An investigation into the effects of game location upon performance in professional soccer.

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An investigation into the effects of game location upon performance in professional soccer

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DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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Date 31st October 2005

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Contents

Abstract

Although the existence of an overall home advantage in professional soccer is well established, there is little empirical information examining the specific effects upon the technical and tactical performance of teams. Consequently, the aim of this thesis was to investigate the effect of playing at home upon team performance in professional soccer. Building upon the existing home advantage literature, study one compared the performance of home and visiting sides using a random sample of matches (n=30), then, in order to provide a more idiosyncratic assessment of soccer performance, study two utilised a case-study approach to examine game location effects in a sample of matches (n=15) from a single team. Data was collected from the 2001/02 and 2002/03 domestic seasons of the English Premiership using the Noldus Observer Video-Pro package via a pre-designed coding system, enabling technical and tactical performance indicators to be compared with respect to game location (home versus away teams) using non-parametric procedures (Wilcoxon signed ranks, Kruskal-Wallis, and Mann-Whitney U). Additional analysis compared the effects of potential confounding variables upon team performance including weather conditions (wet and dry), kick-off times (morning, afternoon, and evening) and game status (winning, losing, and drawing).

In study one the home teams performed a greater number of successful technical behaviours (e.g., tackles, crosses, and shots) than the away teams. With regard to tactical behaviours, the home teams performed more aerial challenges and committed more fouls than away teams in the attacking third of the field. In the defensive third of the field, the away teams performed more interceptions, aerial challenges, and clearances than home teams. When the effect of potential confounding variables were considered, some significant differences were evident in the technical and tactical performance of teams as

a function of weather conditions, kick-off times, and game status (e.g., more attacking indicators and fewer defensive indicators were performed when teams were losing compared to when winning). In study two, the case-study team was found to perform a greater number of successful technical behaviours at home (aerial challenges, blocked shots, and corners) while more successful clearances were performed when playing away. With regard to tactical behaviours, more dribbles, aerial challenges and difficult passes were made in the attacking third of the field at home. In the defensive third of the field, more losses of control, interceptions, clearances and received tackles were observed when away.

The findings suggest that aspects of technical and tactical performance differ as a function of game location. Specifically, teams perform a greater number of successful technical behaviours associated with a functional aggressive response at home (e.g., tackles, aerial challenges, and shots at goal). In addition, more attacking tactical behaviours (actions in the attacking third of the field) appear to be exhibited at home and more defensive tactical behaviours (actions in the defensive third of the field) performed when away. The findings also suggest that variables such as game status and weather conditions may cause teams to alter the type of tactics or strategies adopted. Future research should explore these preliminary findings with larger samples both within leagues and individual teams and allow for the effects of additional confounding variables such as crowd attendance, distance travelled by the away side, and team quality/form. Team strategies also need to be considered in relation to the actual playing tactics adopted by the respective coaches and managers.

List of Figures and Tables

Figures

Tables

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1. Introduction

In the search for success, English professional soccer has begun to embrace the academic discipline of sports science in order to assess, examine, and facilitate the physiological, technical, tactical, and psychological factors that comprise performance (Richardson and Riley, 2003). From a psychological perspective, one aspect of the game that has anecdotally been perceived to influence performance is home advantage, or the benefit a team may glean from playing on its own territory. Courneya and Carron (1992, p. 13) referred to home advantage as:

> "The consistent finding that home teams in sport competitions win over 50% of the games played under a balanced home and away schedule".

Home advantage has been identified in a range of sports at both an amateur and professional level including soccer, basketball, ice-hockey, and American football. For example, Pollard (1986) and Nevill, Newell, and Gale (1996) have found home winning percentages (HWP's) of 66.5% and 60% respectively for soccer, while HWP's of between 51-70% have been reported in American football, basketball, and ice-hockey (Schwartz and Barsky, 1977; Varca, 1980; Bray, 1999).

In an attempt to improve the understanding of home advantage, Courneya and Carron (1992) proposed a framework for researchers to investigate the effects of the location of a match and any subsequent home advantage that may arise. The framework comprised five components that were suggested to be influenced by the location of the game including: the venue of the game itself; game location factors; the critical psychological and behavioural states of the competitors, coaches, and officials; and the subsequent performance outcomes. The components were linked together with; game location factors

(i.e., crowd, travel etc) influencing the critical psychological and behavioural states of the competitors, coaches and officials, which in turn influences performance. Game location referred to whether the venue of the competition was at home or away relative to the studied individual or team. Game location factors denoted the effects of factors including the crowd, the distance travelled by opposition teams, sport-specific rules that may benefit the home side, and the presence of any learning effects that could be manipulated by the home team due to familiarity with a particular venue. Critical psychological states referred to the effects of game location factors upon the cognitive and affective states of the three groups of individuals who influence the competition outcome (i.e., competitors, coaches, and officials), while critical behavioural states referred to the amount of effort expended, level of aggression, and subsequent strategic and subjective decisions made by these individuals. The final influence of the location of the game was upon the subsequent performance of the team, individual or official being studied with respect to primary, secondary, and tertiary measures. Primary measures consisted of fundamental skill execution (batting average, free throw percentage, and penalties per game). Secondary measures usually reflected the scoring necessary to win a contest (e.g., points or goals scored), while tertiary measures indicated the final match outcome (win/loss, point's difference etc.).

The majority of subsequent empirical investigations using Courneya and Carron's (1992) framework have predominantly focused upon the effects of game location factors and critical psychological states upon secondary and tertiary performance measures. For example, Nevill and colleagues showed that in English soccer the percentage of home wins increased as crowd size increased and that the crowd may bias the decision-making of officials (Nevill *et al.* 1996; Nevill, Balmer and Williams, 1999; 2002a; 2002b). Other

studies suggest that the distance travelled by away teams and the number of days between games also increased the home advantage in sports such as soccer (Clarke and Norman, 1995; Pollard, 1986; Brown, Van Raalte, Brewer, Winter, Cornelius and Anderson, 2002) and minor league baseball and NHL ice-hockey (Courneya and Carron, 1991; Pace and Carron, 1992). With regard to the influence of game location upon psychological states, studies by Thuot, Kavouras and Kenefick (1998) and Bray, Jones and Owen (2002) of basketball and hockey, respectively, found that at home athletes' reported differing levels of cognitive and affective states (e.g., higher levels of self-confidence and lower levels of somatic anxiety for females).

Despite the interest in the aspects of game location factors and critical psychological states proposed by Courneya and Carron's (1992) framework surprisingly few studies have considered how playing at home influences the critical behaviours of the athletes their teams, and the subsequent primary measures of performance. Glamser (1990) suggested that the hostile atmosphere that was found to be given to away players by the home crowd in English soccer produced a dysfunctional aggressive response via increased player misconduct. Conversely, the crowd atmosphere was suggested to produce a functional aggressive response in the home team resulting in greater successful behaviours (e.g. tackles made, fouls received). In ice-hockey the functional aggressive response has also been observed to contribute to more assertive attacking styles (pressure by forwards on the puck carrier) by teams at home compared to away (Dennis and Carron, 1999). Other investigations of primary performance measures in sports such as ice-hockey, baseball, and basketball have also found that the home team scores more points, commits less fouls and receives more fouls than the away team (Schwartz and Barsky, 1977; Pickens, 1994; Madrigal and James, 1999).

To date, only three studies have examined the effects of game location upon performance in soccer with a number of differences observed in attacking behaviours in favour of the home team (Nevill *et al.*, 1996; Sasaki, Nevill and Reilly, 1999; Sutter and Kocher, 2004). Although few studies have considered the effects of home advantage upon performance, technical (type of action/behaviour performed e.g., shot, pass, tackle) and tactical (actions/behaviours in relation to areas of the field, patterns of play, etc.) indicators of success in soccer have received considerable attention within the scientific discipline of notational or performance analysis. However, while these studies have considered both the technical and tactical behaviours of successful and unsuccessful teams in domestic and international competition (e.g., Church and Hughes, 1987; Ali, 1988; Hook and Hughes, 2001; Hughes and Pettit, 2001; Abt, Dickson and Mummery, 2002) none have examined whether performance differs as a function of game location.

The sport psychology and soccer notational analysis literature has also highlighted the need to consider the performance of teams as a function of both personal and situational (environmental) factors that may serve to confound or influence the outcome of a match or competition (e.g., Bray, 1999; James, Mellalieu and Hollely, 2002). James *et al.* (2002) suggested that to assume that players will perform in a similar manner across matches without consideration of other factors that are specific to each match is inadequate. Indeed, before any inferences regarding a teams' technical or tactical performance can be made, the influence of potential confounding variables must be accounted for such as the time of kick-off, weather conditions, and game status (i.e., whether the team is winning, losing or drawing at the time of analysis). James *et al.* have also highlighted the need to adopt a more fine-grained individual or idiographic approach to the study of performance through the investigation of a single case or team. This contrasts the existing or group-

based approach that considers the data collected from several different teams and which may serve to hide any individual subtleties in performance due to the aggregation of different tactical and technical behaviours exclusive to each team.

Despite the considerable literature that has examined certain aspects of Courneya and Carron's (1992) framework in sport psychology and the increasing research into the behavioural components of soccer performance within the notational analysis discipline (i.e., technical and tactical/strategic), there has been a lack of in-depth investigation into the effects of home advantage upon specific components of performance in soccer. Although the study by Sasaki *et al.* (1999) provides some detail regarding the performances of home and away teams, the investigation of a more comprehensive range of indicators of performance (technical and tactical), that also considers the influence of potential confounding variables (weather conditions, kick-off times, game status), is needed to detail the effects of game location upon behaviour and subsequent performance in soccer.

The aim of this thesis therefore is to conduct an in-depth investigation into the effect of game location, specifically playing at home, upon team performance in professional soccer. In order to extend the existing home advantage literature in soccer that has examined a limited number of performance indicators (e.g., Nevill *et al.*, 1996; Sasaki *et al.*, 1999) the first objective is to investigate whether there are differences between technical indicators of performance of home and away teams, and specifically whether there is an increased functional aggressive response for the home side (e.g., do teams make more successful tackles, passes, and shots at goal at home compared to away?). Next, as existing studies have only examined technical aspects of soccer performance, the

second objective is to consider any differences in the tactical behaviours of teams as a function of game location (e.g., do teams make more attacking behaviours at home and more defensive behaviours away?). Finally, as no studies have considered the influence of potential confounding variables upon soccer performance the last objective is to compare the effects of these factors (weather conditions, kick-off times, and game status) upon technical and tactical indicators of performance with respect to game location (Bray, 1999; James *et al.*, 2002).

To achieve these objectives this investigation will comprise two studies. Firstly, study one will examine the effect of playing at home upon the technical and tactical performance of teams' randomly sampled from the English professional soccer league. Then, in line with the recommendation for a more idiographic or individual assessment of soccer performance (James *et al.*, 2002), the second investigation will adopt a case-study approach to examine any effects of playing at home upon the technical and tactical performance of a sample of matches from a single professional soccer team over the course of a domestic season. In both studies, additional analyses will consider the influence of potential confounding variables upon any differences in performance as a function of game location.

Based upon the findings in the existing sport psychology (e.g., Courneya and Carron, 1992; Nevill and Holder, 1999; Sasaki *et al.*, 1999; Nevill *et al.*, 2002a; Sutter and Kocher, 2004) and notational analysis literature (e.g., Church and Hughes, 1987; Ali, 1988; Hughes and Pettit, 2001; Abt *et al.*, 2002) several research hypotheses are proposed regarding game location and the influence of playing at home upon team technical and tactical performance:

1. An overall home advantage (i.e., HWP's) will exist for both the random sample of teams in study one and the case-study team in study two (Pollard, 1986; Nevill *et al.*, 1996).
2. In line with the findings of Glamser (1990), it is predicted that more technical performance indicators associated with the functional aggressive response will be performed at home compared to away in studies one and two (Nevill *et al.*, 1996; Sasaki *et al.*, 1999). Similarly, the away side will perform a greater number of behaviours associated with a dysfunctional aggressive response.
3. Based on the findings of Dennis and Carron (1999) regarding differences in playing styles and tactics as a function of game location it is predicted that, for both samples, the home team will perform more attacking tactical behaviours and less defensive tactical behaviours at home when compared to away.
4. When potential confounding variables are taken into account, within both studies, technical and tactical performance is hypothesized to vary as a function of weather conditions (wet or dry), kick-off times (morning, afternoon, or evening) and match status (winning, losing, or drawing). Specifically, wet playing conditions will lead to more defensive and less attacking technical behaviours due to the reduced ability to control and offload the ball, giving more time to the opposition to close players down (Ali, 1988). Early kick off times will favour the home side due to the disruption of preparation associated with travel for the away team (Pollard, 1986). Finally, losing teams will exhibit more attacking behaviours than those in winning or drawing status, as they will be pushing more players into forward positions in order to create scoring opportunities (Church and Hughes, 1987; Abt *et al.*, 2002).

2. Literature Review

2.1 Introduction

More references have been made to the difficulty of defeating a home team than any single factor including skill, prior record, injuries, and form (Edwards and Archambault, 1989). The aim of this review is to discuss the literature that has investigated the phenomenon of home advantage in sport. Firstly, the findings relating to the degree of home advantage observed within sports using outcome measures will be examined (i.e., the home advantage statistic). Secondly, the athletes and coaches' perceptions of why the home advantage exits will be discussed. Then, using Courneya and Carron's (1992) conceptual framework, the focus of the review discusses the potential factors that influence the degree of home advantage (i.e., crowds, travel, learning, rules, and team quality) along with the potential psychological impact upon individual and team performance. Here, the concept of the home disadvantage is also briefly considered. Finally, the review will conclude by considering how performance is analysed in sport, specifically within soccer, via notational analysis procedures. In discussing the existing notation analysis literature within soccer (i.e., studies of technical and tactical performance) various methodological issues will be considered, including system reliability and validity, and the concept of the performance profile.

2.2 Home Advantage Statistic

Home advantage has been calculated in many different ways including Home Winning Percentage (HWP), Percentage Differences, Home/Away Percentage Differential (H/AD), and Percentage Reduction (Bray and Carron, 1993; Bray, 1999; Pollard, 2002). Pollard (2002) noted though that the most common ways of working out HWP was by the

number of home wins or points being expressed as a percentage of the total number of wins or points (see Appendix C for numerical examples). The home advantage statistic has been examined in many sports (Table 2.1), for example, in ice-hockey, Agnew and Carron (1994) analysed fifteen teams over a two-year period and found that 86.7% of the teams exhibited a home advantage while Bray (1999) studied a total of 409 team seasons and found a mean H/AD of 17.6% for the entire sample. It was also shown that 93.2% of the seasons reflected a greater home winning percentage. In basketball, Gayton and Coombs (1995) conducted analysis on four high school teams and showed that on average the four teams won 13% more often at home than away. In addition, Bray and Widmeyer (2000) studied four female teams from the Western Division of the Ontario Women's Intercollegiate Athletic Association (OWIAA) and found that team's won 12% more games at home than away.

In soccer, Brown *et al.* (2002) examined the eleven years prior to the 1998 World Cup for the 32 teams involved and found that for HWP-AWP the mean difference was 27% and all teams except one had a home advantage. Neave and Wolfson (2003) also looked at 30 national teams and found that they won 60% of their games at home and only 43% away. The probability of winning a match at home has also been examined with the home venue shown to have an initial positive effect on the probability of winning, but as the match progresses' playing at home becomes less relevant on winning (Falter and Perignon, 2000). In summary, there seems to be evidence for the existence of an overall home advantage statistic across a number of different sports including soccer. The following sections consider the literature that has offered reasons for home advantage and its proposed effect on sporting performance.

Table 2.1. Home winning percentages for a variety of different sports.

Authors	Sport	Years Analysed	Number of Games	Home Winning Percentage (HWP)	Notes
Schwartz and Barsky (1977)	Baseball	1971	1880	53%	HWP worked out by the number of games won as a percentage of the total number of games.
	Professional Football	1971	182	55% (ties included)	
			178	58% (ties excluded)	
	College Football	1971	910	59% (ties included)	
			899	60% (ties excluded)	
	Ice-Hockey	1971	542	53% (ties included)	
			449	64% (ties excluded)	
Varca (1980)	Basketball (AL and NL)	1977-78	90	70%	Number of home wins out of total number of games.
Pollard (1986)	American				
	Ice-Hockey (NHL)	1981/82-1983/84	2520	59.90% (2 points a win)	Number of points out of total points.
	Baseball	1982-84	6316	53.60%	Number of wins out of the total number of games.
	Football (NFL)	1982-84	571	55% (ties excluded)	
	Basketball (NBA)	1981/82-1983/85	2829	63.30%	
	Soccer (NASL)	1982-84	512	65.20%	
	British				
	Cricket (County Championship)	1981-83	289	56.10% (ties excluded)	Number of wins out of the total number of games.
	Soccer 1st Division	1981/82-1983/84	1386	63.90% (3 points a win)	Number of points out of total points.
	Soccer 1st Division	1888-1939	17233	66.50% (2 points a win)	
	Soccer 1st Division	1946-81	16170	63.05% (2 points a win)	
Gayton, Matthews and Nickless (1987)	Ice-Hockey (Stanley Cup semi-finals and finals)	1960-85	299	54%	Number of wins out of the total number of games.
Silva and Andrew (1987)	Basketball (ACC)	1971-81	418	65.79%	Number of wins out of the total number of games.

Table 2.1 contd.

Courneya and Carron (1991)	Baseball (Minor League Double A)	1988	1812	55.10%	Number of wins out of the total number of games.
Pace and Carron (1992)	NHL	1988-89	840 743	58.30% (ties included) 59.40% (ties excluded)	Number of wins out of the total number of games.
	NHL (play-off games)	1988-89	82	57.30%	
McAndrew (1993)	Wrestling	1989-91	20869	53.80%	Number of wins out of the total number of games.
Salminen (1993)	Soccer, Ice-Hockey and Basketball	1984-86	56	59% (ties included)	Number of wins out of the total number of games.
Adams, Kupper and Jeanne (1994)	Baseball (AN and FL)	1900-91	133560	54.30% (ties excluded)	Number of wins out of the total number of games.
Agnew and Carron (1994)	Ice-Hockey	1986/87-1987/88	990 945	58.80% (ties included) 61.50% (ties excluded)	Number of wins out of the total number of games.
Pickens (1994)	Basketball (ACC)	1990-91	56	68%	Number of wins out of the total number of games.
Clarke and Norman (1995)	English Soccer	1981/82-1990/91	20306	62.10%	Number of wins (plus draws as half a win) as a percentage of total number of games.
Gayton and Coombs (1995)	Basketball (Varsity)	1968-88	1489	61.78%	Percentage of wins at home.
Nevill, Newell and Gale (1996)	Soccer (English and Scottish leagues)	1992-93	2417	60% (ties excluded)	Number of wins as a percentage of total number of games.
Bray (1999)	Ice-Hockey (NHL)	1974/75-1993/94	–	51.85% (ties included) 60.10% (ties excluded)	Percentage of wins at home.

Table 2.1 contd.

Madrigal and James (1999)	Basketball (Big 10)	1982/93-1991/92	1800	60.90%	Percentage of wins at home.
Smith, Ciacciarelli, Serzan and Lambert (2000)	Basketball (NBA)	1996-97	1189	57.20%	Number of wins as a percentage of the total number of games.
		1997-98	1189	59.60%	
	Ice-Hockey (NHL)	1996-97	1066	48.20% (ties included)	
			922	55.80% (ties excluded)	
		1997-98	1066	46% (ties included)	
			901	54.40% (ties excluded)	
	Baseball (MLB)	1996	2266	54.20%	
		1997	2266	54.20%	
Jones, Bray and Bolton (2001)	Cricket	1990-99	1449	57% (ties excluded)	Number of wins as a percentage of the total number of games.
Brown, Van Raalte, Brewer, Winter, Cornelius and Anderson (2002)	Soccer (1998 World Cup teams)	1987-1998	1525	63%	Number of wins at home.
Neave and Wolfson (2003)	Soccer (Premiership)	2000-01	279	66% (ties excluded)	Number of wins at home as a percentage of the total number of wins.
	Soccer (Division 1)	2000-01	404	61% (ties excluded)	
	Soccer (Division 2)	2000-01	401	60% (ties excluded)	
	Soccer (Division 3)	2000-01	395	69% (ties excluded)	

2.3 Athletes and Coaches Perceptions of Home Advantage

The reasons for home advantage have been suggested in a number of studies (c.f. Courneya and Carron, 1992; Nevill and Holder, 1999). This section discusses what athletes and coaches have perceived to be the main causes of home advantage. Gayton, Broida and Elgee (2001) conducted interviews with 144 male and female coaches from thirteen different sports and identified that site familiarity was considered to be the most important explanation for home advantage. Familiarities in general, and with the unique characteristics of a stadium, were again the most cited reasons given in an investigation by Bray and Widmeyer (2000). Crowd support and not having to travel were also seen as important aspects of home advantage. Sasaki *et al.* (1999) found that players in a soccer team responded more positively to the crowd's expectations, judgements, hostile reactions, frustration, and game dominance when playing at home. Crowd support has also been purported to have motivational effects, with playing at home suggested to create a greater pressure to win and causing players to believe the referee will be more lenient towards them as they will be intimidated by the home crowd (Jurkovac, 1985 as cited in Courneya and Carron, 1992). Further reasons given for home advantage were suggested by Wright and House (1989) within the sport of baseball including regime regularity and the umpire bias that favoured the home team.

