likelihood-ratio chi-square was removed, provided that the ensuing model was not significantly different from the full model ($P > 0.05$, Norušis, 1993). Within hierarchical models the retention of higher-order terms implicitly includes associated lower-order terms (e.g. a model incorporating the interaction match location*match status also contains the main effects of match location and match status).

During the next phase of data analysis, parameter estimates were produced for each main effect and interaction term retained within the models. Positive parameter estimates add to the model constant and therefore correspond to an increase in cell frequency, whereas negative parameters relate to decrements. The specific change in behaviour incidence represented by each parameter estimate can be calculated by taking the antilog to produce a multiplicative factor (e.g. a parameter estimate of -1.345 corresponds to a decrease in the frequency of a behaviour by a factor of 0.26 or 74% from the antilog of the model constant). However, as parameter estimates sum to zero across the levels of a variable, the estimates relating to match location and quality of opposition will only be presented for matches played at home and against strong opposition respectively (e.g. if the parameter for home matches was 1.235, then for away matches it would be -1.235). In contrast, to facilitate interpretation, parameter estimates will be presented for all levels (i.e. winning, drawing, and losing) of the match status situation variable. Finally, each parameter estimate was divided by its standard error to produce a z-score, where those >1.96 indicated significant model effects. As no collective test of significance is available for the terms within the models that include factors with more than two levels (i.e. the main effect of, or interactions incorporating, match status – winning, drawing, losing), significance was attributed if any of the individual z-scores reached the requisite levels of >1.96 (Tabachnick & Fidell, 2001).

Results

Models of best fit. Six distinct models were identified to account for the observed incidence of each of the behaviours (Table I). The most complex model was found for aerial challenges and passes and included all possible two-way interactions of the selected variables. In contrast, the model for dribbles only retained the two-way associations of match location*quality of opposition and match location*match status. Unlike these first two sets of models, the models for the remaining behaviours did not include the influence of all the situation variables. For example, the model that best represented the incidence of losses of control, tackles, and times tackled consisted of the single interaction match location*match status. Match location and match status were also evident within the clearance, cross, and interception models but in isolation rather than interaction. The model for shots only included a match location effect, while the final model (relating to corners, free kicks, and throw-ins) excluded the influence of all situation variables.

Parameter estimates. As the models for corners, free kicks, and throw-ins only consisted of a constant, parameter estimates relating to the situation variables were not produced (Table II). For the remaining behaviours, match location occurred within every incidence model, yet no trends in the direction of its

Table I. Model and fit information for the frequency of on-the-ball behaviours performed by a professional British football team as a function of match location [L], quality of opposition [Q], and match status [S].

Behaviour	Model*	Likelihood ratio χ^2	d.f.	$P^{\#}$
Aerial challenge	[LQ] [LS] [QS]	1.09	2	0.578
Clearance	[L] [S]	4.56	8	0.804
Cross	[L] [S]	4.96	8	0.761
Dribble	[LQ] [LS]	9.07	4	0.059
Interception	[L] [S]	4.11	8	0.847
Loss of control	[LS]	0.85	6	0.991
Pass	[LQ] [LS] [QS]	3.91	2	0.142
Shot	[L]	12.87	10	0.231
Tackle	[LS]	4.11	6	0.661
Times tackled	[LS]	4.85	6	0.564
Corner	Constant only‡	6.99	11	0.800
Free kick	Constant only‡	11.18	11	0.428
Throw-In	Constant only‡	11.51	11	0.402

*Interactions between variables are enclosed within square brackets (e.g. a two-way interaction between match location and match status would be signified by [LS]).

‡Constant only models do not retain any effects of the situation variables.

#P-values indicate whether the model of best-fit was significantly different from the full model (i.e. the model that retains all possible interactions between the situation variables – [LQS]).

Table II. Parameter estimates for the frequency of on-the-ball behaviours performed by a professional British football team as a function of match location [L], quality of opposition [Q], and match status [S].