In summary, athletes and coaches perceptions of home advantage appear to be consistent across the level and type of sport. The next section considers the empirical investigations that have purported to explain the reasons given for the existence of the home advantage, beginning with Courneya and Carron's (1992) framework for game location research.

2.4 Empirical Explanations for the Home Advantage

Courneya and Carron (1992) produced a framework for game location research giving reasons for the home advantage and its subsequent effect on performance (Figure 2.1). The framework referred to whether the match was played home or away (neutral games were discounted, as no home advantage exists in these venues). Game location factors consisted of four areas including crowd, learning, travel, and rules. Crowd factors like size and density reflected the social support that the home team can receive from spectators. Learning factors were related to the familiarity of the home team with the facilities used (i.e., surface size and indoor or outdoor stadiums). Travel factors such as distance and length of trips took into account the possibility that physical and mental fatigue may put the visiting teams at a disadvantage. Finally, rule factors may work to favour the home team, such as the option of batting last in baseball. Critical psychological states referred to the effects that game location factors have upon the cognitive and affective states of the three groups of individuals who influence the outcome of the competition (i.e., competitors, coaches, and officials), while critical behavioural states referred to the amount of effort expended, level of aggression, and subsequent strategic and subjective decisions made by these individuals. The final influence of the location of the game was upon the subsequent performance of the team, individual or official being studied with respect to primary, secondary and tertiary measures. Primary measures consisted of fundamental skill execution (batting average, free throw percentage, and penalties per game). Secondary measures usually reflected the scoring necessary to win a contest (e.g., points or goals scored), while tertiary measures indicated the final match outcome (win/loss, point's difference etc.). Each of the components from Courneya and Carron's framework were linked together with game location factors that influence the

critical psychological and behavioural states of the competitors, coaches and officials, which in turn influence performance.

The subsequent sections will discuss the existing literature that has examined each of the components of Courneya and Carron's (1992) framework including game location factors, critical psychological and behavioural states, and performance outcomes. In addition, related factors such as team quality and the proposed home disadvantage will also be discussed.

2.4.1 Game Location Factors

2.4.1.1 The Crowd

The effect crowds have on performance has been well documented with Cox (1998) explaining that social facilitation could improve performance when in the presence of an audience of one or two spectators. Cox (1998, p. 289) stated:

"Based on drive theory Zajonc's model proposed that the presence of an audience has an effect of increasing arousal (drive) in performing subjects. Since increased arousal facilitates the elicitation of the dominant response, the presence of an audience will enhance the performance of a skilled individual while causing a decrement in the performance of an unskilled individual".

Home advantage has been further explained by Falter and Perignon (2000; p. 1762) who suggested:

"The home team can benefit from unconditional popular support, called the twelfth-man effect; it does not need to make a long journey to reach the stadium; and it is accustomed to the playing field and its dimensions".

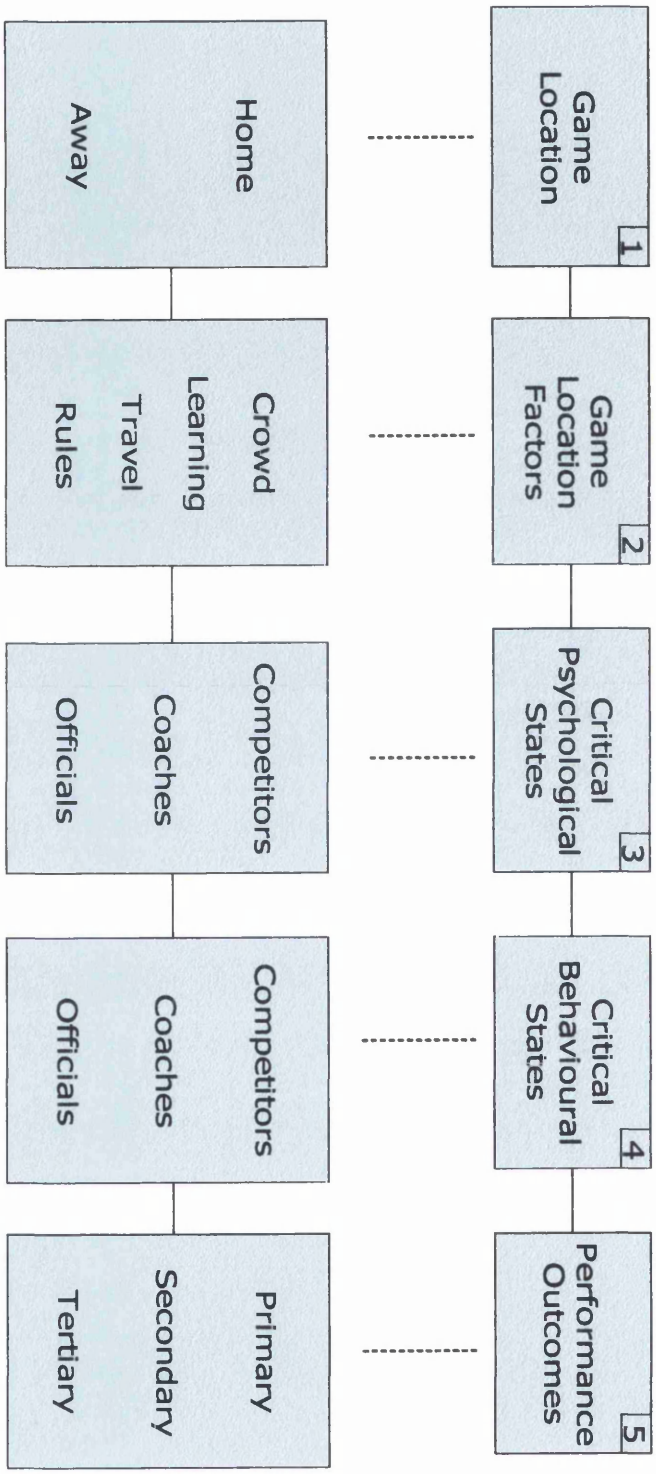

Figure 2.1: Framework for game location research (Courneya and Carron, 1992; p. 14).

One aspect of crowd factors that seems to have an effect on home advantage is crowd size or density (Schwartz and Barsky, 1977; Dowie, 1982; Pollard, 1986; Agnew and Carron, 1994; Nevill *et al.*, 1996). Schwartz and Barsky (1977) conducted analysis of 1880 baseball games played in 1971 and found that as crowd size increased (small, medium and large) so did home wins (48%, 55% and 57%) and runs (11.0, 12.1 and 12.7). It was stated though that this effect was due to differences in team status not crowd size, with little or no effect when teams were of equal standing compared to a more pronounced effect in games of unevenly matched teams. Dowie (1982) compared English 1st and 4th Division soccer teams and found that the extent of home advantage was no different between the divisions. In addition, it was the balance of support that was most important not the absolute number of supporters. Pollard (1986) though did find differences for the top soccer divisions in 1970-71. There was a significant linear increase in home advantage (63.3-65.5%) from Division 1 to 4, disagreeing with the theory that home advantage increases with attendance. A further study analysed fifteen teams in major junior A ice-hockey during 1986-88 (Agnew and Carron, 1994). It was found that as crowd density increased so did home advantage but little effect was attributed to crowds.

In support of the positive effect of crowd size on home advantage Nevill *et al.* (1996) examined English and Scottish soccer leagues. It was found there were increased percentages of home wins in leagues where crowd sizes were relatively large (i.e., Premiership, 64%; 1st Division, 65% and 2nd Division, 64%). Where crowd sizes were relatively small home advantage was reduced but not absent (i.e., General Motors Vauxhall League, 55% and Scottish 2nd Division, 51%). The reduced home advantage displayed in the Premiership compared to the 1st division was seen to be due to the fact that higher quality players and more experienced referees were less likely to be

influenced by larger crowds. The findings also observed that when crowd sizes were large the home team incurred fewer sendings-off and scored more penalties. This was thought to be due to away players' psychological states (i.e., cognitive and somatic anxiety) being heightened which lead to increased reckless behaviour (Nevill *et al.*, 1996).

Crowd support has also been reported to affect a number of aspects of performance of home and visiting teams. Thirer and Rampey (1979) studied college basketball players in twelve home games during the 1977-78 season at Southern Illinois University. Verbal abuse from the audience had a detrimental effect on the home team as they performed significantly more violations. The sample though was limited due to only twelve games being analysed within the study. Greer (1983) studied the home and visiting basketball teams of two large state universities and found that spectator protest caused an increase in performance in home teams and decreased performance in away teams on scoring, violations and turnovers. The sample size and the performance measures used though were limited within the study.

Further studies on the effect of crowd factors have also been conducted in the literature (Moore and Brylinsky, 1993; Salminen, 1993; Strauss, 2002). Moore and Brylinsky (1993) conducted an analysis on the effect of no spectators within the North Atlantic Conference 1988-89 basketball season. A measles epidemic caused two teams to play games with no spectators and performances (total points) for both teams were found to actually improve under the no spectator condition. Salminen (1993) analysed 56 matches on Finnish television between 1984 and 1986, including 24 soccer, 18 ice-hockey and 14 baseball games played by professional, national and amateur players. When the focus of the audience support was given to the home team they scored more points and made more

fouls than visiting teams but they scored more points even when the audience support was in favour of the away team. The study suggested, therefore, that other factors influenced home advantage such as familiarity and travel. Finally, Strauss (2002) analysed a German American football team during four games played in 1997. The results indicated that supporting spectator behaviour such as cheering before a down (a chance to move 10 yards or more forward) had no influence on subsequent performance (whether yards were gained). This contradicted the belief that spectators' cheering encourages better performance in a home team. However, these findings should be interpreted with caution as the study was limited by a small sample size.

In summary, the existing literature suggests that crowds are able to influence performances within different sports and crowd size may have a positive effect on home advantage. Nevill and Holder (1999) suggested that crowds could raise performances of home competitors relative to away competitors and influence officials to subconsciously favour the home team as explained in section 2.4.3.2. The literature has shown though that the crowd alone may not always improve the performances of home teams and decrease those of the away teams (Salminen, 1993; Jones *et al.*, 2001; Strauss, 2002).

2.4.1.2 Travel Factors

Travel factors have also been shown to affect the degree of home advantage. These include the disruption of routines, distances travelled, and number of days between games (Snyder and Purdy, 1985; Brown *et al.*, 2002). The disruption of routines has been stated as a contributing factor to home advantage but has only received modest attention and hasn't been directly measured (Courneya and Carron, 1992). Schlenker, Phillips, Boniecki and Schlenker (1995a; p. 632) did though explain regime regularity further:

> "Players from the home team can capitalise on a more regular home life and game preparation schedule. They are able to live in their own residences rather than in strange hotels; can sleep more regular hours without the problems of travel inconvenience and jet lag; and have friends and family available for support".

In the Winter Olympics, Balmer *et al.* (2001) found that significant differences were found between time-zones crossed for both medals and points won but didn't necessary indicate trends in performance over hours travelled. Courneya and Carron (1991) studied 1812 Minor League Double-A baseball games played in 1988. It was noted that travel wasn't a major factor in home advantage for season or series game numbers and length of home and visitor trips. In addition, travel factors only explained 1.2% of the variance in win/loss outcome. Similar findings were also found in NHL ice-hockey during the 1988-89 season in all 40 and 82 season and play-off games respectively (Pace and Carron, 1992). Only 1% of the variance for visiting teams' success was accounted for by the number of time-zones crossed and the amount of preparation time. The effect of time-zones on home advantage was therefore found to be small compared to other factors.

When distances travelled were examined Snyder and Purdy (1985) observed that home advantage increased when visiting basketball teams travelled over 200 miles compared to less than 200 miles. However, the study was limited due to a small sample size. Pollard (1986) analysed 3496 games within professional soccer in England and stated that the distances travelled was unimportant. Both teams travelling under and over 200 miles produced home advantages of 64.3% disagreeing with Snyder and Purdy (1985). The distances travelled within England are much smaller than America and therefore may not affect the degree of home advantage as much as in American sports. In addition, when the NBA, NHL and Major league baseball were analysed between 1996 and 1998, Smith *et*

al. (2000) found that travel accounted for about 1% of the variance and that team quality was a better predictor of who wins the contest.

Further studies have also been conducted on the effects of travel (Pollard, 1986; Clarke and Norman, 1995; Clarke, 1996; Brown *et al.*, 2002). The 32 teams in the 1998 soccer World Cup were analysed during the eleven years prior to the tournament. For games that were won teams travelled shorter distances, and more days had elapsed from the previous game, while the further teams travelled the worse their performance (Brown *et al.*, 2002). The limitation with this variable was that domestic matches were discounted and that all matches needed to be analysed to assess the full extent of fatigue on home advantage. Some studies have also examined the effect of game location within local derbies. Pollard (1986), for example, conducted a study on 1st and 2nd division soccer clubs during 1970-81 and Clarke and Norman (1995) examined thirteen London clubs during 1981/82-1990/91. Both studies found lower home advantages compared to the whole leagues, while Clarke (1996) found significantly lower home advantages for the thirteen London clubs (0.29 goals per game) compared to the 81 non-London clubs (0.44 goals per game).

In summary, the literature suggests that travel factors do not affect home advantage as much as other variables. However, there have been instances (i.e., within local derbies) where it has caused home advantages to decrease (Pollard, 1986; Courneya and Carron, 1991). A number of factors could explain this reduced home advantage including smaller travelling distances and more crowd hostility or support to the away and home sides respectively. This may be more apparent within local derbies as the match outcome is not only important to the teams involved but equally or more important for the fans within the local area. In conclusion, travel has been shown to have a small effect on home advantage

but studies such as Brown *et al.* (2002) have shown that more games were won the shorter the distances away teams had to travel and the more time there were between matches.

2.4.1.3 Familiarity

Familiarity refers to the home team being more comfortable with the surroundings and facility apparatus (i.e., boards and rims in basketball and pitch characteristics in soccer). Pollard (2002) suggested that in baseball reasons given for home advantage would be that playing surfaces have no fixed dimension or orientation with respect to climatic changes. In addition, each stadium has its own physical characteristics, lighting for both day and night games vary, as do sounds and other sensory information. An aspect proposed to have an effect on home advantage was the use of artificial pitches (AP) within soccer. Barnett and Hilditch (1993) conducted a study on the four English soccer divisions between 1981-82 and 1988-89. Teams with AP scored more points, won more games and scored more goals at home than the visiting teams but the study was limited by a low sample size. An additional study by Clarke and Norman (1995) undertook an analysis of the 22 team seasons played by four teams with AP between 1981-82 and 1990-91. A significant home advantage of 88.9% was found for the AP group compared to 51.9% for the 898 team seasons as a whole.

Further studies have examined the effect of familiarity on the degree of home advantage within sport. In the NCAA Mid American Conference Basketball season during 1992-93 Western Michigan University played nine home games on five different courts due to work being carried out on their home court. Home advantage was found even though their home courts were different suggesting that facility familiarity was not as influential as

other factors in affecting home advantage for this team (Moore and Brylinsky, 1995). Pollard (2002) though disagreed while examining the effect of moving to a new home stadium. Four sports including American football, basketball, ice-hockey, and baseball during 1987-2001 were analysed the season prior to and after the move. Out of the 37 teams home advantage decreased for 26, increased for ten and for one team there was no change. Overall there was a significant decrease of 23.5% showing facility familiarity affected the degree of home advantage.

There have been some studies that have investigated the effect of playing home games under domed stadia. Zeller (1987; as cited in Leonard, 1998) and Zeller and Jurkovac (1988) analysed home teams from the National Football League (NFL) and Major League Baseball respectively. The studies found that in the NFL teams within domed home stadiums scored more points than teams in open-air stadiums while teams in baseball won 10.5% more games at home domed stadiums than away compared to 7.2% in open stadiums. In summary, the findings suggest that familiarity seems to have an effect on home advantage, especially when different facilities are used (i.e., artificial pitches and domed stadia) compared to normal.

2.4.1.4 Rules

Rules have been proposed as having an effect on home advantage but due to the lack of sports that allow rules to benefit the home team (i.e., batting last in baseball and last-line change in ice-hockey) there is paucity of studies (Courneya and Carron, 1992; Nevill and Holder, 1999). The only such study on the effect of rules on home advantage was carried out by Courneya and Carron (1990). Slo-pitch softball teams totalling 2240 games were analysed and no differences were found in the number of games won when batting first

compared to last. It was suggested that the opportunities for offensive and defensive strategies and psychological momentum might be equal thus eliminating any advantage.

2.4.2 Other Factors: Team Quality

One reason suggested as being an important influence upon home advantage but not within Courneya and Carron's (1992) framework is the quality of the teams assessed. Bray (1999) studied the National Hockey League over 20 seasons during 1974-93 and found that high quality teams won 70.29% and low quality teams won 32.48% of their games at home. However, this was misleading as when the home/away percentage difference (H/AD) was compared low quality teams were found to have slightly lower H/AD than high quality teams but the differences were not found to be significant. Comparing teams of varied abilities was further conducted by Schwartz and Barsky (1977). Baseball was analysed in 1971 and hockey in the 1971-72 season and the 1st and 2nd division teams were found to have won half their games at home against comparable teams in both baseball and hockey. In addition, 1st division teams won 60% and 74% against 2nd division teams and 2nd division teams won 48% and 37% against 1st division teams in baseball and hockey respectively. It was concluded that game location and team quality were equally important in determining performance outcomes in sport (Schwartz and Barsky, 1977). A more recent study by Madrigal and James (1999) analysed basketball and found that strong teams (higher winning percentages) won most of their matches against poor teams (95%) and other strong teams (70%), while poor teams (lower winning percentages) won more matches against other poor teams (60%) but only a quarter against strong teams.

In summary, team quality and skill level does seem to be important, as game location affects players of different abilities (Courneya and Carron, 1992). Home advantage has also been found to be less important in professional leagues than national or amateur leagues and if skill levels are stable, varied conditions and the presence of home advantage does not appear to affect performance (Salminen, 1993).

2.4.3 Impact of Game Location Factors

The remaining factors identified within Courneya and Carron's (1992) framework relate to the effects of playing at home or away. Critical psychological states involve self-esteem concerns, confidence, anxiety, and the cohesion of the competitors prior to and during performance. Critical behavioural states comprise the amount of effort and aggression expended by the competitors. These states can also be attributed to coaches and officials, with strategic and subjective decisions affected. Courneya and Carron's framework also stated that home advantage could affect primary, secondary, and tertiary aspects of performances. The following section therefore discusses the effects of home advantage upon the psychological and behavioural states and performance indicators.

2.4.3.1 Critical Psychological States

Players' psychological states prior to and during competitions at home and away have been examined with reference to efficacy, anxiety, and nervousness (Greer, 1983; Glamser, 1990; Bray and Widmeyer, 2000). For example, a study carried out on competitive male and female ski-racers found no difference in psychological states prior to home and away races (Bray and Martin, 2003); while Kroll (1979) found that spectator booing and boisterous spectators were among the more frequent sources of worry and nervousness prior to competition.

Athlete's psychological states prior to matches have also been looked at with regard to the levels of self-efficacy (belief that he or she is competent and can succeed at a particular task, Cox, 1998) and competitive anxiety experienced. Bray *et al.* (2002) stated that higher self-efficacy was associated with increased effort and persistence in the face of difficulties and obstacles. In basketball Jurkovac (1985; as cited in Courneya and Carron, 1992) reported players felt they played better in front of a loud and active crowd both at home and away. They also felt their personal statistics were better, were more self-confident and motivated by banners and signs in their home arena. In one male and female basketball team, female players were found to experience significantly higher somatic anxiety while both male and female players experienced lower self-confidence in away matches compared to when at home (Thuot *et al.*, 1998). Bray and Widmeyer (2000) undertook analysis of 40 female players from four intercollegiate teams in the Western Division of OWIAA during the 1994-95 season. Athletes reported that their teams were more effective in their overall play and specific team skills when playing at home. Within a female field hockey team, players reported lower levels of cognitive and somatic anxiety and higher levels of self-confidence and efficacy at home compared to away (Bray *et al.*, 2002). In the individual event of swimming Shaw and Longman (1998) analysed 26 competitors before home and away competitions. The study found cognitive anxiety and self-confidence was significantly higher away from home, while no differences were found in somatic anxiety.

In summary, the research indicates that athletes' individual and collective cognitive and affective responses are affected by game location. Self-confidence and efficacy have been found to increase while anxiety decreases when athletes performed at home. Consequently, because competitors were found to be more confident when playing at

home they believe they will become more successful and "as such play better at home as part of the 'self-fulfilling' philosophy" (Nevill and Holder, 1999; p. 232).

2.4.3.2 Critical Behavioural States

The impact that game location factors can have on the degree of home advantage has been explained through functional aggressive behaviours (i.e., refers to instrumental aggression that facilitates a successful match outcome such as tackles, shots and passes) for the home side (Varca, 1980) and dysfunctional aggression behaviours (i.e., fouls, rule breaches etc) on the part of the visiting team (Glamser, 1990; McGuire, Courneya, Widmeyer and Carron, 1992). Schwartz and Barsky (1977) stated that aggression was manifested more in offensive than defensive behaviours and that teams won more games at home because they played more aggressively in their home territories. With more offensive success the crowds do display increased excitement with Varca (1980) showing that matches that contain increased levels of aggression would be beneficial to the home side, as they would secure the social support of the crowd. An assertive rather than a more passive approach has also provided more offensive opportunities to a team thus allowing more opportunities to score (Dennis and Carron, 1999). A study on aggression by McGuire *et al.* (1992) in ice-hockey showed that home teams were more aggressive during games they won while away players were found to be more aggressive during games they lost. The increased aggression favoured the home team as it entices the crowd to become actively involved in a contest, which energises and motivates home players. A more recent study by Jones, Bray and Oliver (2005) examined rugby league and found no significant difference in the frequency of aggressive behaviours exhibited by home and away teams but away teams engaged in substantially more aggressive behaviours in games they lost compared to games they won. The cost of behaving aggressive was

therefore greater for the away team with respect to success. The appearance of increased dysfunctional aggressive behaviours by away teams has also been shown with away teams found to be penalised more often as explained in section 2.4.3.3 (Nevill *et al.*, 1996; Sutter and Kocher, 2004).

Neave and Wolfson (2003) have recently revisited aggression and home advantage by investigating testosterone levels before home and away matches of male soccer players from the Unibond Football League and an under-19 Premiership football team. The first study found no significant differences between any of the individual mood measures before home and away matches. Testosterone though was higher before home games compared to away games. The second study observed testosterone levels to be significantly higher in the home condition than in the away and training conditions. In addition, overall, the strikers tended to have the highest levels of testosterone across the different venues.

The effects of game location on the behavioural states of officials have also been examined. Specifically, whether home official bias exists. Balmer, Nevill and Williams (2001) studied the Winter Olympics during 1908-98 and found that there were significantly greater home advantages for the subjective assessed events compared to the more objective events for both medals and points won. In soccer, studies have also conducted research on the effect of crowd noise on decision-making. Nevill *et al.* (1999; 2002b) studied eleven experienced semi-professionals, and qualified coaches and referees in their ability to assess the legality of 52 challenges from a 1998 Champions League match. The results found that there was a greater tendency to award a foul when viewing challenges by away players in the presence of crowd noise. A similar study by Nevill *et*

al. (2002a) used 40 qualified referees in assessing 47 challenges during an English Premier League match in the 1998-99 season. The main finding was that rather than penalise the away players more the dominant effect of crowd noise was to penalise home players less. This study though only used one match so was limited in that without the return match being examined the referee bias may have been a bias towards one of the teams instead of an actual home bias. To examine Nevill *et al's* (1999; 2002a; 2002b) hypothesis indirectly Jones, Bray and Bolton (2001) carried out an investigation within cricket, as fewer spectators equalled less pressure on officials. During 1990-98 a total of 2992 games were analysed and a greater number of umpiring decisions were found in favour of the home team but more wickets were taken. Consequently, the frequency of dismissals requiring an umpiring decision was taken as a function of the total number of wickets. No significant differences were found between home and away sides, implying that in sports with reduced spectator influence teams at home do win more matches but due to factors other than referee bias (i.e., familiarity and team quality).

Further evidence does support the theory of referee bias, specifically, Sutter and Kocher (2004) analysed the German Bundesliga during the 2001-02 season and confirmed the existence of a home bias in soccer referees. The results showed that referees were more likely to award actual penalties to the home team than to the visiting team (81% and 51% respectively). Secondly, referees added significantly more injury time when the home team was behind by one goal than when they were ahead by one goal or drawing after 90 minutes. Most research does support the argument for home referee bias, with more fouls, free kicks and penalties' being awarded to home compared to away teams, but whether referees are subconsciously influenced by home crowds is still uncertain.

Another aspect of the critical behavioural states documented in the literature is with respect to the coaches and the changes in team strategies with respect to game location but there is paucity of studies within soccer. Pace and Carron (1992) suggested that coaches of visiting teams in some sports often adopt more defensive styles to reduce the impact of the home crowd. Tactics have also been shown to change by a team playing more defensively, consequently inhibiting a team's ability to perform offensively. For example, a hockey team that continually shoots the puck out of its own end to avoid an opponent's offensive pressure would not be able to score themselves (Courneya and Carron, 1990). Changes in strategy have also been discussed by Pollard (1986; p. 247) who stated:

> "Most professional soccer teams adopt an initial cautious and defensive approach when playing away from home and there is some evidence that these tactics may contribute to home advantage. This is lower in the FA Cup than in the Football League and may reflect a greater willingness to attack, especially in the sixth round when home advantage is at its lowest. Similarly, in the European Cup where even a 1-0 defeat can be considered a success, ultra-defensive tactics away from home could explain why home advantage is greater than elsewhere".

Dennis and Carron (1999) conducted the only study that has examined the effect of game location on strategic decision-making by studying coaches and players to see if different styles of play were implemented at home compared to away. Questionnaires were given out to 40 coaches and assistants of 23 teams from the NHL and 17 from the Ontario Hockey League. In addition, 62 games from the 1996-97 season in the NHL were analysed via a notation system. It was shown that there were no differences between the coaches of the two leagues in the answers given. A more assertive fore-checking style (constant pressure placed on the puck carrier by at least two of the three forwards in the offensive zone) was found to be used at home compared to away. Coaches also indicated that they used this style more against teams of lower quality. The findings suggested that

game location affected coaches' decision-making prior to matches and that players were instructed to perform different strategies based on their game location. Further research though is needed on the impact game location has on the strategies employed within soccer as little research has been conducted within the area.

2.4.3.3 Performance Outcomes

There have been several studies conducted on the differences found in performances at home compared to away in sport (see Table 2.2). In soccer, Clarke and Norman (1995) investigated home advantage in English leagues during 1981-91, analysing over 20,306 matches. The findings suggested that home teams scored 59.9% of the total number of goals and home ground advantage was worth just over 0.5 of a goal per game. This agreed with the findings of Pollard (1986) who found during 1970-81 home advantage was worth 0.6 of a goal per game. Home advantage was also found to determine winners rather than just winning margins (Clarke and Norman, 1995). When goal times were taken into account the difference between home and away teams in goals scored remained constant over the duration of the game in English soccer during 1960-81 (Dowie, 1982).

A study by Neave and Wolfson (2003) showed that from the Premiership through to Division three in the 2000-01 season the average home goals were higher than the average away goals. In addition, for 30 international countries playing at home led to more goals being scored compared to playing away (19.17 and 13.27 respectively). An increased number of goals at home was emphasised by Pollard (1986) who found that teams at home gained 75% more points than away teams. While Sutter and Kocher (2004) found home teams scored 0.62 more goals than visiting teams during the 2000/01 season in the German Bundesliga. When the number of penalties was examined 55 were awarded

to the home teams while only 21 were given to the visiting teams. In addition, home teams were significantly penalized fewer times by yellow cards (1.98 vs. 2.40 per match) and red cards (0.1 vs. 0.2 per match) than away teams respectively.

With regard to the investigation of other performance indicators (i.e., shots, passes and tackles) there is paucity within the literature. Nevill *et al.* (1996) for example, analysed home and away sides within English and Scottish leagues and found the frequencies of sendings-off (38% and 62%) and penalties scored (64% and 36%) favoured the home side. Consequently, most research on performance differences indicative of game location have concentrated on goals scored. Some studies have undertaken analysis on other aspects including Sasaki *et al.* (1999) who conducted analysis on 26 matches of an English 1st division soccer team in the 1996-97 season. The findings suggested significant differences in favour of the home team in goal attempts, shots on target, shots blocked, shots wide, successful crosses and goal kicks. Finally, Withers, Maricic, Wasilewski and Kelly (1982) analysed player movements within a game and found that there was no significant differences between home and away games for all positions in tackles, ball contacts with the foot, total ball contacts, turns and jumps. In summary therefore, while teams do seem to perform at a higher standard of performance at home than teams away from home with regard to the number of goals scored there is a lack of analysis on more detailed performance indicators within soccer.

Table 2.2: Studies of performance differences with respect to home advantage.

Authors	Sport	Years	Sample/Games	Major Findings
Schwartz and Barsky (1977)	Baseball	1971	1880	• No differences in defensive performance. • Home team exhibited superiority in the rate of runs scored, extra base hits, total hits and runs as a proportion of hits.
	Ice-Hockey	1971-72	542	• Visiting teams displayed an advantage on saves as a percentage of opponent's shots on goal. • Home teams exhibited superiority per game in goals scored, number of shots at goal and assists.
	Philadelphia Big 5 teams in Basketball	1952-66	1485	• Home teams were efficient in shooting. • Home teams took ↑ shots and scored ↑ field goals and points. • No differences in assists, teamwork, personal fouls and scoring as a percentage of shots.
Varca (1980)	Basketball	1977-78	90	• Home court advantage of 4.8 points per game was found. • Home sides performed ↑ steals, blocked shots and rebounds (functional aggression). • Home sides performed ↓ fouls (dysfunctional aggression) than away sides. • No significant differences on field goal percentages, free throw percentages and turnovers.
Greer (1983)	Basketball (2 large state universities)	–	–	• Home teams on average scored ↑ than visitors. • Visiting teams on average committed ↑ turnovers than home teams.
Lehman and Reifman (1987)	Professional Basketball	1984-85	42 stars and 171 non-stars	• Star players had ↓ fouls called on them at home. • The non-star group didn't differ.
Silva and Andrew (1987)	ACC Men's Basketball	1971-81	418	• Home teams averaged ↑ points, rebounds and field goal percentages and ↓ personal fouls and turnovers. • The frequency of home victories was not down to home court advantage but away court disadvantage.
Salminen (1993)	Soccer, Ice-Hockey and Basketball	1984-86	56	• Home teams scored ↑ goals.

Table 2.2 contd.

Harville and Smith (1994)	College Basketball	1991-92	1678	• Home advantage was worth 4.68 +/- 0.28 points.
Pickens (1994)	ACC men's Basketball	1990-91	56	• The home team was better on field goal percentage and assists. • Turnovers (↓ for home side) and free throw percentages (↑ for home side).
Gayton and Coombs (1995)	High School Varsity Basketball	1968-88	1489	• 4 home teams scored 11 ↑ points at home.
Moore and Brylinsky (1995)	Basketball	1992-93	–	• Male teams scored ↑ points at home than away while females scored ↑ points at home (non-significant).
Madrigal and James (1999)	Women's Big 10 Basketball	1982/83-1991/92	1800	• Teams that had a ↑ field goal percentage at home and executed ↑ steals at home won ↑ often.
Clarke (2000)	Olympic Games	1896-1996	24 Olympics	• 14 out of 17 host nations won their greatest ever percentage of medals at home. • 50% of host nations won ↑ than 3.5 times their historical average while after 1956 the host nations averaged 2.5 times ↑ at home.
Balmer, Nevill and Williams (2001)	Winter Olympics	1908-1998	Average of 12 events over the period	• Home advantage was found to be significantly ↑ for both medals and points while no differences were found between events.

↑ = more/increase/less
↓ = less/decrease/fewer

2.4.4 Home Disadvantage

The home field is not only seen as an advantage to the home team but can also become a disadvantage with home teams tending to choke especially when playing deciding championship games (Baumeister and Steinhilber, 1984; Wright, Voyer, Wright and Roney, 1995). Baumeister and Steinhilber (1984) analysed baseball and basketball series and found that in baseball the home team tended to win the first two games but lose the last. The visitors also made more errors in the first two games while the home team made more in the seventh game. In basketball the home team also fared significantly better in the early games than in the final games. In addition, with regard to free throw percentages the home and visiting teams performed equally well during early games but the visiting teams performed significantly better in the final game. In conclusion, the presence of supportive audiences was found to be harmful to performance rather than be helpful due to the added pressures by spectators on home teams in deciding championship games.

To examine whether home disadvantage actually existed the data used by Baumeister and Steinhilber (1984) was modified and reanalysed by Schlenker *et al.* (1995a). It was found that in baseball home advantage was slightly higher in championship games than during the regular season but the differences weren't found to be significant. The home teams were also shown not to choke in the league, performing as well in the seventh as in games one and two. When basketball was analysed the final and semi-final championship games from 1967 to 1993 were used (excluding any four game sweeps). When the first four home games were compared to the last game the differences were still significant but when broken down into the number of games in a series (i.e., 5, 6 and 7), for all but the six game series the home team performed as well as the away team in early games compared to games later in the series. Schlenker, Phillips, Boniecki and Schlenker

(1995b) disagreed with the 'home choke' hypothesis and stated home teams do not perform poorly in key games. It was stated that choking favoured a darker form (social pressures plus self-doubts) rather than the kinder form (disruptive fantasies of success in front of supportive audiences). No evidence was found for the 'home choke' with home athletes found to be unaffected by supporters but affected by pressures and doubts about their own ability whether performing at home or away. Schlenker *et al.* (1995b; p. 649) though did state "the coach and players should take the home field if given the choice".

Baumeister (1995) disagreed with Schlenker *et al.* (1995a) stating that the findings did not differ significantly from what Baumeister and Steinhilber (1984) found and that the results were essentially similar. It was suggested that the analysis did not correspond to their hypothesis in that they looked at the final game in every season. Therefore, games in which the home team had a chance to win and choked forcing another game were excluded from their analysis. It was also noted that the same results were found in that home teams win such games when on the brink of elimination and lose when on the brink of becoming champions. There have been several studies that have since supported the existence of the home choke. For example, Wright, Jackson, Christie, McGuire and Wright (1991) conducted an analysis of the British Open Golf Championships from 1946 to 1980. The results showed that the scores of contending British players tended to deteriorate more than the contending foreign golfers from round one through to four. Wright *et al.* (1995) analysed NHL Stanley Cup play-offs and found that home teams won games one and three but lost the last game, indicating that home-ice was a disadvantage in crucial games. In addition, there were significantly more series where the home team won the 1st but lost the last game than losing the 1st but winning the last game.

When experiments of a non-sporting capacity were researched the 'home choke' was also displayed. Butler and Baumeister (1998) carried out tests on skill-based exercises and found supportive audiences were associated with performance decrements. On difficult skill-based tasks, participants were more likely to fail when observed by supportive audiences but when the criterion was easy supportive audiences had no effect. Despite this performers still found supportive audiences more helpful and less stressful than neutral or adversarial audiences and believed wrongly that they had performed better.

Other studies within the literature have disagreed with the theory of home disadvantage (Gayton, Matthews and Nickless, 1987; Kornspan, Lerner, Ronayne, Etzel and Johnson, 1995). Gayton *et al.* (1987) analysed semi-final and final Stanley Cup series in ice-hockey between 1960 and 1985. The findings showed no evidence of home disadvantage with the home team faring as well in the early games as the final games whether five, six or seven was the final game. This was suggested to be due to the attentional demands of ice-hockey being different to that of baseball and basketball where disadvantages were found. Kornspan *et al.* (1995) found that in American football home teams won 71% of the play-off games held in the two conferences of the NFL.

In summary, the literature has produced contradictory findings of whether home disadvantage actually exists. The main findings suggest that the home arena could be a disadvantage within deciding championship games but within certain sports this is not the case with athletes not performing worse at home in these types of matches (Baumeister and Steinhilber, 1984; Gayton *et al.*, 1987).

2.4.5 Summary

The literature review of home advantage based on Courneya and Carron's (1992) model gives insight into the effect of game location factors and their impact on psychological states, behavioural states and performances in sport. Courneya and Carron's model has influenced a lot of research into home advantage, all of which have examined different aspects of home advantage. An aspect of the research that little is known about is the effect of game location on the actual performances of teams based on the primary, secondary and tertiary measures (i.e., passing, shooting, tackling etc). In addition, how these behaviours are affected by other factors including weather, kick-off times and game status is important. One form of measuring actual sporting performance is through the quantifying of behaviours (i.e., notational analysis).

2.5 Notational Analysis

2.5.1 Introduction

Notational analysis has been used for many centuries in providing feedback on areas as diverse as movement and music studies (Hughes and Franks, 1997). Examples of notation have existed for centuries within Egyptian and Roman cultures (c.f. Hughes, 1996a) and within sport analysis procedures have developed from the basic hand notation techniques to the more up to date computerised systems (Church and Hughes, 1987; Ali, 1988; Hughes, 1996a; Hughes and Franks, 1997; Hook and Hughes, 2001). Many sports (i.e., rugby union, tennis and squash) have been examined using notation systems (Potter, 1996b; O'Donoghue and Liddle, 1998; Wells and Hughes, 2001), however soccer has received the most attention. This section will highlight the use of notational analysis as a more rigorous method for analysing technical and tactical performance indicators and

strategies within sport in greater detail than have been currently used in the existing home advantage literature. In addition, studies that have looked at performances and tactics used in soccer will be discussed (for a review of the notational analysis literature in sport see Hughes and Franks, 1997).

2.5.2 Terminology in Notation

Within notational analysis there are many terms that are used when describing different aspects of sport. They are often interchangeable and misused and therefore must be clearly defined so the reader understands what is being described. In soccer these terms have included strategy, tactics and styles of play (Table 2.3).

2.5.3 Notation in Soccer

In the soccer literature a range of different areas have been examined including time and motion, women's soccer, statistical studies, positional studies and set-plays (Reilly and Thomas, 1976; Lanham, 1993; Garganta and Goncalves, 1996; Hill and Hughes, 2001; Wooster and Hughes, 2001). The important aspect of this thesis is how technical and tactical issues are affected within soccer therefore the following section will focus on studies that have examined the impact of performance indicators and strategic decisions on soccer performance.

2.5.3.1 Technical and Tactical Studies

Both the technical and tactical aspects of soccer, including many performance indicators (i.e., passes, shots and goals), have been examined within notational analysis (Table 2.4). Many researchers believe that skill and chance play an important role in soccer and that a

Table 2.3: Terminology used in soccer notation.

Term	Definition
Strategy	A plan that a coach would devise to achieve a specific objective e.g., exploits a team's weakness or enhances the strengths of a team. Appropriate strategies could include the use of marking individual players or keeping a balanced shape in defence and midfield. Strategy is often used in conjunction with "styles of play" or "patterns of play".
Tactics	In order to make a strategy work a number of decisions or actions (tactics) need to be employed e.g., a specific defensive formation is used like a zone defence or man-to-man marking (Robertson, 1999).
Patterns of play (playing patterns)	A repetitive action or series of actions e.g., clearance kick or a pass to the winger who crosses for a centre forward. They can be identified as having a direct effect on a team's performance and are assessed via performance indicators.
Styles of play	Summations of the patterns of play used by a team e.g., long ball are employed from different areas of the pitch as the main attacking option. Styles of play are often used in conjunction with strategy and tactics.
Performance Indicators/Behaviours	"A selection, or combination, of an action variable that aims to define some or all aspects of a performance" (Hughes and Bartlett, 2002; p. 739). Action variables such as shots at goal, passes or tackles are used to measure successful or unsuccessful performances at both individual and team level.
Tactical performance indicators	Playing patterns, styles of play and strategies employed by teams e.g., passes/possession, length of passes and areas of the pitch used (Hughes and Bartlett, 2002).
Technical performance indicators	How the actions were performed e.g., types of shots, accuracy in passing and loss of control (Hughes and Bartlett, 2002).
Perturbations	A disruption in play that creates an important action e.g., a shot at goal. The disruption can be caused by a piece of skill that creates an imbalance in the defence or an error by the defence causing a similar disruption (Hughes, Langridge and Dawkins, 2001).

goal is more likely to be scored when attacking moves originate in the attacking third of the field (Reep and Benjamin, 1968; Reep, Pollard and Benjamin, 1971; Rico and Bangsbo, 1996; Pollard and Reep, 1997; Grant, Williams and Reilly, 1999a). Bate (1988) criticised the concept of 'possession football' stating that it does not lead to as many shots and therefore goals being scored. He also suggested that it was important to get the ball into the attacking third by playing the ball forward as much as possible, reducing backward and sideways passing, increasing the number of long forward passes and playing the ball into space behind defenders as early as possible. Dooan, Eniseler, Aydin, Morali and Ustun (2001) supported this view by showing that after gaining possession the aim should be to reach the opponents half as quickly as possible increasing the probability of scoring. By increasing the numbers of long passes though Ali (1988) found that they were most likely to end in an offside decision. Garganta, Maia and Basto (1997) further explained that a team should put heavy pressure on opposition players in their 'back third' in an attempt to force turnovers of possession. In addition, it was concluded that European top level teams in scoring movements often win the ball in their attacking third, have a short reaction time (less than 10 seconds), involve few players touching the ball (3 or less) and perform only a few passes (3 or less). Studies have continued to look at the number of possessions and have continued to support the direct style that Bate (1988) advocated (e.g., Olsen, 1988; Dufour, 1993; Hook and Hughes, 2001; Stanhope, 2001).

The differences in the strategies employed by teams based on the areas of the pitch used within soccer have been examined within many studies. For example, Ali (1988) stated that wing attacks provided more scoring opportunities than any other forms of attack. In comparing the team that won both the 1998 World Cup and Euro 2000 Japheth and Hughes (2001) found that wing attacks were used more often in 1998 while the middle of

the field was used more in 2000 reflecting the different strategies used in both tournaments. Pollard, Reep and Hartley (1988) developed a computer-aided method, which enabled a quantitative comparison of different playing styles to be made based on Reep and Benjamin's (1968) notational analysis system. Team playing styles were assessed on passing style and the use of width and were rated between elaborate and direct styles. The results showed differences between playing styles of teams of similar quality and between club and international teams. In addition, James *et al.* (2002) concluded that dropping deep within matches might be a tactical choice that was necessitated by the strength of the opposition. The strategies employed by teams may also be affected by the weather as Ali (1988) stated that weather conditions (i.e., wet and muddy pitches) might dictate what performance indicators were performed and how successful they were. This shows that even though a goal may be scored after a certain style of play it does not mean that style should be adopted all the time as other factors may influence how a team plays.