	Model effect	Aerial challenge	Clearance	Cross	Dribble	Interception	Loss of control	Pass	Shot	Tackle	Tackled	Corner	Free kick	Throw-in
θ	**Constant**	**4.445**	**3.775**	**2.900**	**3.957**	**2.699**	**2.312**	**5.553**	**2.736**	**4.329**	**2.933**	**1.674**	**2.376**	**3.415**
[L]	Home	−0.032	−0.121*	0.291*	0.085*	−0.148*	−0.037	0.005	0.172*	−0.074*	−0.053	\	\	\
[Q]	Strong	−0.007	\	\	−0.032	\	\	0.017	\	\	\	\	\	\
[S]	Winning	0.105*	0.303*	−0.366*	−0.136*	0.313*	−0.019	−0.137*	\	0.061	−0.032	\	\	\
	Drawing	−0.068	−0.085	0.078	0.009	−0.068	0.031	−0.021	\	−0.068	−0.086	\	\	\
	Losing	−0.036	−0.219*	0.288*	0.128*	−0.245*	−0.011	0.157*	\	0.008	0.118	\	\	\
[LQ]	Home Strong	0.079*	\	\	−0.144*	\	\	−0.062*	\	\	\	\	\	\
[LS]	Home Winning	−0.155*	\	\	−0.116*	\	−0.335*	−0.185*	\	−0.220*	−0.330*	\	\	\
	Home Drawing	−0.014	\	\	−0.016	\	0.080	0.044	\	0.034	0.066	\	\	\
	Home Losing	0.169*	\	\	0.132*	\	0.255	0.141*	\	0.186*	0.264*	\	\	\
[QS]	Strong Winning	−0.108*	\	\	\	\	\	0.081*	\	\	\	\	\	\
	Strong Drawing	0.060	\	\	\	\	\	−0.029	\	\	\	\	\	\
	Strong Losing	0.048	\	\	\	\	\	−0.052*	\	\	\	\	\	\
[LQS]	Home Strong Winning	\	\	\	\	\	\	\	\	\	\	\	\	\
	Home Strong Drawing	\	\	\	\	\	\	\	\	\	\	\	\	\
	Home Strong Losing	\	\	\	\	\	\	\	\	\	\	\	\	\

*$z > 1.96$ model effect represents a significant change ($P < 0.05$) in behaviour incidence from the model constant.

\ = effect not present in the behaviour incidence model.

Note: All omitted parameters (involving away match location and weak opposition) can be derived from others as estimates sum to zero across categories. Thus, for aerial challenges, the parameter estimate for away = 0.032; similarly, the estimate for playing against weak opposition and winning = 0.108.

main effect were observed. For example, playing at home resulted in an increase of crosses and shots but fewer interceptions and tackles. The absence of directional trends in situation variable main effects and interactions was a common characteristic across behaviour incidence models. Indeed, where present within the behaviour incidence models, directional consistency was only found for the winning and losing levels of the match location*match status interaction. Specifically, playing at home and winning resulted in a decreased number of aerial challenges, dribbles, losses of control, passes, tackles, and times tackled, whereas the frequency of these behaviours increased when playing at home and losing.

Significance of model effects. Examination of the *z*-scores associated with each parameter estimate (Table II) indicated that the main effect of match location had a significant influence on the frequency of clearances, crosses, dribbles, interceptions, shots, and tackles. Although the quality of the opposition main effect was not significant within any behaviour incidence model that it appeared in, match status significantly influenced the occurrence of all behaviours except losses of control, tackles, and times tackled. Finally, where retained within the models, all two-way interactions between the situation variables were associated with a significant change in behaviour frequency.

Stage 2: The influence of situation variables on behaviour outcomes

Logit modelling procedures

The independent and interactive effects of the situation variables on behaviour outcomes were investigated through logit modelling (Knoke & Burke, 1980; Nevill *et al.*, 2002; Norušis, 1993). Logit models examine the influence of selected categorical variables (i.e. match location, quality of the opposition, and match status) on a further categorical variable (i.e behaviour outcome) and are derived from the usual log-linear model (see Norušis, 1993). Consequently, the procedures for establishing the best-fitting models, parameter estimates, and the significance of model effects were similar to those used in Stage 1. However, only terms involving the outcome variable were examined and parameter estimates for model effects relate to the change in the ½ log odds of being in one category of the dependent variable relative to another (i.e. successful outcomes to unsuccessful outcomes). Therefore, the specific change in the odds of success associated with each model effect can be calculated as the antilog of 2 × the parameter estimate (Norušis, 1993).

Results

Models of best fit. Five models were identified to account for the behaviour outcomes (Table III). The models for pass and throw-in outcomes, while different, both retained the effects of all three situation variables. However, the models for aerial challenge and shot outcomes only incorporated the influence of quality of opposition and match status respectively. The final behaviour outcome model, applying to clearances, crosses, dribbles, interceptions, tackles, and times tackled, did not retain any situation variable effects.

Parameter estimates. The parameter estimate for the outcome model effect indicated that aerial challenges, clearances, dribbles, interceptions, passes, tackles, and throw-ins were predominantly successful, with the opposite being evident for crosses, shots, and times tackled (Table IV). Where the effects were present within the outcome models, playing strong opposition was associated with an increase in the odds of success, as was playing strong opposition and winning. However, playing at home against strong opposition and playing strong opposition while losing were characterized by decreased odds of success. Mixed trends in the direction of the parameter estimates were observed across behaviours when playing at home, for all levels of the match status variable and when playing strong opposition while drawing. The remaining model effects only related to the throw-in behaviour, with playing at home and winning, playing at home and losing, and

Table III. Model and fit information for on-the-ball behaviour outcomes [O] performed by a professional British football team as a function of match location [L], quality of opposition [Q], and match status [S].

Behaviour	Model*	Likelihood ratio χ^2	d.f.	$P^{\#}$
Aerial challenge	[OQ]	6.85	10	0.740
Clearance	[O]	9.84	11	0.545
Cross	[O]	5.00	11	0.931
Dribble	[O]	9.88	11	0.541
Interception	[O]	2.94	11	0.992
Pass	[OLQ] [OQS]	0.88	4	0.927
Shot	[OS]	5.94	9	0.746
Tackle	[O]	9.63	11	0.564
Tackled	[O]	3.90	11	0.973
Throw-in	[OLQS]	0.00	0	—

*Interactions between variables are enclosed within square brackets (e.g. a two-way interaction effect between match location and match status upon the outcome of a behaviour would be signified by [OLS]).

#*P*-values indicate whether the model of best-fit was significantly different from the full model (i.e. the model that retains all possible interaction effects between the situation variables upon behaviour outcome – [OLQS]).

Table IV. Parameter estimates for the outcomes [O] of on-the-ball behaviours performed by a professional British football team as a function of match location [L], quality of opposition [Q], and match status [S].

	Model effect	Aerial challenge	Clearance	Cross	Dribble	Interception	Pass	Shot	Tackle	Tackled	Throw-in
[O]	Successful	0.137*	1.113*	−0.627*	0.569*	1.062*	0.438*	−0.184*	0.604*	−0.145*	0.436*
[OL]	Successful Home	\	\	\	\	\	0.040*	\	\	\	−0.016
[OQ]	Successful Strong	0.079*	\	\	\	\	0.040*	\	\	\	0.130*
[OS]	Successful Winning	\	\	\	\	\	−0.085*	0.396*	\	\	−0.029
	Successful Drawing	\	\	\	\	\	0.023	−0.240*	\	\	−0.167
	Successful Losing	\	\	\	\	\	0.062*	−0.156	\	\	0.196*
[OLQ]	Successful Home Strong	\	\	\	\	\	−0.052*	\	\	\	−0.020
[OLS]	Successful Home Winning	\	\	\	\	\	\	\	\	\	0.126
	Successful Home Drawing	\	\	\	\	\	\	\	\	\	−0.240*
	Successful Home Losing	\	\	\	\	\	\	\	\	\	0.114
[OQS]	Successful Strong Winning	\	\	\	\	\	0.073*	\	\	\	0.070
	Successful Strong Drawing	\	\	\	\	\	−0.038	\	\	\	0.123
	Successful Strong Losing	\	\	\	\	\	−0.034	\	\	\	−0.194*
[OLQS]	Successful Home Strong Winning	\	\	\	\	\	\	\	\	\	−0.248*
	Successful Home Strong Drawing	\	\	\	\	\	\	\	\	\	0.278*
	Successful Home Strong Losing	\	\	\	\	\	\	\	\		−0.030