Hughes and Pettit (2001) carried out analysis on the 1998 World Cup and stated that it was important for teams to attack down the wings, as defenders will attempt to stay central in an attempt to push the ball away from the danger area. The study concluded that the principles of crossing implied by Partridge and Franks (1989a; 1989b) still applied to crossing in the 1998 World Cup finals. Further studies on tactical differences have also been conducted for example, Olsen (1988) suggested that soccer had become a much faster game and that players were now given less space. In addition, dribbling was seen no longer as a critical element in the modern game as few goals were scored after three or more touches. This finding wasn't supported by Grant *et al.* (1999a) and Japheth and Hughes (2001) who found that 16.7% of goals were scored with four or more touches and

that the World Champions heavily utilised dribbling in 1998. The differences found between the studies emphasised the change in tactics over the twelve years in the game.

Harris and Reilly (1988) studied time and space and concluded that it was important to outnumber opponents in crucial areas such as the attacking third and use runners to drag defenders out of position. In addition, Olsen (1988) found that space was important in scoring goals, which was further explained by Grehaigne, Bouthier and David (1997) who stated that when attacking the object was to create time and space and the ball should be played to the player in the best scoring position. Rico and Bangsbo (1996) coded ball actions and concluded that as the pressure to win increased the number of overall passes reduced as a result of fewer easy passes. It could be argued though that the increased pressure led to more risk taking while the system also displayed that the score during a match influenced the teams playing style. A further study by Tiryaki, Cicek, Erdogan, Katay, Atalay and Tuncel (1996) found that more shots were taken by a national team in midfield areas suggesting that they were unable to breakdown the opposition.

The timing of goals within soccer has also been examined suggesting that the number of goals scored increases as the game progresses (Jinshan, Xiaoke, Yamanaka and Matsumoto, 1993; Egesoy and Eniseler, 2001; Grehaigne, 2001; Abt *et al.*, 2002). Ridder, Cramer and Hopstaken (1994) analysed 340 matches in the professional divisions of Holland during 1991-92. It was found as each fifteen-minute period passed the goals scored increased (128-198 goals from the 0-15 and 75-90 minute periods respectively). Reilly (1997) meanwhile didn't attribute this rise in scoring to fatigue as he suggested that this would be levelled out in both teams. It was more likely that the increase was due to changes in tactics, losses of concentration and teams taking more risks.

Nicholls, McNorris, White and Carr (1993) studied the impact of team structure and interaction by providing managers with questionnaires on what they believed to be most important positions within a team. The questionnaires suggested that central positions were as important as non-central positions while the efficiency of players, shots, tackles and passes weren't significantly different between positions. In central positions, though, players made significantly more interceptions whereas players in non-central positions took more set-pieces. In summary, some players were found to be more involved than others but these players were apparent in both central and non-central positions.

The outcome of matches has also been examined with reference to differences found between successful and unsuccessful teams. Grant, Williams and Reilly (1996b) found that successful teams penetrated the defence by passing, running or dribbling in a forward direction for longer sequences of play. Whereas Hook and Hughes (2001) concluded that successful teams kept the ball for longer durations, created shots from their own half and applied a varied approach in attack. While unsuccessful teams were more predictable in attack, unable to keep the ball on the ground, attempted shots from longer range and scored fewer goals. Bishovets, Gadjiev and Godik (1993) concluded that winners had a better understanding between themselves while losers were more unreliable in team play.

Hughes, Dawkins, David and Mills (1998) suggested teams play in rhythms until a team produces a skill that creates an imbalance in the defence or one of the defenders makes an error that creates a similar disruption called perturbations. Hughes *et al.* (2001) stated that they are an indicator of where team's weaknesses lie, would be used to recognise patterns of play and aid the coach in identifying weaknesses. Stanhope (2001) further concluded that the best indicator of whether a goal could be scored would be the state of play at a

given time. This would be either a piece of skill that beats a defender or a mistake by a defender allowing the striker a shot at goal. The state of play has been further investigated by Church and Hughes (1987). Six matches of an English 1st division team in the 1985-86 season were analysed and when the team was losing they performed a greater number of passes, lost more possessions through error and took more shots at goal than when winning. Abt *et al.* (2002) stated that losing teams do push players further forward to create scoring opportunities leading to scoring themselves or conceding further goals. In addition, Stanhope (2001) concluded that scoring first was crucial as teams played more erratically when losing by gambling to get back into the match.

Finally, within the literature (Ali, 1988; Japheth and Hughes, 2001; Stanhope, 2001) the performance indicators and strategies employed by teams have shown to be affected by many potential confounding variables (i.e., weather conditions, team quality and game status) as explained earlier. It is therefore important that research not only should show that differences exist but also explain why through the effect of confounding variables.

2.5.3.2 Summary

In summary, the notational analysis literature within soccer has considered a wide range of performance behaviours. These include the analysis of individual and groups of teams across different domestic, European and international competitions. The effect of game location on soccer performance has, however, received little consideration within notation. Therefore, to more comprehensively investigate whether a home advantage exists, a broad selection of performance behaviours would need to be examined.

Table 2.4: Tactical and technical studies within soccer.

Study	Subjects and Matches	Variables	Results	R[1]
Reep and Benjamin (1968)	English 1st Division (n=3213) and World Cups between 1953 and 1967.	Passes, Possession, Shots: goals and Areas of the pitch.	• 1 in 10 shots lead to a goal and 5.5% of the 9175 goals originated in the attacking third. • 80% of goals came from ↓ than three passes. • Concluded that the game was dominated by chance.	N
Reep, Pollard and Benjamin (1971)	English 1st Division during 1957-58 (n=42).	Passes and Possession.	• ↑ than 23,000 possessions but ↓ than 5% contained ↑ than 4 passes.	N
Hughes and Lewis (1987)	1986 World Cup.	Passing and Areas of the pitch.	• Successful teams used the centre of the pitch ↑ and passed the ball ↑ when attacking out of defence and in the final attacking end compared to unsuccessful teams.	N
Ali (1988)	Scottish Premier Division team (n=18).	Dribbles, Passes, Interceptions, Set-pieces, Goals and Shots.	• Short Corners were the most likely set-piece to result in a goal.	N
Bate (1988)	International and English 1st division teams.	Passes, Goals, Areas of the pitch, Set-plays, Shots and Possession.	• International; 48% of goals (1-pass movements) and 79% of goals (↓ than 4 passes). • League; 94% of goals were scored from 4 or ↓ passes. • Set-plays were found to contribute significantly to goals scored. • The theory that 'possession football' produces ↑ goals was dismissed.	N
Harris and Reilly (1988)	Top Division (n=24).	Shots, Passes, Areas of the pitch and Dribbling.	• Attacking teams should pressurise defenders near to their own goal, quickly move the ball forward or play the long ball style game. • Attacks resulting in a shot originated due to ↑ space between defenders and attackers.	N
Hughes, Robertson and Nicholson (1988)	1986 World Cup (teams that reached semis or were eliminated after 1st round).	Areas of the pitch, Dribbles, Shots, Possession and Touches.	• Successful teams had ↑ shots from inside the penalty area. • Unsuccessful teams used the wings while successful teams played through the centre. • Unsuccessful teams lost ↑ possession in their attacking and defending sixths. • Successful teams played ↑ 'possession football' than unsuccessful teams.	N
Olsen (1988)	1986 World Cup (n=52).	Touches, Passes, Goals, Set-plays and Pitch areas.	• Most goals scored with one touch while 90% of goals were scored within 16m of goal. • 30% of goals scored when there were ↑ than 4m of space. • Most goals were scored after 1 or 2 passes, only 20% (↑ than 5 passes).	N

Table 2.4 contd.

Pollard, Reep and Hartley (1988)	1982 World Cup (n=32) and English 1st Division during 1984-85 (n=42).	Passing.	• World Cup teams had ↑ elaborate styles than 1st division teams. • England was found to have the least elaborate style using high numbers of centres while the combination of a multi-passing style with few centres set France apart from the rest.	N
Starosta (1988)	World Cup, Polish 1st and 3rd division players (n=298).	Shot: Goals, Areas of the pitch and Dominant foot.	• Polish (64.2%, 20.5% and 15.3%) and World Cup (55.8%, 29% and 15.2%) performed with the right foot, left foot and head respectively. • 66.7% of the tournaments top scorers shot with their left foot and 75% of left footed players performed shots with their right foot.	N
Partridge and Franks (1989a; 1989b)	1986 World Cup (n=50).	Crosses and Areas of the pitch.	• Crosses should be played behind the defence, out of the keepers reach, played first time if possible, past the near post and without too much time in the air. • Target players should aim to get goal side of defenders, make direct runs, not running past the near post and always attack the ball. • Supporting players need to seal off the top of the penalty area and crosses should not be taken from areas near the corner flag.	N
Bishovets, Gadjiev and Godik (1993)	1990 World Cup (n=52).	Areas of the pitch and Possession.	• Winners and losers did not differ much on the number of attacks in which the ball was propelled to the 4th zone (attacking zone). • Winners were ↑ effective when moves started in the 1st zone (defensive) and 2nd zone after gaining possession from opponents.	N
Dufour (1993)	Not Reported	Crosses and Possession.	• Crossing out wide accounted for 25% of goals scored but only displayed 2% efficiency. • In 65% of cases the team with the majority of possession won and winning teams held onto the ball longer than opponents. • The team taking the most shots won in only 56% of the cases suggesting 'possession football' pays little unlike the long ball style.	N
Jinshan, Xiaoke, Yamanaka and Matsumoto (1993)	1990, 1982 and 1986 World Cups (n=52).	Goals, Set-pieces, Crosses, Shots, Dribbles, Passes and Pitch areas.	• Goals from set-plays were 26% of total in 1982 compared to 3% and 32.2% in 1986 and 1990. • 1st half goals scored significantly ↓ in 1990 from 1986. • Percentage 2nd half goals scored from headers ↑ from 1986 to 1990. • Percentage goals from crosses from the middle third out wide ↓ from 1986 to 1990. • 1990 World Cup; the successful shooting techniques were inside, front, instep and headers. • 32 goals (27.8%) were of a result of wing attacks in 1990. • The number of goals during games rose with time except in the 30-45 min period in 1990.	N

Table 2.4 contd.

Luhtanen (1993)	World Cup matches (*n*=47).	Shots, runs and Areas of the pitch.	• Germany was the strongest team and had the highest number of attacking trials, lowest number of lost attacks and highest number of scoring trials both with shots and headers. • Germany used the middle and attacking thirds ↑ than all other teams in runs with the ball.	N
Partridge, Mosher and Franks (1993)	1990 World Cup (*n*=52) and the 1990 World Collegiate Soccer Championship (*n*=7).	Shots, Goals, Passes, Possession, Areas of the pitch and Crosses.	• Collegiate teams created the same numbers of shooting opportunities (15.8 vs. 14.8), completed ↓ passes (230.3 vs. 347.3), had ↑ changes of possession (240.6 vs. 180.1), completed ↓ passing movements between 4 and 10+ passes and ↑ passes where either 0 or 1 pass was completed compared to World Cup teams. • Collegiate teams significantly lost a higher mean (46.11% vs. 40.53%) of their possessions in the middle third, created ↓ crossing opportunities (14.4 vs. 19.3) and had similar numbers of successful crosses per game (2.9 vs. 3.1) compared to World Cup teams.	N
Potter (1996a)	1994 World Cup (*n*=2).	Passes and Shots.	• Brazil kept possession for longer periods and passed the ball 3 times as often as Sweden. • Brazil's possessions (↓ than 3 passes) were 44% and had 20 shots compared to 87.5% and 3 for Sweden. • Switzerland built their attacks from deep, had 73% of possessions (↓ than 3 passes) and 18 shots compared to 80% and 14 shots for Spain.	Y
Rico and Bangsbo (1996)	Euro 1992 (*n*=5).	Passes, Dribbles, Interceptions, Shots and Goals.	• Mean number of shots per team was 12.2, and the ratio of goals per shot was 1: 12. • Number of passes per team per game was 388 (252 were easy, 116 difficult and 20 very difficult) and ↓ easy passes were attempted in the last 15 minutes. • Interceptions were 159 per team and dribbles fell from 165 in the 1st half to 143 in the 2nd.	N
Tiryaki, Cicek, Erdogan, Katay, Atalay and Tuncel (1996)	Switzerland at the 1994 World Cup (*n*=4).	Pitch areas, Passes, Shots, and Crosses.	• 58% and 15% of Switzerland's passes took place in midfield and attacking areas. • In defensive areas passing occurred ↑ in central areas. • Left and right sides were used equally for crossing with 79% of crosses being unsuccessful. • 82% of their shots were taken from midfield areas with only 34% of these being successful.	N
Garganta, Maia and Basto (1997)	Five European teams (*n*=44).	Possessions and Areas of the Pitch.	• Three teams won higher percentage of ball possession in their attacking third. • Number of players used in scoring (1-3 players) ranged from 47.7% up to 85%. • Scoring movements (↓ than 3 passes) ranged from 51% up to 93%.	N
Luhtanen, Korhonen and Ilkka (1997)	Brazil and their opponents in the 1994 World Cup (*n*=7).	Shots.	• Brazil was the strongest team with the highest number of successful attacking trials in the attacking third (61 to 31), scoring chances (27 to 10) and shots in scoring goals (17 to 7).	N

Table 2.4 contd.

Pollard and Reep (1997)	1986 World Cup (*n*=22).	Possession, Goals and Shots.	• 5844 possessions; 489 resulted in a shot and 47 in a goal (p=0.096, 1: 10 for goals to shots). • 15% of the possessions contained ↑ than 4 passes. • The probability of scoring inside an arc defined with an 18m radius and a 45° radius from the centre was 0.189 compared to 0.014 outside.	N
Hughes, Dawkins, David and Mills (1998)	English Premier league (*n*=20) and Euro 1996 (*n*=31).	Goals, Shots, Dribbles, Tackles, Passes and Perturbations.	• Premier League; the most effective perturbation category for producing goals was lost control (1: 5.5 goals per perturbation). • Successful and unsuccessful teams had different patterns in the way they produced their perturbations both in attack and defence. • Euro 96; the most effective categories that produced goals were the pass (1: 8.1), skill (1: 8.2) and the lost control variable (1: 10.2). • Comparing successful and unsuccessful teams, most differences occurred with the bad pass defensive variable (1: 3.3), piece of skill (1: 3.7) and the attacking pass (1: 5).	Y
Grant, Williams and Reilly (1999a)	World Cup 1998 (*n*=64), 1990 and 1994.	Goals, Shots, Areas of the pitch, Set-plays, Touches, Possessions and Passes.	• 1998 World Cup; majority of goals due to possession regained in the defensive third. • 16.7% of goals scored with ↑ than 4 touches and there was on average 2.67 goals per game with open play accounting for 63.2% of the goals scored. • ↑ than 50% of the goals scored from open play and set-plays involved a one-touch finish. • The mode for the number of passes before goals from open play was 3 (21.3%) and 6-10 seconds was the most frequent duration of possession that preceded a goal (25.9%). • In the 1998 World Cup there were ↓ headers from 1990 and only 10.4% of goals were scored outside the penalty area compared to 20% in 1994.	N
Grant, Williams and Reilly (1999b)	1998 World Cup (*n*=30).	Shots, Passes, Crosses, Dribbles and Time.	• Successful teams averaged ↑ attempts at goal per game (18.1 vs. 9.5), ↑ passes per game (362.7 vs. 30.8.9) and crossed ↑ frequently (19.1 vs. 12.7) than unsuccessful teams. • Successful teams performed ↑ passes per game in central attacking areas and had ↑ attempts at goal in open play from build ups involving 4 or ↑ passes and over 15 seconds.	N
Lee, Shelton, Reilly and Rienzi (1999)	Uruguay in 1995 Copa America and Germany in Euro 1996 (*n*=4 in each).	Shots, Areas of the pitch and Passes.	• Most of Germany's shots came from passing on the right (42%) compared to Uruguay's from the middle of the pitch (47%). • The passes per game were 307 ± 29 and 230 ± 49, the shots per game were 9 and 12 with 64% and 79% from three or ↓ passes for Germany and Uruguay respectively. • 17 (47%) of Germany's shots were taken from 18 yards or ↑ compared to 23 (43%) for Uruguay.	N

Table 2.4 contd.

Egesoy and Eniseler (2001)	1st, 2nd and 3rd Divisions in Turkey during 1993-94 and 1994-95.	Shots, Pitch areas, Set-plays, Positions and Time.	• Goals scored ↓ as the distance ↑ from goal and goals scored from outside the area ↑ the higher the league. • ↑ goals were scored by set-pieces in the 1st division. • Defenders and midfielders in the 1st division scored ↑ goals than any other league. • ↑ goals were scored in the 1st and 2nd divisions between 76 and 90 minutes. • A high percentage of teams that scored first won the match and the highest percentage of teams that scored first and lost was in the 1st division.	N
Grehaigne (2001)	English 1st Division in 1978-79 (*n*=462), French 1st Division in 1996-97 (*n*=760), English league and cup matches in 1980, French 1st division during 1994-97, European league in 1997-98 and 1998 World Cup (*n*=64).	Time of goals.	• Within 15-minute periods the number of goals either ↑ from beginning to end or ↑ within each half. • The last 15 minutes always gave a larger number of goals with these goals giving victory or maintaining the lead in 77% of the time. • In the last 15-minute period the last 5 minutes contained half the goals scored. • The number of scored goals by the top scorer in a given European league ranged between 18 and 34 with the majority between 22 and 24.	N
Hook and Hughes (2001)	Euro 2000 (*n*=46).	Shots, Goals, Possessions and Passes.	• Unsuccessful teams performed 10.6% ↑ shots in the air while successful teams used ↑ accurate or inventive shots (20.1%). • Successful teams scored over twice as many goals and unsuccessful teams had higher percentages of missed shots, saves and blocks. • Successful teams utilised longer possessions and had ↓ attacks lasting ↓ than 5 second but no differences were found between the numbers of passes used. • Successful teams were able to utilise the defence splitting pass and used ↑ short and long passes compared to the aerial passes used by unsuccessful teams.	Y
Hughes and Pettit (2001)	World cup 1998 (*n*=64) and 1986.	Crosses, Shots, Goals, Time and Areas of the pitch.	• 1998 World Cup; no differences between the number of crosses in each half but there were ↑ crosses at the end of each half than in any other 15-minute period. • ↑ goals were scored in the 2nd half and ↑ with time. • Striking the ball while on the ground was the best chance of scoring, with it struck low to either side of the keeper and if possible placed or driven. • There were 2.5 goals per match in 1986 compared to 5.4 in 1954. • Shots taken from crosses with the feet produced 22 and 32 goals, while headers produced 16 and 21 goals in 1986 and 1998 respectively.	Y

Table 2.4 contd.

Japheth and Hughes (2001)	World Cup 1998 (*n*=7) and Euro 2000 (*n*=6).	Shots, Passes, Areas of the pitch, Touches, Dribbles, Possession, Goals and Crosses.	• In 1998 France performed 6 ↑ shots in every match totalling 54 ↑ shots, had a goals to shot ratio (1: 10.2 vs. 1: 7.2), 42 ↑ passes in every match, 30 ↓ ends of possession, 10 ↑ crosses per match, 56 ↑ runs and 8 ↓ dribbles compared to 2000. • 18% ↑ possessions were lost in the defensive area during 2000 while both competitions had the highest numbers lost in the attacking area but 1998 was 26% higher. • During the first 4 games France crossed the ball ↓ than opponents while during the semi and final they crossed ↑ in 2000. • 18% of France's and 43% of their opponent's goals came via set-pieces in the attacking $^1/_3$.	Y
Luhtanen, Belinskij, Hayrinen and Vanttinen (2001)	Euro 1996 and 2000 (*n*=31).	Shots, Passes, Goals, Possessions, Dribbles, Tackles and Interceptions.	• Shots leading to goal scoring trials were on average per team 12 and 13, the number of passes per team was 366 and 369, the possessions in distance were 6.4km and 5.7km, runs with the ball were 66 and 38, interceptions were 79 and 113 per team and there were 51% and 47% successful tackles for 1996 and 2000 respectively.	N
Stanhope (2001)	Teams in semi-finals and teams who were knocked out without a win in 1994 World Cup (*n*=8). Eight other countries were used.	Goals, Passes, Time and Distance.	• Successful teams ↑ their possessions the longer the 1st half continued. The 2nd half showed a ↓ in the number of possessions before a rise in the last 15 minutes. • Unsuccessful teams reached their peak in the last 15 minutes of the half after a drop in the number possessions from the beginning of the match. • Successful teams' goals ↑ as the match progressed in the 1st half and remained steady in the 2nd half until the last 15 minutes.	N
Abt, Dickson and Mummery (2002)	National Soccer League players during 1994-98 (*n*=703).	Goals and Time.	• There were 2065 goals and differences were found in the number of goals scored with regard to time with 34% ↑ goals scored in the 2nd half compared to the 1st. • ↑ were seen between 15-minute and 5-minute periods, an increase of 10% and 6%.	N
James, Mellalieu and Hollely (2002)	British Premier League team, Domestic (*n*=12) and European (*n*=9).	Areas of the pitch, Passes and Time.	• The ball was played into the middle areas 60.3% of the time compared to 39.7% out wide. • 59.9% of ball entries were in midfield areas. • The ball stayed in an area between 3-5 seconds with the only differences in the middle defensive and offensive areas where the ball stayed on average 6.3 and 1 second. • The team attacked ↑ down the right in domestic matches and entered the defensive area (pre-defensive) ↑ in Europe. • Domestically they won 41.76%, lost 41.67% and scored 18 while conceding 22 goals. • In Europe they won 44.5%, lost 11% and scored 18 while conceded 7 goals.	Y

R[1] = Was a Reliability Test Conducted
↑ = more/increase/less
↓ = less/decrease/fewer

2.5.4 Methodological Issues in Notational Analysis

2.5.4.1 Reliability and Validity

An integral part of the validity of an analysis system is its reliability, which shows the consistency or repeatability of a measure. While both are equally important a system cannot be considered to be valid unless it is reliable (Thomas and Nelson, 1996). There are many issues with the reliability of methods used within notational analysis. Hughes, Cooper and Nevill (2002) carried out a survey of papers presented in performance analysis at the first three World Conferences in Science of Notational Analysis of Sport and the first two Conferences in Science and Racket Sports. They stated that 67 papers were experimental studies using notation systems and 70% of these did not present any reliability studies while 15% applied inappropriate statistical processes for these tests. So many papers within sports notation do not include or use incorrect reliability tests so the results displayed may not produce valid interpretations of the sports being studied. It is vital therefore to demonstrate the reliability of a data gathering system clearly in a way that is compatible with the intended analysis (Hughes *et al.*, 2002).