*$z > 1.96$ model effect represents a significant change ($P < 0.05$) in the odds of successful behaviour outcomes.
\ = effect not present in the behaviour outcome model.
Note: All omitted parameters (involving away match location and weak opposition) can be derived from others as estimates sum to zero across categories. Thus, for throw-ins, the parameter estimate for away = 0.016; similarly, the estimate for playing at home against weak opposition and winning = 0.248.

playing at home against strong opposition and drawing all related to increments in the odds of success. Conversely, playing at home and drawing, playing at home against strong opposition and winning, and playing at home against strong opposition and losing were all associated with a decrease in the odds of success.

Significance of model effects. Assessment of parameter estimate *z*-scores (Table IV) indicated that the outcome main effect (i.e. the difference in the proportion of successful and unsuccessful outcomes) was significant within every model. The main effects of quality of opposition and match status, where present within the behaviour outcome models, had a significant influence on the odds of success. The main effect of quality of opposition was evident within the model for pass and throw-in outcome models but was only significant in the former case. In contrast, the quality of opposition*match status interaction was associated with a significant change in the odds of both successful pass and throw-in outcomes. All possible remaining interactions between the situation variables were significant but only applied to the outcomes of the throw-in behaviour.

Discussion

The aim of this study was to examine the influence of match location, quality of opposition, and match status on the technical aspects of performance within a professional football team. Existing notational analysis research has provided preliminary information on the effects of situation variables such as match location and match status on football performance at a behavioural level (e.g. Bloomfield *et al.*, 2005a, 2005b; Jones *et al.*, 2004; O'Donoghue & Tenga, 2001; Sasaki *et al.*, 1999; Tucker *et al.*, 2005). However, the examination of situation variables independently would appear to provide limited insight into the complex nature of football performance. Indeed, the findings of this study, together with those of Lago and Martin (2007), suggest that effective evaluation of football performance at a behavioural level needs to account for the potential interactions between situation variables.

The first stage of this study examined the influence of match location, quality of opposition, and match status on the incidence of on-the-ball behaviours in football. The findings suggest that potential independent and interactive effects of situation variables occur at the behavioural level, supporting the notion that football performance is a complex construct that is influenced by numerous factors (James, Mellalieu, & Holley, 2002). For example, the occurrence of most behaviours associated with "open play" were influenced by two or more situation variables, with match status, and to a greater extent match location, particularly pertinent (cf. Bloomfield *et al.*, 2005b; Jones *et al.*, 2004; Lago & Martin, 2007; Sasaki *et al.*, 1999; Tucker *et al.*, 2005). In contrast, the incidence of behaviours with the common function of "set plays", such as corners, free kicks, and throw-ins (cf. Ensum, Taylor, & Williams, 2002), were not found to vary as a function of any of the situation variables. This indicates that the distinction between different phases of play may be an important consideration for analysts and coaches when evaluating football performance.

The discrepancies in behaviour incidence as a function of match location, quality of opposition, and match status could stem from several sources. For example, the team manager may tailor strategies and tactics to situation variables that potentially affect a particular match and is subsequently reflected in the behaviours performed by the team (cf. Dennis & Carron, 1999). Similarly, variations in behaviour occurrence may be required as a response to the strategies employed by, and the strengths of, the opposition teams faced (James *et al.*, 2002). To this effect, it is surprising that the quality of opposition variable was excluded from all behaviour incidence models, apart from those for aerial challenges, dribbles, and passes. Despite the lack of investigations of opposition quality in the existing football-based notational analysis literature, this finding appears counter-intuitive. For example, it may be expected that more clearances and tackles and fewer crosses and shots would be executed, against strong opposition. The "strong"–"weak" dichotomy used in this study may therefore lack the necessary sensitivity to differentiate changes in behaviour incidence as a function of the quality of the opposition. Future studies could overcome this issue by using more quality of opposition categories (e.g. strong, medium, weak) or via alternative approaches to classification, such as the current league positions of competing teams at the time of a particular match, rather than their end-of-season ranking.

The second stage of this study examined the effect of match location, quality of opposition, and match status on the outcomes of on-the-ball behaviours. The results indicated that the outcomes of most behaviours were not influenced by the situation variables, either independently or interactively. This finding is similar to that of Eom and Shultz (1992), who reported that execution of skills in volleyball was resistant to the effects of contextual variables. A possible explanation for this result is that the sampled team in our study was of a professional standard, and therefore the players were likely to be within the autonomous stage of skill learning. Consequently, execution of the respective technical behaviours would probably be resistant to external influences such as those of the situational factors within the current investigation (Magill, 2003; Williams, Horn, & Hodges, 2003).

Our findings regarding the consistent nature of behaviour outcomes in relation to match location were in direct contrast to the literature, which suggests performance is improved when playing at home (cf. Nevill & Holder, 1999). Indeed, this finding is at odds with previous research that found the performance of behaviours such as aerial challenges and crosses to be more successful during home matches (e.g. Sasaki *et al.*, 1999; Tucker *et al.*, 2005). These equivocal findings are unlikely to reflect the different playing standards of the teams analysed within each study, as the existing literature suggests that home advantage is consistent across league divisions (e.g. Clarke & Norman, 1995; Nevill & Holder, 1999). It is possible, therefore, that our findings, and those of Sasaki *et al.* (1999) and Tucker *et al.* (2005), are indicative of situation variables, such as match location, having unique effects upon individual teams (c.f. Clarke & Norman, 1995; Nevill & Holder, 1999).

Overall, our results emphasize the importance of accounting for match location, quality of opposition, and match status during the assessment of the technical component of football performance (Carling *et al.*, 2005). Our results add to the existing football-based notational analysis literature by highlighting both the independent and interactive effects of situation variables on performance at a behavioural level (cf. Bloomfield *et al.*, 2005a, 2005b; Jones *et al.*, 2004; Lago & Martin, 2007; O'Donoghue & Tenga, 2001; Sasaki *et al.*, 1999; Tucker *et al.*, 2005). The salient finding, however, was the dependence of most behaviour occurrences, but not the majority of behaviour outcomes, on the specific match situation.

The detailed evaluation of the influence of match location, quality of opposition, and match status on technical components of performance within this study presents a number of implications for notational analysts and football coaches. First, existing recommendations suggest that the scouting of upcoming opposition should be carried out under circumstances that are reflective of the conditions under which the future match will occur (Kormenlink & Seeverens, 1999). However, such procedures are unlikely to be pragmatic due to time and resource constraints. Consequently, by establishing the impact of particular situation variables on performance, teams can be observed, when possible, with appropriate adjustments being made to analyses based on knowledge of such effects. Similarly, post-match assessments of the technical aspects of performance can be made more objective by factoring in the effects of situation variables (Carling *et al.*, 2005). Finally, if a notational analyst or coach has identified that technical aspects of performance are adversely influenced by specific situation variables, possible causes can be examined and match preparation focused towards reducing such effects. For example, in the present study drawing match status was found to be associated with a significant decrease in the odds of a successful outcome for shots. The coach could therefore identify possible explanations for this change in performance and implement appropriate interventions, such as training drills, to negate any potential detrimental effects in future matches.

Although the results of this study highlight the importance of accounting for the influence of situation variables on technical-related components of football performance, there are several limitations that provide areas for future research. First, our study adopted a fine-grained approach to football analysis by considering a single team's performances over a sustained period (two seasons). This contrasts with previous football literature that has tended to aggregate performances of different teams during analysis, thereby limiting the validity of their conclusions. However, an obvious limitation of case study designs is that generalization of findings is precluded. Indeed, the contradictory effects of match location found within this study and those of Sasaki *et al.* (1999) and Tucker *et al.* (2005) emphasize the need to validate the models developed here across numerous additional teams. In accordance with previous football research, samples should be considered from a range of populations, including amateur, women, and youth football teams, as well as focusing on a range of countries and competitions (e.g. Burchill, Donovan, & Peters, 2006; James *et al.*, 2002; Konstadinidou & Tsigilis, 2005; Reilly, 2003a; Shaw & O'Donoghue, 2004; Yamanaka, Hughes, & Lott, 1993). Similarly, the models established within this study should be validated on a further sample drawn from the same team in future seasons. This will provide an indication of whether the effects of the situation variables are consistent over time and thus their importance as predictors of football performance at a behavioural level.