James *et al.* (2002) explained how to carry out reliability via the methods of intra-observer and inter-observer reliability. Intra-reliability was carried out by an experienced observer (over 100 hours experience), with two tests either side of a six-week gap being performed on the same 15 minutes of action so comparisons could be made between the two sets of data. Inter-reliability was performed by two researchers (15 years of soccer experience) on 15 minutes of action after a two-hour training session. The data obtained was then compared to the data gained from the experienced observer. Errors were shown to arise from operational, observational and definitional errors. Operational errors occurred when the observer used the wrong code or button to label an event.

Observational errors occurred when the observer missed and subsequently failed to code an event. Definitional errors were areas of ambiguity or doubt where the observers were not completely familiar with the definitions and coding structure. The implications of increased definitional errors would be that the coding structure may be difficult to use and produces unreliable data. The areas of ambiguity within the coding structure may make the observer unable to differentiate between performance indicators (i.e., clearance and a pass). Further development of the system would therefore be needed before any more coding could be conducted.

There have been several examples of reliability studies demonstrated within the notation literature (Potter, 1996a; Hook and Hughes, 2001; James *et al.*, 2002). James *et al.* (2002) found that low levels of definitional (2.46%) but higher levels of operational (5.15%) and observational (7.73%) errors were collected during inter-observer reliability of their system. The lack of training given to the observers was stated as a reason for these errors but these tests were limited due to the low sample size. Within studies Hughes *et al.* (2002) stated that different levels of accuracy could be required for different variables within a notation system as some observations are more difficult to make than others. To improve the validity of a system coaches, assistants and notational analysis experts need to be consulted so relevant indicators of performance can be collected and used to aid the understanding of sporting performance (Taylor, Mellalieu, and James, 2004). Even though examples of tests have been found within the research there is still a paucity of studies that have been validated or tested for reliability in addition to their main objectives.

2.5.4.2 Performance Indicators

Performance indicators or behaviours must be established and collected when researching aspects of sporting performance. They should relate to successful or unsuccessful aspects of performance and be used by analysts and coaches in assessing the performance of an individual, team or elements of a team. Performance indicators have been broken down into different areas within the notation literature, including technical and tactical indicators (Hughes and Bartlett, 2002). Within soccer technical indicators have included accuracy in passing, shots off target, lost control and on/off target crosses (Partridge and Franks, 1989a; 1989b; Hook and Hughes, 2001; Hughes and Pettit, 2001), while tactical indicators have included passes/possession, passing distributions, length of passes and areas of the pitch (Bate, 1988; Hughes *et al.*, 1988; Hughes and Pettit, 2001).

These indicators can be further categorised into scoring indicators (i.e., goals, baskets and tries) and indicators of the quality of performance (i.e., tackles, passes and possession), which are used as a measure of positive or negative aspects of performance. Many studies do not give sufficient data from the performance to represent fully significant events. One aspect of giving better representations of performance is by using ratios therefore normalising the action variables with the total frequency of the action variables or the total frequency of all actions (Hughes and Bartlett, 2002). An example would be two players, A and B having four and six shots respectively. Player B would seem to be performing better but out of the respective total of shot attempts player A had a 100% success rate while player B only had a 50% success rate resulting in a better strike rate for player A (Hughes and Bartlett, 2002). Therefore, it is important how the data is displayed in the results not just what is found within the data as the findings may misrepresent what actually occurs.

The performance indicators are not only used across different sports (i.e., passing is used in soccer and hockey) but can also be sport-specific (i.e., a lineout throw in rugby or a cover drive in cricket). Consequently, each sport analysed requires time and effort in establishing all relevant indicators. Given the increasing television coverage in different sports, performance indicators have become a useful method of explaining how an individual or team is performing to viewers by statistics being displayed (e.g., at half and full time in soccer and rugby). The media, coaches and players have therefore become increasingly involved in using performance indicators due to the use of statistics and the use of notational analysis within sport teams such as Everton Football Club and The Scottish Rugby Union (www.noldus.com). Even with the increasing use of performance indicators in sport, few studies highlight whether they have used indicators that have been fully defined and if they are reliable and valid (Taylor *et al.*, 2004; James, Mellalieu and Jones, in press).

2.6 Summary

Home advantage is a phenomenon that exists in many sports, including soccer, and is suggested to be influenced by a number of factors (i.e., crowd, travel, learning, rules, and team quality), which subsequently affect the behaviours, and performances of players, coaches, and officials. Although studies have shown that both performance and tactics or strategy may differ as a function of game location (i.e., away teams play more defensively and home teams take more shots and score more goals), there has been paucity of performance indicators used and little analysis of the tactical or strategic differences between home and away sides. While potential confounding variables (e.g., weather conditions and game status) have been suggested as important factors that may influence performance when playing at home and away, previous studies have been limited in their

examination of such effects. One method already used to examine performance indicators in greater detail than the existing home advantage literature is notational analysis. Data is collected on sporting performance to provide feedback to coaches on their athletes' performance and is used in research to further enhance the understanding of sport. To date no notational analysis studies have examined home advantage and performance indicators (technical or tactical) in any detail.

3. Methodology

3.1 Study Design

A computerised video analysis system, the Noldus Observer Video-Pro behavioural measurement package (Noldus Information Technology, 2002) was used to collect data on technical and tactical behaviours for home and away teams. Premiership soccer matches from a league and case study sample were recorded from terrestrial and satellite television and analysed. In addition, the effects of potential confounding variables (i.e., weather conditions, kick-off times, and game status) on technical and tactical performance indicators were also examined with respect to game location.

3.2 Participants

To investigate whether home advantage existed in a league sample 30 English Premiership matches were collected during the 2001-02 and 2002-03 domestic seasons. To examine home advantage in a case study a further 15 matches from an English Premiership club were analysed at home and away (n=6 and n=9 respectively). In order to allow for any potential effects of team quality (Madrigal and James, 1999) a broad range of teams from the league were sampled. In total this constituted matches from 20 out of the 23 teams of the league (86.96%) as shown in Appendix B. In addition, both the league and case samples consisted of separate matches with no overlapping, which allowed independence between the samples. Home winning percentages (HWP's) and home goal percentages (HGP's) for the whole English Premier League, the league sample, and the case Premiership team over both seasons are shown in Table 4.1.

3.3 Instruments and Measures

3.3.1 Performance Indicators

Prior to designing any analysis system, it is important to decide what information is required and how it is related to the study (Hughes and Franks, 1997). One way of achieving this objective is to develop performance indicators, which describe the technical behaviours that explain performance (i.e., successful or unsuccessful tackles). Within the research the identification and definition of such indicators allows a performance to be assessed in either success or failure within each indicator, and forms an objective assessment of a team's technical performance (Bate, 1988; Hook and Hughes, 2001; Hughes and Pettit, 2001). However, additionally, for meaningful data to be obtained the indicators must be shown in a way that allows accurate interpretations, e.g., the ratio of shots on goal per game to the total number of shots per game (Hughes and Bartlett, 2002).

The performance indicators and the notation system for the thesis were developed by first collating all the previously used performance behaviours in academic studies. Then in addition, based on the various theoretical explanations for home advantage cited in Courneya and Carron's (1992) model performance behaviours were developed relating to the explanations i.e., tackling, passing and shooting linked with crowd support and strategic differences (see table 3.1). Once a list was compiled, definitions were constructed for each indicator and the system was piloted so that any unclear definitions could be amended. Unclear definitions or anomalies found during the early stages of analysis were corrected either by changing the wording of the definitions or by adding a new code to account for an aspect of play previously not considered. Consequently, by improving the understanding of the definitions within the system areas of uncertainty

between certain indicators were reduced (e.g., foot clearances and forward very difficult passes with the foot). After a pilot of five matches had been completed, it was assumed that all unclear definitions had been amended within the system and was ready for use within the study. The main performance indicators and their definitions are presented in section 3.4.

To enhance the understanding of the tactical behaviours or playing patterns/strategies employed the areas of the pitch where the teams performed their technical behaviours were also included within the study design. The pitch was divided into defensive, attacking, and middle thirds based on information and recommendations obtained from a professional soccer manager (B. Flynn, personal communication, 2003). The pitch was further divided into wide and central areas (Figure 3.1) so that the use of width by teams could be expressed in the analysis. The purpose of using the grid system was to allow differences in the action areas to be identified within home and away sides, and indicate the main dimensions of the play and the prevalent distribution of the players on the pitch (cf., Grehaigne, Mahut and Fernandez, 2001).

To obtain appropriate face/content validity the performance indicators were evaluated in two stages. Firstly, the key performance indicators were presented to three sports scientists with between fifteen and thirty years of soccer notation experience. The indicators were examined for relevance to performance and any other indicators were added if previously missed. Secondly, three Football Association (FA.) coaches with thirty and fifty years of soccer coaching experience were asked to comment upon, improve, or add to the list.

Table 3.1: Table of performance indicators related to the theory of home advantage.

Performance Indicators	Theories of Home Advantage
Clearances: Success rate. **Interceptions:** Success rate. **Aerial Challenges:** Success rate.	• **Attendance (Size and Density):** Social Support (Nevill *et al.*, 1996). • **Antisocial Supporters (Home/Away):** Verbal abuse (Greer, 1983). • **Effects on Strategy:** More defensive away from home and counter attack (Dennis and Carron, 1999). • **Psychological Factors:** Self-efficacy/confidence and anxiety (Bray *et al.*, 2002). • **Team Quality:** Weak and strong teams (Bray, 1999).
Crossing: Area and Success rates. **Possessions:** Number of possessions and Passes per possession. **Dribbling:** Numbers and Success.	• **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse. • **Effects on Strategy:** More defensive away from home and counter attack. • **Psychological Factors:** Self-efficacy/confidence and anxiety. • **Team Quality:** Weak and strong teams. • **Familiarity:** Pitch size.
Shooting: Success rate and Outcome of shots. **Passing:** Distance of pass, Number of passes to goal, Success rate, Difficulty and Direction.	• **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse. • **Effects on Strategy:** More defensive away from home and counter attack. • **Psychological Factors:** Self-efficacy/confidence and anxiety. • **Team Quality:** Weak and strong teams. • **Home Disadvantage (choking):** Pressure on winning key games (Baumeister and Steinhilber, 1984). • **Familiarity:** Pitch size.
Tackling: Success rate. **Bookings:** Numbers of yellow and red cards.	• **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse. • **Team Quality:** Weak and strong teams. • **Psychological Factors:** Self-efficacy/confidence, anxiety and aggression. • **Distance Travelled:** Derby matches (Clarke and Norman, 1995). • **Effects on Strategy:** More defensive away from home and counter attack.
Goals: Numbers scored/conceded, Open play/Set piece and Position.	• **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse. • **Effects on Strategy:** More defensive away from home and counter attack. • **Psychological Factors:** Self-efficacy/confidence and anxiety. • **Team Quality:** Weak and strong teams. • **Home Disadvantage (choking):** Pressure on winning key games. • **Referee:** Bias to home team (Nevill *et al.*, 1999).
Offsides: Position.	• **Psychological Factors:** Self-efficacy/confidence and anxiety. • **Effects on Strategy:** More defensive away from home and counter attack. • **Referee:** Bias to home team
Fouls: Position and Frequency and Cards.	• **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse. • **Referee:** Bias to home team. • **Psychological Factors:** Self-efficacy/confidence, anxiety and aggression. • **Distance Travelled:** Derby matches.

Table 3.1 contd.

Set Pieces: Corners and Goal kicks, Throw ins, Free kicks and Penalties.	• **Referee:** Bias to home team. • **Psychological Factors:** Self-efficacy/confidence and anxiety. • **Team Quality:** Weak and strong teams.
Goalkeeper Actions: Saves and Distribution.	• **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse. • **Psychological Factors:** Self-efficacy/confidence and anxiety. • **Team Quality:** Weak and strong teams.
Areas of the Pitch: Thirds, Initiation of scoring moves, Areas of shots and Regaining possession.	• **Effects on Strategy:** More defensive away from home and counter attack. • **Familiarity:** Pitch Size.
Goals or events: Time and position.	• **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse. • **Effects on Strategy:** More defensive away from home and counter attack. • **Travel:** Time since previous game.
Entries into attacking third.	• **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse. • **Effects on Strategy:** More defensive away from home and counter attack. • **Team Quality:** Weak and strong teams.
Loss and gain possession.	• **Psychological Factors:** Self-efficacy/confidence, anxiety and aggression. • **Attendance (Size and Density):** Social Support. • **Antisocial Supporters (Home/Away):** Verbal abuse.

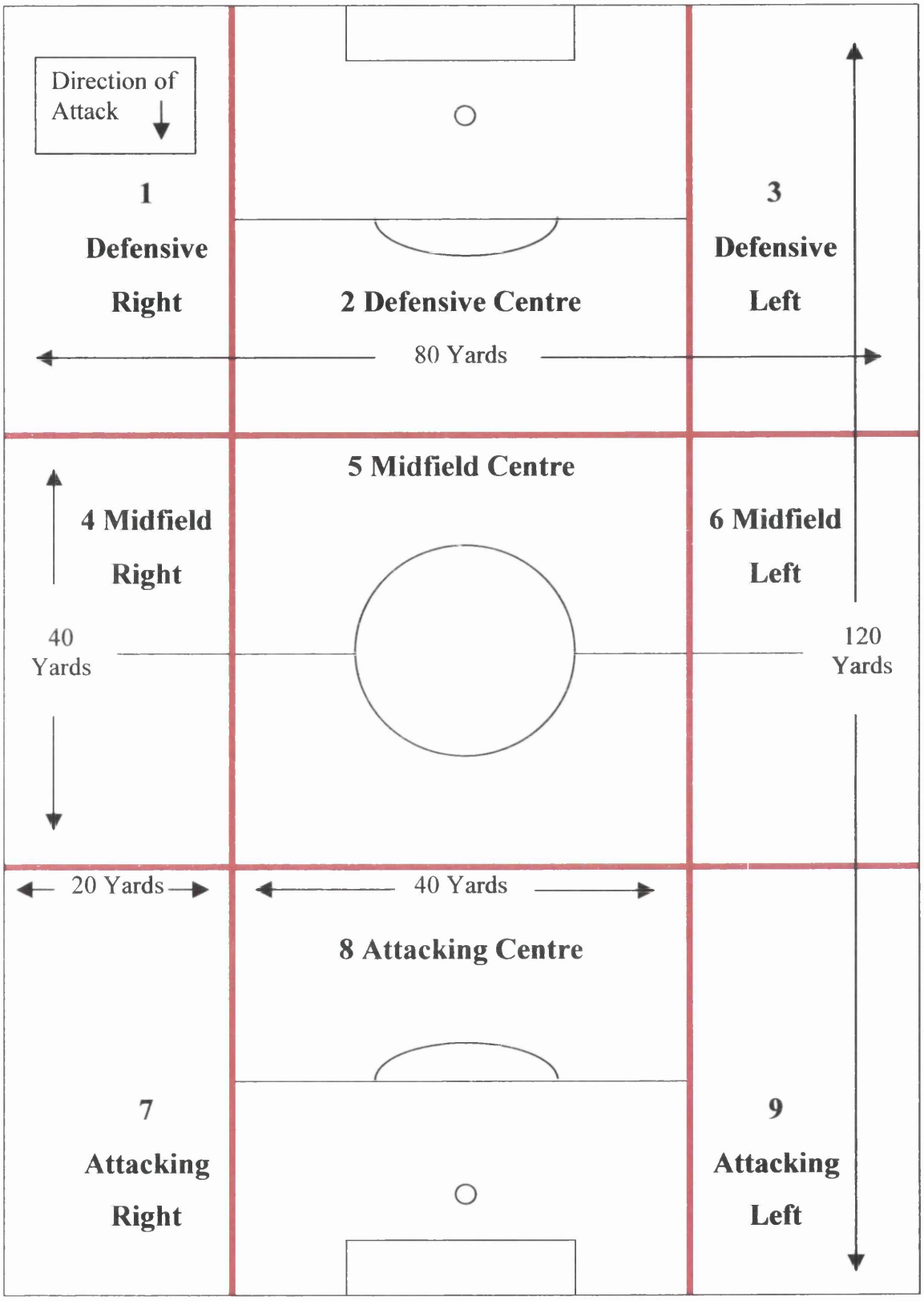

Figure 3.1: Grid system used to identify areas of the pitch.

Some indicators were removed that the coaches didn't feel were necessary or important indicators of performance (i.e., type of shot). Also definitions were changed to include successful and unsuccessful performance (i.e., within set-pieces). This enabled the analyst to reduce the uncertainty within the coding process by including important performance behaviours with accurate definitions.

3.3.2 System Reliability

The key component in any research design is the repeatability and accuracy of the apparatus used. System reliability was conducted by using intra-observer and inter-observer reliability. Intra-observer reliability examined the ability of the same observer to accurately code the same passage of play twice. The analyst (over 100 hour's experience of the system) coded two randomly selected soccer matches before and after a nine-week period (to negate any possible learning effects). The data from both coding sessions were compared with any differences calculated via percentage errors for each stage in the coding process. Inter-observer reliability assessed the ability of two external observers (fifteen years of experience in soccer) in using a system to successfully code a passage of play compared to the experts' coding. Inter-reliability was measured in a similar manner to intra-reliability but the external observers coded the same two games after a two-hour training session, which was then compared to that of the expert. To ensure standardisation every effort was made to replicate similar conditions for each coding session. Errors made by the researchers were classified as operational, observational, or definitional errors as explained in Table 3.2 (see James *et al.*, 2002).

Table 3.2: Types of errors found within the analysis system.

Type of Error	Definition
Definitional Errors	Operational definitions were unclear to the observer (i.e., areas of doubt), thought to be due to the observer not being completely familiar with the definitions and coding structure. For example, coding a foot forward very difficult pass as a foot clearance.
Operational Errors	The observer knew what to code but used the wrong code or button to label an event. This can be overcome through observer training.
Observational Errors	Events missed by the observer and therefore un-coded. This type of error can be attributed to the level of observer competence and their relative soccer knowledge.

3.3.2.1 Reliability Results

There has been a paucity of studies that have examined the reliability of a coding system within soccer. Hook and Hughes (2001) examined patterns of play leading to shots and found reliability increased from 96.2% to 99.3% when the system was improved. Hughes and Pettit (2001) analysed crossing and shooting and found low percentage errors when one match was tested either side of a week. In addition, Japheth and Hughes (2001) found within inter and intra-reliability the analysts had reliability all greater than 95.34%. While, James *et al.,* (2002) found a 99.44% agreement for intra-reliability and found low levels of definitional (2.46%), operational (5.15%) and observational (7.73%) errors within inter-reliability but only 15 minutes were analysed. The lack of studies with sufficient reliability analysis means that comparison with this thesis is difficult because of the existing weaknesses.

For the present study, intra-reliability results showed levels of error less that 5% on each stage of the coding process (Table 3.3). The most errors were found within the areas (4.87%) and action (4.96%) stages of coding where most of the ambiguity between

indicators would expect to be found (see Appendix D for the percentage errors per half on the intra-observer reliability test).

Within the inter-reliability tests the results showed errors less that 4% for team recognition and outcome. Even though observer reliability errors for area and action were unacceptably high, this was not seen as primarily important as the expert analyst coded all games in the study (see Appendix D for the percentage errors per half on the inter-observer reliability test). However, if more than one person was coding the matches improved training of the notational systems would be needed so that errors could be reduced (James *et al.*, 2002). Levels of accuracy given for each variable would also need to be different due to some observations being more difficult to make than others (i.e., areas of ambiguity), so it is logical therefore to allow different levels of accuracy for different variables (Hughes *et al.*, 2002). In addition, for both intra and inter-reliability a cumulative reliability was calculated as shown in Table 3.3. The percentages of 24.40% and 28.34% for inter-reliability and 13.47% for intra-reliability were also unacceptably high and therefore suggests that increased knowledge and training is needed when using the coding system.

Table 3.3: Percentage errors for the coding process during reliability testing.