This study has extended the existing notational analysis literature by examining both independent and interactive effects of situation variables on the technical component of performance. However, only three situation variables were incorporated into our analysis due to a combination of time and resource constraints and a paucity of previous empirical evidence. Both football coaching and scientific notational analysis literature have nevertheless proffered numerous factors that may influence the various technical, tactical, mental, and physical components of performance (Carling *et al.*, 2005; Kormelink & Seeverens, 1999; Maynard, 2002). For example, environmental factors such as the weather and the conditions of the pitch appear to be common concerns within applied and research settings (cf. Carling *et al*., 2005; Kormelink & Seeverens, 1999; Reilly, 2003b). The inclusion of these variables in any analysis, however, would require the collection of objective meteorological data that are not available from the video recordings upon which notational analysis studies are commonly based (cf. Lee & Garraway, 2000). A further limitation of working from video footage is that a single camera viewpoint is usually used, which tends to limit investigations to on-the-ball behaviours. Nonetheless, it is plausible that behaviours occurring off-the-ball, such as player runs and positioning, may also be influenced by situation variables and thus is an area for future research.

Of the situation variables examined within this study, match location and match status were found, either in isolation or in interaction, to be prominent influences upon technical aspects of football performance, particularly behaviour incidence. The importance of these factors may, as previously stated, relate to changes in team strategy as a response to specific match situations (Bloomfield *et al*., 2005b; Dennis & Carron, 1999; Tucker *et al*., 2005). However, it is also possible that time-related factors will have further confounding effects. For example, the incidence and outcomes of behaviours performed by a team might differ under any given match status if there was 50 min of the match remaining rather than 10 min. To this effect, an analysis of performance by match half would appear appropriate, as this interval provides a manager or coach with an ideal opportunity to implement new strategies and tactics. Nevertheless, alternative match periods, such as the time since the last change of match status or the previous goal, also appear credible stimuli for strategic and tactical changes and accordingly deserve further examination.

The findings of this study suggest that the variations in behaviour incidence and behaviour outcomes to a lesser extent are linked to team strategy and tactics. For example, playing strong opposition was characterized by an increase in passes and a decrease in dribbles, potentially reflecting different possession strategies (cf. Jones *et al*., 2004; Lago & Martin, 2007). Similarly, shots were less successful when drawing or losing compared with winning, which may reflect the team attempting more difficult shots (e.g. from longer distances and tighter angles) when "chasing" the game. To provide additional insight into such strategic and tactical changes, future research should record the particular location on the pitch surface where behaviours were executed (cf. Hughes & Franks, 2004). Indeed, our failure to account for pitch area may explain the absence of the influence of situation variables upon some behaviour outcomes in the present study. For example, under a given match circumstance, aerial challenges may be mainly unsuccessful within the defensive half yet successful within the attacking half. This would have clear implications for match analysts and coaches in terms of performance evaluation and the development of relevant training drills.

Finally, while the findings of this study broaden our understanding of football performance, the influences of the selected situation variables were only investigated in relation to the overall team performance. This contrasts with applied research, where the evaluation of the components of performance is also made at playing position and individual player levels (Carling *et al*., 2005; Kormelink & Seeverens, 1999). Although these team structures have received some research interest (e.g. Dunn, Ford, & Williams, 2003; Grehaigne, Bouthier, & David, 1997; Hughes & Probert, 2006; James *et al*., 2002; Taylor, Mellalieu, & James, 2004, 2005; Williams, Williams, & Horn, 2003), the influence of situation variables needs to be addressed to provide a comprehensive framework upon which to base individual player and position-specific performance assessments.

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