Stages of coding process	Inter-observer reliability		Intra-observer reliability
	Operator 1	Operator 2	
Subjects	1.54%	1.09%	0.76%
Areas	10.50%	9.11%	4.87%
Action	13.20%	11.83%	4.96%
Outcome	3.10%	2.37%	1.89%
Cumulative Error	28.34%	24.40%	13.47%

3.3.3 Classification of Home Advantage Confounding Variables

To investigate the effect of additional factors upon home advantage several potential confounding variables were assessed (Table 3.4). These included weather conditions, kick-off times, and game status, and were derived from the psychology and notational analysis literature that suggested they had an effect on performance and strategy (Bray, 1999; James *et al.*, 2002). The degree to which each variable affected the technical and tactical performance at home and away was also examined by comparing the sub-groups within each confounding variable.

Table 3.4: Measure of home advantage variables.

Variable	Measure
Weather Conditions	The majority of the game was wet or dry.
Kick-off Times	Morning (11:00-13:00), Afternoon (14:00-18:00) and Evening (19:00-21:00).
Game Status	If the home or away team was winning, losing or drawing when each performance indicator was collected.

3.4 Coding Structure and Definitions Used to Record the Performance Indicators

Once the performance indicators were constructed a coding structure was defined to enable analysis to be conducted. Each individual event within the game (i.e., a tackle or a pass) had four parameters that needed to be coded when they occurred (Table 3.5); the team carrying out the action (i.e., home or away), the area of the pitch the event took place, the type of action and the result of that action.

3.4.1 Possession

Possession was coded in five different ways taking into account both teams gaining possession, no possession and both teams' one-touch possession. The home and away teams gaining possession were coded when either team first gained possession of the ball or regained the ball from an opposition clearance, interception or tackle. The ball was classed as in possession when a player gained the ball and it was under obvious control for the first time. Possession was classified as being gained from within open-play, through a kick-off or set-piece. If a player touched the ball in an attempted tackle but did not succeed in dispossessing the ball carrier then possession was not coded as being changed. However, if as a consequence of the sliding tackle, the ball ricoched to a team-mate who controlled the ball then possession was deemed to have changed. No possession was coded when the ball was out of play (i.e., when the ball crossed the touchline or the referee stopped the game due to an offence or injury). The home and away team's one-touch possessions were also coded when the ball was contacted but no actual possession was gained.

Table 3.5: Table of performance indicators and associated parameters.

SECTION	KEY PRESS 1	2	3	4
3.4.1	Home/Away Team Gains Possession (hg/ag)	Area (1-9)	Dummy Key (dk)	Dummy Key (dk)
3.4.1	No Possession (np)	Dummy Key (dk)	Dummy Key (dk)	Dummy Key (dk)
3.4.2	Home/Away Team (hh/aa)	Area (1-9)	Pass (multiple)	Successful (ss) Unsuccessful (uu)
3.4.3	Home/Away Team (hh/aa)	Area (1-9)	Head (ha) /Foot Shot (fa)	Goal (gg) Saved (sd) Off-target (ot) Blocked (bb) Deflected Goal (dg) Deflected Save (ds) Deflected Off-Target (do)
3.4.4	Home/Away Team (hh/aa)	Area (1-9)	Tackle (tt)	Successful (ss) Unsuccessful (uu) Foul (ff)
3.4.5	Home/Away Team (hh/aa)	Area (4, 6, 7 and 9)	Cross (cc)	Successful (ss) Unsuccessful (uu)
3.4.6	Home/Away Team (hh/aa)	Area (1-9)	Dribble (dd)	Successful (ss) Unsuccessful (uu)
3.4.7	Home/Away Team (hh/aa)	Area (1-9)	Head (ch)/Foot Clearance (cf)	Successful (ss) Unsuccessful (uu)
3.4.8	Home/Away Team (hh/aa)	Area (1-9)	Interception (ii)	Gained Possession (gp) Lost Possession (lp) Blocked (bb)
3.4.9	Home/Away Team (hh/aa)	Area (1-9)	Set pieces (multiple)	Successful (ss) Unsuccessful (uu) Goal (gg)
3.4.10	Home/Away Team (hh/aa)	Area (1-9)	Goalkeeper Actions (multiple)	Successful (ss) Unsuccessful (uu)
3.4.11	Home/Away Team (hh/aa)	Area (1-9)	Aerial Challenge (ac)	Successful (ss) Unsuccessful (uu) Foul (ff) Fouled (fl)
3.4.12	Home/Away Team (hh/aa)	Area (1-9)	Offside (oo)	Dummy Key (dk)
3.4.12	Home/Away Team (hh/aa)	Area (1-9)	Tackled (tk)	Dummy Key (dk)
3.4.12	Home/Away Team (hh/aa)	Area (1-9)	Fouled (fl)	Dummy Key (dk)
3.4.12	Home/Away Team (hh/aa)	Area (1-9)	Foul (fo)	Dummy Key (dk)
3.4.12	Home/Away Team (hh/aa)	Area (1-9)	Loss of Control (ll)	Dummy Key (dk)
3.4.12	Home/Away Team (hh/aa)	Area (1-9)	Booking (bb)	Yellow/Red Card (yy/rr)
3.4.12	Home/Away Team (hh/aa)	Area (1-9)	Dummy Key (dk)	Goal (gg)

3.4.2 Passing

A pass was defined as a player attempting to play the ball to another player on the same team enabling the team to keep possession. For a pass to be coded as such there had to be obvious intent to play it to a team-mate, therefore clearances and crosses were considered separately. A pass was most commonly performed with the foot or head but chest passes were also coded. The passes were coded on four variables including the type of pass, direction of the pass, difficulty of the pass and outcome of the pass (Table 3.6; 3.7).

Table 3.6: The definitions of a pass by type, direction, difficulty and outcome.

Type	Direction	Difficulty	Outcome
Foot: The player in possession used their foot to play the ball.	**Forward:** The direction of play was taken as 0° and a forward pass was coded when the pass was made between 285° and 75°.	**Easy:** Short pass (< 20 yards) made with no chance of interception.	**Successful:** Player on own team touched the ball first.
Head: The player in possession used their head to play the ball.	**Sideways:** The direction of play was taken as 0° and a sideways pass was coded when the pass was made between 75° and 105° or 255° and 285°.	**Difficult:** Short pass made with chance of interception or a longer pass (20-60 yards) with no chance of an interception.	
Chest: The player in possession used their chest to play the ball.	**Backwards:** The direction of play was taken as 0° and a backwards pass was coded when the pass was made between 105° and 255°.	**Very Difficult:** Long pass with chance of interception or a very long pass/cross field ball (> 60 yards).	**Unsuccessful:** Opponent touched the ball first or it left play.

Table 3.7: Coding structure for a pass.

Keystroke 1	2	3	4
Home Team (hh)	Area of the Pitch (1-9)	Foot Forward Easy Pass (ffe) Foot Forward Difficult Pass (ffd) Foot Forward Very Difficult Pass (ffv) Foot Sideways Easy Pass (fse) Foot Sideways Difficult Pass (fsd) Foot Sideways Very Difficult Pass (fsv) Foot Backwards Easy Pass (fbe) Foot Backwards Difficult Pass (fbd) Foot Backwards Very Difficult Pass (fbv) Head Forward Easy Pass (hfe) Head Forward Difficult Pass (hfd) Head Forward Very Difficult Pass (hfv) Head Sideways Easy Pass (hse) Head Sideways Difficult Pass (hsd) Head Sideways Very Difficult Pass (hsv) Head Backwards Easy Pass (hbe) Head Backwards Difficult Pass (hbd) Head Backwards Very Difficult Pass (hbv) Chest Pass Forwards (cpf) Chest Pass Sideways (cps) Chest Pass Backwards (bcp)	Successful (ss)
Away Team (aa)			Unsuccessful (ss)

3.4.3 Shooting

A shot occurred when a player in possession attempted to score by striking the ball towards the goal and was coded regardless of outcome. Shots were coded with regard to the part of the body used to perform the shot and the outcome of the shot (Table 3.8).

3.4.4 Tackling

A tackle occurred when a player attempted to dispossess an opponent that was in control of the ball. A tackle was successful if the tackling player dispossessed the ball carrier, even if the ball then rolled to an opposing player; therefore a successful tackle did not necessarily mean that the tackler's team gained possession. A drop ball was also classed as a tackle and the outcome was classed in the same way as a normal tackle. When both teams attempted a tackle at the same time the team that was coded first was the team that was successful then the unsuccessful tackle was coded (Table 3.9).

Table 3.8: Coding structure for a shot.

Keystroke 1	2	3	4
Home Team (hh)	Area of the Pitch (1-9)	**Foot Shot (fa):** The player made an attempt to score a goal using their foot or any part of their leg.	**Goal (gg):** Ball passed over the goal line under the bar and between the posts as a result of the shot or off the goalkeeper.
			Saved (sd): The shot was touched by the goalkeeper and stopped from entering the goal.
			Off-Target (ot): The shot went wide, high, hit the post or hit the bar as a result of the shot.
			Blocked (bb): A defending player shut down the shooter and the ball was blocked stopping the shot from threatening the goal.
Away Team (aa)		**Head Shot (ha):** The player made an attempt to score a goal using their head or chest.	**Deflected Goal (dg):** The shot was taken and hit a player and as a result the ball was redirected unintentionally into the goal.
			Deflected Save (ds): The shot hit another player and was redirected towards goal before being touched by the goalkeeper stopping a goal.
			Deflected Off-Target (do): The shot went wide, high, hit the post or hit bar as a result of the shot hitting another player and being redirected.

Table 3.9: Coding structure for a tackle.

Keystroke 1	2	3	4
Home Team (hh)	Area of the Pitch (1-9)	**Tackle (tt)**	**Successful (ss):** The ball carrier was dispossessed of the ball.
			Unsuccessful (uu): Tackling player failed to dispossess the ball carrier.
Away Team (aa)			**Foul (ff):** The tackler committed an offence and a free-kick or penalty was awarded against them.

3.4.5 Crossing

A cross was an attempt by a player in possession of the ball to play the ball into the penalty area from a wide position near the attacking third (Table 3.10).

Table 3.10: Coding structure for a cross.

Keystroke 1	2	3	4
Home Team (hh)	Area of the Pitch (4, 6, 7 and 9)	**Cross (cc)**	**Successful (ss):** The first player to make contact with the ball was a team-mate.
Away Team (aa)			**Unsuccessful (uu):** The first player to make contact with the ball was an opponent.

3.4.6 Dribbling

A player was said to be dribbling the ball when they were in locomotion, with the ball under control. To be classed as a dribble the player had to be moving with intent. Actions such as pushing the ball to make space or moving the ball while shielding it were therefore not coded as dribbling (Table 3.11).

Table 3.11: Coding structure for a dribble.

Keystroke 1	2	3	4
Home Team (hh)	Area of the Pitch (1-9)	**Dribble (dd)**	**Successful (ss):** The player dribbling the ball was not dispossessed during the movement and was able to perform another action (i.e., a pass).
Away Team (aa)			**Unsuccessful (uu):** The player dribbling the ball was dispossessed during the movement either due to a tackle, loss of control or the ball went out of play.

3.4.7 Clearances

Clearances mostly occurred in the defensive third immediately around the edges of the penalty area. A clearance involved a player using their feet or head to play the ball away from the danger area so there would no longer be an immediate threat at goal. A clearance differed from a pass in that there was no obvious intent to find a team-mate, the primary objective was just to avert the danger from the goal by playing the ball into touch or as far away as possible. Unsuccessful clearances were also notated for own goals from attacking crosses or passes and headed clearances were coded prior to an aerial challenge if a clearance was also attempted (Table 3.12).

Table 3.12: Coding structure for a clearance.

Keystroke			
1	**2**	**3**	**4**
Home Team (hh)	Area of the Pitch (1-9)	**Head Clearance (ch):** The area above the waist including head and chest was used to clear the ball or the goalkeeper used their fist to clear the ball.	**Successful (ss):** The ball left open play. The ball was removed from the danger area. The ball went to a team-mate and he was under no immediate threat within the danger area. The ball went to the opposition but there was no immediate threat on goal.
Away Team (aa)		**Foot Clearance (cf):** The area below the waist including the foot or leg was used to clear the ball.	**Unsuccessful (uu):** The ball went to the opposition and there was direct threat on goal. The ball went to a team-mate who was within the danger area and under threat from the opposition. An own goal was scored from defending attacking passes or crosses.

3.4.8 Interceptions

An interception occurred when a player attempted to capture the ball as it was being passed between two players on the opposing team. Any pass or shot that was blocked was also classed as an interception. A block differed from an interception in that the ball was

contacted almost as soon as the opposing player played it and there was no intent to gain possession of the ball, only to stop it from travelling in its intended direction. An interception was also coded if a player headed a ball stopping it from reaching the designated player (Table 3.13).

Table 3.13: Coding structure for an interception.

Keystroke 1	2	3	4
Home Team (hh)			**Gained Possession (gp):** A player made an attempt to intercept the ball and successfully gained control of the ball and the team regained possession.
	Area of the Pitch (1-9)	**Interception (ii)**	**Lost Possession (lp):** A player made an attempt to intercept the ball but failed to gain possession of the ball for their team.
Away Team (aa)			**Blocked (bb):** Any pass or cross that the opponent made was deemed as blocked when a player from the studied team cut out the ball almost as soon as the pass or cross occurred. Any shot blocked was also coded via this method.

3.4.9 Set-Pieces

A set-piece was a method of restarting the game from a dead-ball situation. This normally occurred after an offence or after the ball had gone out of play. The set-pieces that occurred after an offence were penalties and free-kicks. Methods of restarting the game after a ball had left play were throw-ins, goal-kicks and corners. Set-pieces were coded with reference to its outcome and if a shot was taken from a set-piece then it was coded as being successful or unsuccessful followed by coding the shot as if it was taken from open play (Table 3.14).

Table 3.14: Coding structure for set-pieces.

Keystroke 1	2	3	4
Home Team (hh)	Area of the Pitch (1-9)	**Penalty (pp):** Awarded after a foul on the attacking team by the defending team within the penalty area.	**Successful (ss):** The first player to make contact with the ball after a set-piece was a team-mate or a goal was scored directly.
		Corner (co): Restarted the game after a defending player had the last touch of the ball and it went over the dead ball line.	
		Throw-in (ti): Restarted the game after the ball left the playing area across the touchline.	**Unsuccessful (uu):** The first player to make contact with the ball after the set-piece was an opposing player. With regard to penalties and direct free-kicks struck at goal, unsuccessful would mean that a goal wasn't scored.
Away Team (aa)		**Free-kick (fk):** Restarted game after an offence and could be direct or indirect.	
		Goal-Kick (gk): Restarted the game after the attacking team played the ball over the goal line.	

3.4.10 Goalkeeper Actions

There were a variety of goalkeeper actions that were coded and were unique to this position (Table 3.15).

3.4.11 Aerial Challenge

An aerial challenge occurred when one or more players from each of the opposing teams jumped in an attempt to win a ball that was in the air. The difference between this and a headed clearance was that the main aim was to head the ball first and not necessarily clear the ball away from the danger area. When coding aerial challenges the order of coding

depended on the outcome, with the team that won the challenge or fouled the opponent being coded first followed by the team that lost the challenge or was fouled. In addition, a headed clearance was coded prior to the aerial challenges when this occurred. Aerial challenges were also coded with respect to the outcome (Table 3.16).

Table 3.15: Coding structure for goalkeeper actions.

Keystroke			
1	**2**	**3**	**4**
Home Team (hh)	Area of the Pitch (1-9)	**Save (gs):** The goalkeeper attempted a save.	**Successful (ss):** Ball was held or deflected away and stopped from entering the net.
			Unsuccessful (uu): Goalkeeper made contact or no contact with the ball and it entered the net.
		Kick from hands (gh): Goalkeeper kicked ball from their hands or drop kicked the ball.	**Successful (ss):** A team-mate made the first contact.
		Kick from floor (gz): Goalkeeper kicked ball from floor.	
Away Team (aa)		**Roll (gr):** The goalkeeper rolled out the ball.	**Unsuccessful (uu):** An opponent made the first contact.
		Throw (gt): The goalkeeper threw out the ball.	

Table 3.16: Coding structure for an aerial challenge.

Keystroke 1	2	3	4
			Successful (ss): Player from studied team made first contact.
Home Team (hh)			**Unsuccessful (uu):** If a player from the opposing team made first contact or both players missed ball.
	Area of the Pitch (1-9)	**Aerial Challenge (ac)**	**Foul (ff):** A player from the studied team committed an offence and a free-kick was awarded to them.
Away Team (aa)			**Fouled (fl):** A player from the studied team had an offence committed against them so a free-kick was awarded to them.

3.4.12 Other Indicators

Several other indicators were also coded within the study (Table 3.5). The game officials deemed a player as offside when the ball was played forward by an attacking player and another attacking player did not have at least two opposing players between themselves and the opposition's goal. It was not possible to be offside in your own half or directly from a throw in. Any player caught offside was penalised by having an indirect free-kick awarded against them. Offsides were coded for both the home and away teams. Offsides were coded as soon as the ball was played forward followed by coding no possession. A player was coded as tackled when they were caught in possession. Any player may have had the ball at their feet and not be making any coded actions when an opponent tackled them. If the opposing player failed to dispossess them then the action was not coded. When tackled the team that made the successful tackle was coded followed by the tackled team.

A foul was coded when a player committed a foul (not including those from tackles, offsides and aerial challenges) against an opponent. In most cases this was due to off the ball incidents or infringements such as holding, pulling, pushing or impeding a player. In most cases except handball when a foul was committed a player was also fouled. The player that was fouled may not be involved directly in play, for example, it could have been an off the ball incident such as being pushed in the area during a corner or being backed into when defending. Loss of control was coded when a player miss-controlled the ball, which included headers that were not interceptions or clearances. Bookings were coded when a player received a yellow or red card for committing a foul or giving dissent. If a second yellow was given followed by a red then it was coded in that order. It was coded straight after the offence followed by no possession unless the card was given off the ball, in which the sequence was no possession, booking followed by no possession for a second time. If an own goal was scored from actions such as crossing or passing then dummy key and then goal were coded for the attacking team.

3.5 Procedures

The procedures were conducted in six stages. The first stage involved Premiership matches being recorded from either Terrestrial or Satellite television onto a VHS tape using a Panasonic NV-HS820B video recorder and a Panasonic TX-21JT1 television. The second stage consisted of the games being transferred from VHS tape via a JVC HR-56856EK video recorder onto a Dell PC computer. This was carried out by using a Clipmaster MPEG converter (Fast Multimedia, 1999) and the dazzle MovieStar Digital Video Creator version 4.22 software (Fast Multimedia, 1999). This process converted the film into MPEG format, which was stored on the computer hard drive. The third stage involved the MPEG format being written to a CD using the Roxio Easy CD Creator 5

programme (Roxio, 2001). Each half of the soccer matches was recorded onto separate CDs due to the limited storage space of this media. The fourth stage was to devise a computerised notation system using the Noldus Observer Video-Pro package (Noldus Information Technology, 2002). To assist this system a coding structure was designed, which allowed the performance indicators to be coded into the system using a one, two, or three key entry. Once a configuration was designed analysis of games could then be carried out using the Observer package. The configuration consisted of four levels including subjects, areas, behaviours, and outcomes. Each level allowed a piece of information to be inputted into the system. In the subject level, two keys were entered that corresponded to the team being studied (e.g., hh = Home Team) while in the area level a single digit number corresponded to the area of the pitch players received the ball (e.g., 6 = Midfield Left). In the behavioural level, two or three keys were entered for the action carried out (ffe = Foot Forward Easy Pass). Finally, in the outcome level, two keys were entered corresponding to the outcome of the actions previously coded (ss = Successful). For example, the home team in left midfield made a successful foot forward easy pass (Table 3.17).

Table 3.17: A data entry example using the coding system.

	Subject	**Behaviour**	**Modifier 1**	**Modifier 2**
Key Press	hh	6	ffe	ss
Meaning	Home Team	Area 6	Foot Forward Easy Pass	Successful

The fifth stage consisted of transforming the data once a half was coded from the format that was produced in Observer into the format that could be analysed in SPSS 11.0 (SPSS Inc). Following completion of coding each half of the soccer match an observer file was created that contained the match data, which was then opened in a Microsoft Word

document. A self-written macro then converted the data to a numerical format, which was then pasted into a ready prepared SPSS Inc file and converted back into its original format. The potential confounding variables (i.e., weather conditions, kick-off times, and game status) were also entered into the SPSS Inc file in addition to the data colleted from Observer. The final stage was to analyse the data in the SPSS file once all the games had been analysed.

3.6 Data Analysis

Data analysis was conducted in two main stages. Firstly, home advantage was calculated with reference to the Home Winning Percentages (HWP's) and Home Goal Percentages (HGP's) for the league and case samples. Home winning percentages were calculated in three different ways including wins, ties included, and points. Home goal percentages were calculated by dividing the total number of home goals by the total number of goals scored (see Appendix C for the calculations). This enabled a simple test of home advantage to be conducted on the outcome of matches and on the performance indicator responsible for the outcome of matches (goals).

The second stage involved statistical tests being assigned to each aspect of the data analysis process. This was conducted on both the league and case study samples and consisted of four separate steps within each sample. The first step involved the data being screened for any errors within the coding process. The data within both samples was found to be non-normally distributed and therefore analysis of the data was conducted via non-parametric tests (Ntoumanis, 2001). The second step involved the performance indicators being tested with respect to game location. For the league sample a Wilcoxon signed ranks test was conducted as the home and away data were related specifically to

each other. For the case study, a Mann Whitney U test was conducted as two different sample sets were used home and away. The third step examined the effect of game location on tactical performance (strategy) by looking at location on the pitch (i.e., thirds, wide, and central areas) where technical behaviours occurred. A Wilcoxon signed ranks test was conducted on the league sample, while a Mann Whitney U test was used on the case study.

For the final stage of the analysis, potential confounding variables were examined within each variable and with respect to game location. Mann Whitney U tests were used to compare independent variables with two groups (i.e., weather conditions in the case and league samples; winning and losing with respect to game location in the league sample and weather conditions, kick-off times and game status with respect to game location in the case study). Kruskal Wallis tests were used to compare independent variables with more than two groups (i.e., kick-off times and game status within the league and case study samples). Wilcoxon signed ranks tests were used to compare related variables with two groups (i.e., weather conditions and kick-off times as a function of game location and drawing as a function of game location for the league sample).

4. Results

4.1 The Home Advantage Statistic

Home winning percentages (HWP's) and home goal percentages (HGP's) were calculated for both the league sample and the case Premiership team over the 2001/02 and 2002/03 seasons (Table 4.1) via the methods used by Pollard (1986) and Clarke and Norman (1995). In addition, HWP's and HGP's were calculated for the entire Premier League over the 2001/02 and 2002/03 seasons for comparison. With respect to HWP's and HGP's, a home advantage was evident for the case study and the entire Premier League but the case study HGP was only just over 50%. No home advantage was evident for the league sample.

4.2 Performance Indicators for League Sample

Table 4.2 shows the means, standard deviations, and frequencies for the technical and tactical performance indicators performed by the league sample.

4.2.1 Technical Indicators as a Function of Game Location

The first objective of the study was to examine the effect of game location on the technical performance indicators, and specifically those associated with a functional aggressive response (Table 4.3). A Wilcoxon signed ranks test revealed that the home team performed significantly more successful tackles (Mean Rank = 16.50, 13.83; $z = 2.00$; $p<0.05$), shots on goal, (Mean Rank = 10.31, 14.26; $z = 2.17$; $p<0.05$), crosses (Mean Rank = 15.31, 14.88; $z = 2.06$; $p<0.05$) and unsuccessful passes (Mean Rank = 13.50, 14.90; $z = 2.17$; $p<0.05$) than the away team.

Table 4.1: Home winning percentages and home goal percentages for the league sample, case study team and the Premier League over the 2001/02-2002/03 seasons.

	League Sample			Premier League			Case Study Team		
	2001/02	2002/03	2001/02-2002/03	2001/02	2002/03	2001/02-2002/03	2001/02	2002/03	2001/02-2002/03
HWP[a]	43.75%	44.44%	44.00%	59.14%	64.48%	61.86%	45.80%	64.00%	55.10%
HWP[b]	44.74%	45.45%	45.00%	56.71%	61.05%	58.88%	46.55%	60.61%	54.03%
HWP[c]	44.44%	45.16%	44.71%	57.36%	62.00%	59.69%	45.45%	60.24%	53.10%
HGP	48.00%	40.00%	44.71%	55.70%	57.00%	56.35%	45.90%	56.80%	50.90%

[a]statistic calculated by wins out of total wins
[b]statistic calculated by ties included
[c]statistic calculated by points
(See Appendix C for all the calculations)

Table 4.2: Means, standard deviations and frequencies of performance indicators.

Performance Indicators	Means, Standard Deviations and Frequencies
Losses of Control	44.73 ± 7.91 (1342)
Tackles	89.30 ± 18.43 (2679)
Successful Tackles	49.10 ± 10.77 (1473)
Unsuccessful Tackles	30.47 ± 8.67 (914)
Crosses	31.93 ± 6.45 (958)
Successful Crosses	6.53 ± 2.62 (196)
Unsuccessful Crosses	25.40 ± 5.31 (762)
Dribbles	191.07 ± 29.85 (5732)
Successful Dribbles	157.83 ± 30.09 (4735)
Unsuccessful Dribbles	33.23 ± 8.05 (997)
Interceptions	77.23 ± 13.82 (2317)
Corners	10.80 ± 3.46 (324)
Successful Corners	4.33 ± 1.86 (130)
Unsuccessful Corners	6.47 ± 2.45 (194)
Goal Kicks	17.77 ± 5.02 (533)
Successful Goal Kicks	7.20 ± 2.72 (216)
Unsuccessful Goal Kicks	10.57 ± 4.15 (317)
Offsides	6.60 ± 3.30 (198)
Tackled	35.80 ± 8.23 (1074)
Gk Kick Distribution	9.93 ± 4.30 (298)
Gk Arm Distribution	9.87 ± 5.03 (296)
Aerial Challenges	135.93 ± 33.11 (4078)
Successful Aerial Challenges	60.97 ± 14.25 (1829)

Performance Indicators	Means, Standard Deviations and Frequencies
Yellow Cards	3.33 ± 1.65 (100)
Red Cards	0.30 ± 0.60 (9)
Free Kicks	31.27 ± 8.04 (938)
Successful Free Kicks	16.87 ± 4.48 (506)
Unsuccessful Free Kicks	14.40 ± 5.98 (432)
Passes	688.93 ± 125.46 (20668)
Successful Passes	531.87 ± 116.43 (15956)
Unsuccessful Passes	157.07 ± 18.31 (4712)
Shots	26.70 ± 5.61 (801)
Goals	2.83 ± 1.66 (85)
On-Target Shots	9.77 ± 3.61 (293)
Off-Target Shots	11.37 ± 3.44 (341)
Blocked Shots	5.57 ± 2.85 (167)
Clearances	85.50 ± 17.75 (2565)
Successful Clearances	71.90 ± 15.23 (2157)
Unsuccessful Clearances	13.60 ± 4.29 (408)
Fouls Committed	28.77 ± 7.80 (863)
Fouls Received	27.60 ± 7.25 (828)
Easy Passes	259.77 ± 72.94 (7793)
Difficult Passes	283.67 ± 48.73 (8510)
Very Difficult Passes	140.67 ± 21.74 (4220)
Forward Passes	403.23 ± 62.72 (12097)
Sideways Passes	115.10 ± 35.00 (3453)
Backward Passes	170.60 ± 34.15 (5118)

Table 4.3: Means, standard deviations and frequencies of performance indicators in relation to game location.

Performance Indicators	Means, Standard Deviations and Frequencies	
	Away Team	Home Team
Loss of Control	23.00 ± 4.28 (690)	21.73 ± 5.60 (652)
Tackles	44.33 ± 9.87 (1330)	44.97 ± 11.19 (1349)
Successful Tackles	23.40 ± 6.25 (702)	25.70 ± 6.96 (771)*
Unsuccessful Tackles	15.90 ± 5.50 (477)	14.57 ± 5.44 (437)
Crosses	14.03 ± 5.52 (421)	17.90 ± 6.69 (537)
Successful Crosses	2.67 ± 1.56 (80)	3.87 ± 2.26 (116)*
Unsuccessful Crosses	11.37 ± 4.85 (341)	14.03 ± 5.29 (421)
Dribbles	90.80 ± 25.90 (2724)	100.27 ± 27.14 (3008)
Successful Dribbles	74.27 ± 24.24 (2228)	83.57 ± 26.84 (2507)
Unsuccessful Dribbles	16.53 ± 5.49 (496)	16.70 ± 5.03 (501)
Interceptions	40.63 ± 10.29 (1219)	36.60 ± 8.73 (1098)
Corners	4.83 ± 2.10 (145)	5.97 ± 2.79 (179)
Successful Corners	2.07 ± 1.36 (62)	2.27 ± 1.55 (68)
Unsuccessful Corners	2.77 ± 1.72 (83)	3.70 ± 1.91 (111)
Goal Kicks	10.00 ± 4.31 (300)	7.77 ± 3.24 (233)*
Successful Goal Kicks	4.27 ± 2.39 (128)	2.93 ± 1.76 (88)*
Unsuccessful Goal Kicks	5.73 ± 3.34 (172)	4.83 ± 2.42 (145)
Offsides	3.50 ± 2.15 (105)	3.10 ± 2.60 (93)
Tackled	18.93 ± 5.25 (568)	16.87 ± 4.79 (506)
Gk Kick Distribution	4.97 ± 3.30 (149)	4.97 ± 3.74 (149)
Gk Arm Distribution	5.17 ± 3.01 (155)	4.70 ± 3.11 (141)
Aerial Challenges	67.97 ± 16.55 (2039)	67.97 ± 16.55 (2039)
Successful Aerial Challenges	31.17 ± 8.20 (935)	29.80 ± 8.72 (894)
Yellow Cards	1.73 ± 1.23 (52)	1.60 ± 1.16 (48)
Red Cards	0.10 ± 0.31 (3)	0.20 ± 0.48 (6)
Free Kicks	15.70 ± 4.86 (471)	15.57 ± 5.25 (467)
Successful Free Kicks	8.67 ± 4.49 (260)	8.20 ± 2.82 (246)
Unsuccessful Free Kicks	7.03 ± 3.19 (211)	7.37 ± 4.50 (221)
Passes	336.17 ± 91.25 (10085)	352.77 ± 91.51 (10583)
Successful Passes	260.83 ± 84.71 (7825)	271.03 ± 84.57 (8131)
Unsuccessful Passes	75.33 ± 11.68 (2260)	81.73 ± 11.81 (2452)*
Shots	12.00 ± 4.33 (360)	14.70 ± 4.71 (441)*
Goals	1.57 ± 1.41 (47)	1.27 ± 1.34 (38)
On-Target Shots	4.77 ± 2.25 (143)	5.00 ± 2.88 (150)
Off-Target Shots	4.80 ± 2.85 (144)	6.57 ± 3.09 (197)
Blocked Shots	2.43 ± 1.87 (73)	3.13 ± 2.22 (94)
Clearances	46.67 ± 13.17 (1400)	38.83 ± 13.52 (1165)*
Successful Clearances	38.90 ± 11.29 (1167)	33.00 ± 11.10 (990)
Unsuccessful Clearances	7.77 ± 2.86 (233)	5.83 ± 3.36 (175)*
Fouls Committed	14.27 ± 5.15 (428)	14.50 ± 4.36 (435)
Fouls Received	14.07 ± 4.21 (422)	13.53 ± 4.70 (406)
Easy Passes	127.67 ± 52.19 (3830)	132.10 ± 53.45 (3968)
Difficult Passes	138.63 ± 34.82 (4159)	145.03 ± 33.40 (4351)
Very Difficult Passes	67.57 ± 14.22 (2027)	73.10 ± 15.18 (2193)
Forward Passes	195.27 ± 46.30 (5858)	207.97 ± 49.80 (6239)
Sideways Passes	56.77 ± 24.01 (1703)	58.33 ± 23.73 (1750)
Backward Passes	84.13 ± 24.86 (2524)	86.47 ± 22.04 (2594)

*$p<0.05$; **$p<0.01$

The away team received significantly more goal kicks (Mean Rank = 17.14, 11.50; z = 1.97; $p<0.05$), which were found to be more successful (Mean Rank = 15.14, 11.72; z = 2.02; $p<0.05$), and performed a larger number of clearances (Mean Rank = 15.88, 14.61; z = 2.08; $p<0.05$), of which a greater number were more unsuccessful (Mean Rank = 14.88, 13.56; z = 2.16; $p<0.05$). None of the remaining performance indicators were found to differ significantly ($p>0.05$).

4.2.2 Strategic Behaviours

The second objective of the study was to examine the effect of game location upon playing strategy. Specifically, technical performance indicators were examined in relation to the respective thirds and wide and central areas of the field to give an indication of the team's tactical behaviours (Table 4.4; 4.5). The Wilcoxon signed ranks test revealed that in the defensive third the away team attempted more interceptions (Mean Rank = 17.25, 12.00; z = 2.32; $p<0.05$), performed significantly more aerial challenges (Mean Rank = 14.88, 13.36; z = 2.50; $p<0.05$), and received significantly more fouls (Mean Rank = 16.74, 11.70; z = 2.19; $p<0.05$). In the middle third, the away team was tackled more often (Mean Rank = 15.64, 10.72; z = 2.24; $p<0.05$), while in the attacking third, the home team performed significantly more aerial challenges (Mean Rank = 13.36, 14.88; z = 2.50; $p<0.05$) and committed more fouls (Mean Rank = 11.13, 18.42; z = 2.05; $p<0.05$). None of the remaining performance indicators were found to differ significantly within each third of the field ($p>0.05$). Analysis of the technical performance indicators in wide and central areas revealed only a greater number of clearances performed in wide areas by the away team (Mean Rank = 16.95, 12.60; z = 2.20; $p<0.05$).

Table 4.4: Means, standard deviations and frequencies of performance indicators relative to thirds of the pitch as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies Defensive Third Away	Defensive Third Home	Middle Third Away	Middle Third Home	Attacking Third Away	Attacking Third Home
Losses of Control	3.57 ± 1.91 (107)	2.87 ± 1.94 (86)	10.60 ± 2.84 (318)	9.00 ± 3.36 (270)	8.83 ± 2.64 (265)	9.87 ± 3.44 (296)
Tackles	18.57 ± 5.65 (557)	17.63 ± 5.68 (529)	21.03 ± 5.88 (631)	21.47 ± 7.33 (644)	4.73 ± 2.96 (142)	5.87 ± 2.36 (176)
Crosses	–	–	0.33 ± 0.55 (10)	0.20 ± 0.76 (6)	13.70 ± 5.47 (411)	17.70 ± 6.56 (531)
Dribbles	19.83 ± 6.28 (595)	21.43 ± 8.56 (643)	48.20 ± 16.54 (1446)	52.00 ± 15.82 (1560)	22.77 ± 7.56 (683)	26.83 ± 7.90 (805)
Interceptions	22.73 ± 7.35 (682)	17.57 ± 5.10 (527)*	14.53 ± 5.61 (436)	15.17 ± 4.85 (455)	3.37 ± 2.39 (101)	3.87 ± 2.30 (116)
Offsides	–	–	0.53 ± 0.78 (16)	0.83 ± 1.37 (25)	2.97 ± 2.03 (89)	2.27 ± 2.05 (68)
Tackled	1.23 ± 1.19 (37)	0.93 ± 0.91 (28)	7.93 ± 3.77 (238)	6.50 ± 2.13 (195)*	9.77 ± 3.13 (293)	9.43 ± 3.76 (283)
Aerial Challenges	19.37 ± 6.90 (581)	14.97 ± 6.85 (449)*	33.63 ± 9.64 (1009)	33.63 ± 9.64 (1009)	14.97 ± 6.85 (449)	19.37 ± 6.90 (581)*
Free Kicks	5.40 ± 2.37 (162)	4.63 ± 2.50 (139)	6.83 ± 3.31 (205)	7.30 ± 3.69 (219)	3.47 ± 1.80 (104)	3.63 ± 2.11 (109)
Passes	69.60 ± 18.20 (2088)	73.07 ± 21.39 (2192)	203.40 ± 58.36 (6102)	208.57 ± 59.12 (6257)	63.17 ± 21.92 (1895)	71.13 ± 25.28 (2134)
Clearances	44.70 ± 12.40 (1341)	36.80 ± 12.27 (1104)*	1.97 ± 1.63 (59)	2.03 ± 2.03 (61)	–	–
Fouls Committed	3.47 ± 2.29 (104)	3.37 ± 1.83 (101)	7.67 ± 3.89 (230)	6.80 ± 3.09 (204)	3.13 ± 1.93 (94)	4.33 ± 2.29 (130)*
Fouls Received	4.23 ± 2.30 (127)	2.80 ± 1.92 (84)	6.53 ± 2.97 (196)	7.37 ± 3.61 (221)	3.30 ± 1.88 (99)	3.37 ± 2.33 (101)
Easy Passes	24.47 ± 9.66 (734)	26.83 ± 13.44 (805)	78.83 ± 34.21 (2365)	77.90 ± 33.70 (2337)	24.37 ± 12.16 (731)	27.37 ± 13.76 (821)
Difficult Passes	24.47 ± 7.44 (734)	25.23 ± 8.27 (757)	81.70 ± 23.36 (2451)	84.10 ± 22.81 (2523)	32.47 ± 10.12 (974)	35.70 ± 11.00 (1071)
Very Difficult Passes	20.43 ± 6.87 (613)	20.63 ± 5.43 (619)	41.50 ± 9.53 (1245)	45.17 ± 10.66 (1355)	5.63 ± 2.71 (169)	7.30 ± 4.11 (219)
Forward Passes	48.83 ± 12.53 (1465)	51.03 ± 14.09 (1531)	117.00 ± 29.95 (3510)	123.30 ± 31.10 (3699)	29.43 ± 9.62 (883)	33.63 ± 12.27 (1009)
Sideways Passes	8.83 ± 4.74 (265)	8.87 ± 5.06 (266)	35.30 ± 15.61 (1059)	35.17 ± 16.61 (1055)	12.63 ± 6.28 (379)	14.30 ± 5.84 (429)
Backward Passes	11.93 ± 3.55 (358)	13.17 ± 4.52 (395)	51.10 ± 17.07 (1533)	50.10 ± 16.14 (1503)	21.10 ± 8.64 (633)	23.20 ± 9.65 (696)

*$p<0.05$; **$p<0.01$

Table 4.5: Means, standard deviations and frequencies of performance indicators relative to wide and central areas as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies				Ratios (Central: Wide)	
	Central		Wide			
	Away	Home	Away	Home	Away	Home
Losses of Control	14.63 ± 3.32 (439)	14.07 ± 3.65 (422)	8.37 ± 2.95 (251)	7.67 ± 3.96 (230)	15:8	14:8
Tackles	26.17 ± 7.53 (785)	26.77 ± 7.35 (803)	18.17 ± 5.04 (545)	18.20 ± 6.56 (546)	26:18	27:18
Crosses	3.10 ± 1.65 (93)	3.87 ± 2.43 (116)	10.93 ± 5.01 (328)	14.03 ± 5.56 (421)	3:11	4:14
Dribbles	51.43 ± 16.98 (1543)	56.90 ± 19.08 (1707)	39.37 ± 11.65 (1181)	43.37 ± 11.57 (1301)	51:39	57:43
Interceptions	24.27 ± 7.46 (728)	22.37 ± 6.72 (671)	16.37 ± 5.68 (491)	14.23 ± 4.85 (427)	24:16	22:14
Offsides	2.57 ± 1.68 (77)	2.40 ± 2.06 (72)	0.93 ± 1.20 (28)	0.70 ± 1.24 (21)	3:1	2:1
Tackled	10.13 ± 3.43 (304)	9.00 ± 3.44 (270)	8.80 ± 3.99 (264)	7.87 ± 3.19 (236)	10:9	9:8
Successful Aerial Challenges	24.77 ± 6.40 (743)	24.37 ± 7.47 (731)	6.40 ± 13.16 (192)	5.43 ± 2.60 (163)	25:6	24:5
Free Kicks	9.63 ± 3.53 (289)	9.00 ± 3.09 (270)	6.07 ± 2.90 (182)	6.57 ± 3.37 (197)	7:6	9:7
Passes	210.00 ± 60.48 (6300)	219.33 ± 64.67 (6580)	126.17 ± 37.23 (3785)	133.43 ± 30.64 (4003)	210:126	219:133
Clearances	35.97 ± 9.19 (1079)	30.80 ± 11.82 (924)	10.70 ± 5.68 (321)	8.03 ± 3.24 (241)*	36:11	31:8
Fouls Committed	7.63 ± 2.85 (229)	8.10 ± 3.13 (243)	6.63 ± 3.30 (199)	6.40 ± 2.59 (192)	8:7	8:6
Fouls Received	7.80 ± 3.06 (234)	7.30 ± 2.53 (219)	6.27 ± 2.45 (188)	6.23 ± 3.23 (187)	8:6	7:6
Easy Passes	77.87 ± 32.24 (2336)	80.50 ± 34.33 (2415)	49.80 ± 22.53 (1494)	51.60 ± 20.76 (1548)	78:50	81:52
Difficult Passes	90.73 ± 25.02 (2722)	93.30 ± 26.31 (2799)	47.90 ± 14.67 (1437)	51.73 ± 10.39 (1552)	91:48	93:52
Very Difficult Passes	39.57 ± 9.28 (1187)	43.70 ± 10.03 (1311)	28.00 ± 6.99 (840)	29.40 ± 8.90 (882)	40:28	44:29
Forward Passes	124.70 ± 33.89 (3741)	133.00 ± 37.85 (3990)	70.57 ± 18.27 (2117)	74.97 ± 16.97 (2249)	125:71	133:75
Sideways Passes	37.73 ± 16.52 (1132)	38.87 ± 17.26 (1166)	19.03 ± 9.31 (571)	19.47 ± 7.97 (584)	38:19	39:19
Backward Passes	47.57 ± 13.77 (1427)	47.47 ± 13.40 (1424)	36.57 ± 13.12 (1097)	39.00 ± 10.77 (1170)	48:37	48:39

*p<0.05; **p<0.01

In respect to the ratios between central and wide areas (Table 4.5) no differences were found in the relationship between the numbers of indicators performed within the different areas.

4.2.3 Home Advantage and Additional Factors

The third objective of the thesis was to examine the influence of potential confounding variables upon the technical and tactical performance indicators, such as weather conditions, kick-off times, and game status.

4.2.3.1 Weather Conditions

Preliminary analysis involved comparison of the technical performance indicators with respect to weather conditions (Table 4.6). The sample of games was divided into wet and dry conditions (n=6 and n=24 respectively) and analysed using a Mann Whitney U test. In dry conditions there were more shots on-target (Mean Rank = 8.42, 17.27; U = 29.50; $p<0.05$), more crosses attempted (Mean Rank = 8.06, 17.35; U = 27.50; $p<0.05$), which were more successful (Mean Rank = 7.58, 17.48; U = 24.50; $p<0.05$), and more corners were received (Mean Rank = 8.50, 17.25; U = 30.00; $p<0.05$) which were also more successful (Mean Rank = 6.75, 17.69; U = 19.50; $p<0.01$). In the wet conditions, more interceptions were also attempted (Mean Rank = 23.00, 13.63; U = 27.00; $p<0.05$), and significantly more difficult passes were performed (Mean Rank = 22.50, 13.75; U = 30.00; $p<0.05$). None of the remaining performance indicators were found to differ significantly ($p>0.05$).

Further analysis examined each condition (i.e., wet and dry) with respect to game location (see Appendix E for the performance indicators) using a Wilcoxon signed ranks test. In

wet conditions the away team received more offside decisions (Mean Rank = 3.50, 0.00; z = 2.23; $p<0.05$) and performed more clearances (Mean Rank = 3.50, 0.00; z = 2.20; $p<0.05$) both successful (Mean Rank = 3.00, 0.00; z = 2.02; $p<0.05$) and unsuccessful (Mean Rank = 3.50, 0.00; z = 2.21; $p<0.05$). In dry conditions, the home team performed more crosses (Mean Rank = 11.57, 12.88; z = 1.97; $p<0.05$), which were more successful (Mean Rank = 8.10, 11.30; z = 2.42; $p<0.05$), and also performed more unsuccessful passes (Mean Rank = 11.58, 12.15; z = 2.09; $p<0.05$). The remaining performance indicators within wet and dry conditions failed to reach significance ($p>0.05$).

4.2.3.2 Kick-off Times

Technical performance indicators were compared with respect to kick-off times (morning, afternoon, and evening; see Table 4.7) using a Kruskal-Wallis test (n=9, n=11 and n=10 respectively). Differences were found between dribbles (Mean Rank = 17.94, 19.77, 8.60; Chi-square = 9.44; $p<0.01$), successful dribbles (Mean Rank = 18.89, 18.27, 9.40; Chi-square = 7.233; $p<0.05$), red cards (Mean Rank = 12.00, 14.55, 19.70; Chi-square = 7.02; $p<0.05$), successful free kicks (Mean Rank = 10.33, 19.95, 15.25; Chi-square = 5.98; $p<0.05$), goals (Mean Rank = 21.44, 13.14, 12.75; Chi-square = 6.21; $p<0.05$), the numbers of clearances performed (Mean Rank = 16.00, 10.73, 20.30; Chi-square = 6.24; $p<0.05$), unsuccessful clearances (Mean Rank = 19.50, 9.86, 18.10; Chi-square = 7.29; $p<0.05$), easy passes (Mean Rank = 19.89, 16.91, 10.00; Chi-square = 6.43; $p<0.05$) and forward passes (Mean Rank = 19.33, 17.36, 10.00; Chi-square = 6.11; $p<0.05$).

Further analysis examined kick-off time as a function of game location using a Wilcoxon signed ranks test (see Appendix E for the performance indicators). For morning games, the home team performed more corners (Mean Rank = 1.50, 4.42; z = 2.12; $p<0.05$) and

unsuccessful corners (Mean Rank = 0.00, 3.50; z = 2.23; p<0.05), successful (Mean Rank = 1.00, 4.00; z = 2.01; p<0.05) and unsuccessful crosses (Mean Rank = 6.00, 4.42; z = 1.96; p<0.05), successful free kicks (Mean Rank = 1.75, 5.93; z = 2.26; p<0.05), unsuccessful passes (Mean Rank = 4.00, 5.13; z = 2.19; p<0.05), shots on goal (Mean Rank = 2.50, 5.71; z = 2.08; p<0.05) and blocked shots (Mean Rank = 1.50, 4.42; z = 2.13; p<0.05). The away team performed more unsuccessful free kicks (Mean Rank = 5.79, 2.25; z = 2.14; p<0.05).

In the afternoon, the home team made more tackles (Mean Rank = 4.75, 6.28; z = 2.09; p<0.05) and successful tackles (Mean Rank = 5.25, 6.17; z = 2.00; p<0.05) and committed more fouls (Mean Rank = 3.25, 6.61; z = 2.38; p<0.05) than the away side. The away team made more successful free kicks (Mean Rank = 5.61, 4.50; z = 2.35; p<0.05) and received more fouls (Mean Rank = 6.78, 2.50; z = 2.51; p<0.05). In the evening, the home team made more successful tackles (Mean Rank = 1.00, 5.00; z = 2.41; p<0.05), while the away team made more unsuccessful tackles (Mean Rank = 5.88, 4.00; z = 2.00; p<0.05) and successful goal kicks (Mean Rank = 5.83, 2.50; z = 2.57; p<0.01).

Table 4.6: Means, standard deviations and frequencies of performance indicators with respect to weather conditions.

Performance Indicators	Means, Standard Deviations and Frequencies	
	Wet	Dry
Losses of Control	49.17 ± 7.73 (295)	43.63 ± 7.72 (1047)
Tackles	91.17 ± 23.39 (547)	88.83 ± 17.56 (2132)
Successful Tackles	51.50 ± 14.84 (309)	48.50 ± 9.82 (1164)
Unsuccessful Tackles	28.83 ± 10.17 (173)	30.88 ± 8.45 (741)
Crosses	26.00 ± 8.56 (156)	33.42 ± 5.01 (802)*
Successful Crosses	4.00 ± 1.90 (24)	7.17 ± 2.41 (172)*
Unsuccessful Crosses	22.00 ± 7.54 (132)	26.25 ± 4.41 (630)
Dribbles	184.50 ± 49.51 (1107)	192.71 ± 24.02 (4625)
Successful Dribbles	149.00 ± 44.04 (894)	160.04 ± 26.35 (3841)
Unsuccessful Dribbles	35.50 ± 8.22 (213)	32.67 ± 8.09 (784)
Interceptions	89.83 ± 19.35 (539)	74.08 ± 10.37 (1778)*
Corners	8.50 ± 2.07 (51)	11.38 ± 3.52 (273)*
Successful Corners	4.33 ± 1.21 (26)	4.33 ± 2.01 (104)
Unsuccessful Corners	4.17 ± 1.72 (25)	7.04 ± 2.27 (169)**
Goal Kicks	15.67 ± 2.25 (94)	18.29 ± 5.41 (439)
Successful Goal Kicks	6.67 ± 2.66 (40)	7.33 ± 2.78 (176)
Unsuccessful Goal Kicks	9.00 ± 1.26 (54)	10.96 ± 4.53 (263)
Offsides	7.33 ± 2.66 (44)	6.42 ± 3.46 (154)
Tackled	38.33 ± 11.09 (230)	35.17 ± 7.52 (844)
Gk Kick Distribution	9.17 ± 3.43 (55)	10.13 ± 4.53 (243)
Gk Arm Distribution	8.33 ± 5.28 (50)	10.25 ± 5.01 (246)
Aerial Challenges	127.33 ± 47.09 (764)	138.08 ± 29.60 (3314)
Successful Aerial Challenges	57.00 ± 20.00 (342)	61.96 ± 12.80 (1487)
Yellow Cards	4.00 ± 0.89 (24)	3.17 ± 1.76 (76)
Red Cards	0.50 ± 0.84 (3)	0.25 ± 0.53 (6)
Free Kicks	35.00 ± 8.60 (210)	30.33 ± 7.81 (728)
Successful Free Kicks	18.00 ± 5.59 (108)	16.58 ± 4.25 (398)
Unsuccessful Free Kicks	17.00 ± 8.25 (102)	13.75 ± 5.30 (330)
Passes	696.17 ± 179.31 (4177)	687.13 ± 113.31 (16491)
Successful Passes	528.00 ± 155.85 (3168)	532.83 ± 108.66 (12788)
Unsuccessful Passes	168.17 ± 30.35 (1009)	154.29 ± 13.50 (3703)
Shots	23.50 ± 4.64 (141)	27.50 ± 5.63 (660)
Goals	2.67 ± 1.75 (16)	2.88 ± 1.68 (69)
On-Target Shots	7.67 ± 4.89 (46)	10.29 ± 3.13 (247)*
Off-Target Shots	10.33 ± 4.59 (62)	11.63 ± 3.16 (279)
Blocked Shots	5.50 ± 1.22 (33)	5.58 ± 3.15 (134)
Clearances	77.83 ± 27.78 (467)	87.42 ± 14.51 (2098)
Successful Clearances	66.00 ± 23.05 (396)	73.38 ± 12.86 (1761)
Unsuccessful Clearances	11.83 ± 5.19 (71)	14.04 ± 4.04 (337)
Fouls Committed	30.17 ± 7.19 (181)	28.42 ± 8.05 (682)
Fouls Received	29.67 ± 6.86 (178)	27.08 ± 7.40 (650)
Easy Passes	249.50 ± 89.86 (1497)	262.33 ± 70.14 (6296)
Difficult Passes	305.33 ± 78.78 (1832)	278.25 ± 38.63 (6678)*
Very Difficult Passes	135.67 ± 26.88 (814)	141.92 ± 20.76 (3406)
Forward Passes	408.83 ± 97.15 (2453)	401.83 ± 53.84 (9644)
Sideways Passes	114.83 ± 45.25 (689)	115.17 ± 33.15 (2764)
Backward Passes	172.50 ± 40.33 (1035)	170.13 ± 33.40 (4083)

*$p<0.05$; **$p<0.01$

Table 4.7: Means, standard deviations and frequencies of performance indicators with respect to kick-off times.

Performance Indicators	Means, Standard Deviations and Frequencies		
	Morning	Afternoon	Evening
Losses of Control	44.56 ± 6.98 (401)	44.27 ± 6.15 (487)	45.40 ± 10.75 (454)
Tackles	91.56 ± 18.56 (824)	96.36 ± 13.49 (1060)	79.50 ± 20.33 (795)
Successful Tackles	51.78 ± 9.64 (466)	52.36 ± 10.63 (576)	43.10 ± 10.26 (431)
Unsuccessful Tackles	32.22 ± 9.67 (290)	32.36 ± 6.59 (356)	26.80 ± 9.40 (268)
Crosses	31.22 ± 5.87 (281)	33.09 ± 6.89 (364)	31.30 ± 6.95 (313)
Successful Crosses	6.22 ± 2.39 (56)	6.55 ± 3.01 (72)	6.80 ± 2.62 (68)
Unsuccessful Crosses	25.00 ± 5.24 (225)	26.55 ± 5.52 (292)	24.50 ± 5.46 (245)
Dribbles	199.44 ± 17.49 (1795)	205.00 ± 26.73 (2255)	168.20 ± 30.29 (1682)**
Successful Dribbles	167.33 ± 23.54 (1506)	169.00 ± 27.76 (1859)	137.00 ± 29.05 (1370)*
Unsuccessful Dribbles	32.11 ± 10.46 (289)	36.00 ± 5.93 (396)	31.20 ± 7.58 (312)
Interceptions	78.11 ± 11.74 (703)	82.55 ± 13.77 (908)	70.60 ± 14.06 (706)
Corners	11.00 ± 4.15 (99)	11.36 ± 3.85 (125)	10.00 ± 2.36 (100)
Successful Corners	4.22 ± 1.72 (38)	5.09 ± 2.30 (56)	3.60 ± 1.17 (36)
Unsuccessful Corners	6.78 ± 2.82 (61)	6.27 ± 2.65 (69)	6.40 ± 2.07 (64)
Goal Kicks (GK)	17.33 ± 5.83 (156)	17.45 ± 5.05 (192)	18.50 ± 4.67 (185)
Successful GK	6.44 ± 3.09 (58)	7.64 ± 3.07 (84)	7.40 ± 2.01 (74)
Unsuccessful GK	10.89 ± 3.79 (98)	9.82 ± 3.82 (108)	11.10 ± 5.04 (111)
Offsides	6.11 ± 3.14 (55)	7.09 ± 3.33 (78)	6.50 ± 3.66 (65)
Tackled	38.56 ± 7.60 (347)	38.18 ± 7.52 (420)	30.70 ± 7.79 (307)
Gk Kick Distribution	9.00 ± 4.74 (81)	9.64 ± 4.13 (106)	11.10 ± 4.25 (111)
Gk Arm Distribution	9.33 ± 3.57 (84)	10.36 ± 4.57 (114)	9.80 ± 6.81 (98)
Aerial Challenges	133.56 ± 20.56 (1202)	131.27 ± 44.50 (1444)	143.20 ± 29.41 (1432)
Successful Aerial Challenges	61.00 ± 9.53 (549)	58.64 ± 18.32 (645)	63.50 ± 13.66 (635)
Yellow Cards	2.44 ± 2.13 (22)	3.73 ± 1.49 (41)	3.70 ± 1.06 (37)
Red Cards	0	0.22 ± 0.44 (2)	0.64 ± 0.81 (7)*
Free Kicks	26.44 ± 9.21 (238)	32.55 ± 7.12 (358)	34.20 ± 6.48 (342)
Successful Free Kicks	14.22 ± 3.53 (128)	19.27 ± 4.31 (212)	16.60 ± 4.33 (166)*
Unsuccessful Free Kicks	12.22 ± 6.51 (110)	13.27 ± 4.56 (146)	17.60 ± 6.06 (176)
Passes	747.22 ± 103.22 (6725)	711.55 ± 94.50 (7827)	611.60 ± 143.58 (6116)
Successful Passes	586.67 ± 97.66 (5280)	548.53 ± 93.34 (6034)	464.20 ± 130.74 (4642)
Unsuccessful Passes	160.56 ± 12.48 (1445)	163.00 ± 19.68 (1793)	147.40 ± 18.77 (1474)
Shots	24.56 ± 5.94 (221)	28.09 ± 6.63 (309)	27.10 ± 3.75)
Goals	3.89 ± 1.76 (35)	2.45 ± 1.75 (27)	2.30 ± 1.06 (23)*
On-Target Shots	9.78 ± 4.15 (88)	10.64 ± 3.78 (117)	8.80 ± 2.97 (88)
Off-Target Shots	10.22 ± 3.56 (92)	11.36 ± 4.30 (125)	12.40 ± 1.96 (124)
Blocked Shots	4.56 ± 2.55 (41)	6.09 ± 3.75 (67)	5.90 ± 1.79 (59)
Clearances	87.67 ± 12.45 (789)	75.45 ± 18.33 (830)	94.60 ± 16.87 (946)*
Successful Clearances	72.22 ± 10.33 (650)	64.55 ± 16.03 (710)	79.70 ± 15.25 (797)
Unsuccessful Clearances	15.44 ± 3.88 (139)	10.91 ± 3.70 (120)	14.90 ± 4.07 (149)*
Fouls Committed	24.11 ± 8.54 (217)	30.27 ± 8.27 (333)	31.30 ± 4.85 (313)
Fouls Received	23.11 ± 7.80 (208)	29.09 ± 7.74 (320)	30.00 ± 4.42 (300)
Easy Passes	294.78 ± 62.71 (2653)	274.73 ± 60.25 (3022)	211.80 ± 74.57 (2118)*
Difficult Passes	302.89 ± 38.30 (2726)	291.91 ± 43.08 (3211)	257.30 ± 55.33 (2573)
Very Difficult Passes	145.00 ± 21.02 (1305)	140.36 ± 19.39 (1544)	137.10 ± 26.07 (1371)
Forward Passes	431.22 ± 49.28 (3881)	418.91 ± 44.38 (4608)	360.80 ± 72.43 (3608)*
Sideways Passes	128.56 ± 30.81 (1157)	117.64 ± 29.11 (1294)	100.20 ± 41.54 (1002)
Backward Passes	187.44 ± 31.27 (1687)	175.00 ± 29.04 (1925)	150.60 ± 34.64 (1506)

*p<0.05; **p<0.01

4.2.3.3 Game Status

Technical performance indicators were examined as a function of game status (i.e., winning, losing, and drawing), using a Kruskal Wallis test (Table 4.8). Significant differences were found for tackles, successful and unsuccessful tackles, dribbles, successful dribbles, interceptions, successful and unsuccessful goal kicks, aerial challenges, successful aerial challenges, successful and unsuccessful free kicks, passes, successful and unsuccessful passes, shots, off-target and blocked shots, easy, difficult, forward and backward passes ($p<0.05$). Differences ($p<0.01$) were also found for crosses, successful and unsuccessful crosses, corners, unsuccessful corners, goal kicks, goalkeeper kick distributions, goals, clearances, successful and unsuccessful clearances, very difficult and sideways passes (see Appendix F for all significance values).

Further analysis examined winning, losing, and drawing as a function of game location (see Appendix E for the performance indicators). The Mann Whitney U test revealed that, when winning, the away team received more goal kicks (Mean Rank = 34.77, 26.23; $U = 322.00$; $p<0.05$) and successful goal kicks (Mean Rank = 35.78, 25.22; $U = 291.50$; $p<0.01$). When losing, the home team performed more successful crosses (Mean Rank = 25.97, 35.03; $U = 314.00$; $p<0.05$) and off-target shots (Mean Rank = 26.15, 34.85; $U = 319.50$; $p<0.05$). When drawing, the home team performed more successful crosses (Mean Rank = 10.83, 12.41; $z = 2.34$; $p<0.05$), committed more fouls (Mean Rank = 12.31, 14.03; $z = 1.97$; $p<0.05$) and received more red cards (Mean Rank = 0.00, 10.00; $z = 2.00$; $p<0.05$). The away team was found to be awarded more fouls (Mean Rank = 14.97, 11.69; $z = 2.31$; $p<0.05$).

Table 4.8: Means, standard deviations and frequencies of performance indicators with respect to game status.

Performance Indicators	Means, Standard Deviations and Frequencies		
	Winning	Losing	Drawing
Losses of Control	12.10 ± 6.93 (363)	12.97 ± 7.70 (389)	19.67 ± 13.61 (590)
Tackles	26.23 ± 14.14 (787)	23.50 ± 13.35 (705)	39.57 ± 26.30 (1187)*
Successful Tackles	14.83 ± 8.73 (445)	12.67 ± 7.44 (380)	21.60 ± 14.99 (648)*
Unsuccessful Tackles	8.43 ± 5.30 (253)	8.30 ± 5.57 (249)	13.73 ± 9.03 (412)*
Crosses	5.57 ± 3.98 (167)	17.37 ± 7.30 (341)	15.00 ± 10.17 (450)**
Successful Crosses	1.13 ± 1.17 (34)	2.30 ± 1.64 (69)	3.10 ± 2.55 (93)**
Unsuccessful Crosses	4.43 ± 3.32 (133)	9.07 ± 6.32 (272)	11.90 ± 8.29 (357)**
Dribbles	44.43 ± 25.23 (1333)	66.30 ± 38.20 (1989)	80.33 ± 57.29 (2410)*
Successful Dribbles	35.20 ± 21.16 (1056)	56.47 ± 33.88 (1694)	66.17 ± 47.62 (1985)*
Unsuccessful Dribbles	9.23 ± 5.33 (277)	9.83 ± 6.01 (295)	14.17 ± 10.98 (425)
Interceptions	23.53 ± 14.98 (706)	18.93 ± 12.09 (568)	34.77 ± 24.01 (1043)*
Corners	2.30 ± 2.28 (69)	3.37 ± 2.33 (101)	5.13 ± 4.08 (154)**
Successful Corners	1.20 ± 1.37 (36)	1.27 ± 1.05 (38)	1.87 ± 1.63 (56)
Unsuccessful Corners	1.10 ± 1.18 (33)	2.10 ± 1.77 (63)	3.27 ± 2.92 (98)**
Goal Kicks	6.63 ± 4.65 (199)	3.67 ± 2.71 (110)	7.47 ± 5.35 (224)**
Successful Goal Kicks	2.43 ± 2.06 (73)	1.53 ± 1.53 (46)	3.23 ± 2.80 (97)*
Unsuccessful Goal Kicks	4.20 ± 3.35 (126)	2.13 ± 2.00 (64)	4.23 ± 3.32 (127)*
Offsides	2.33 ± 2.28 (70)	1.77 ± 1.89 (53)	2.50 ± 2.70 (75)
Tackled	9.17 ± 5.58 (275)	11.10 ± 6.52 (333)	15.53 ± 11.18 (466)
Gk Kick Distribution	3.67 ± 3.52 (110)	1.80 ± 1.67 (54)	4.47 ± 3.52 (134)**
Gk Arm Distribution	2.43 ± 2.37 (73)	2.70 ± 2.07 (81)	4.73 ± 4.86 (142)
Aerial Challenges	37.07 ± 20.61 (1112)	37.07 ± 20.61 (1112)	61.80 ± 43.02 (1854)*
Successful Aerial Challenges	17.63 ± 10.27 (529)	15.83 ± 8.90 (475)	27.50 ± 18.75 (825)*
Yellow Cards	0.73 ± 0.78 (22)	1.00 ± 1.05 (30)	1.60 ± 1.81 (48)
Red Cards	0.07 ± 0.25 (2)	0.10 ± 0.31 (3)	0.13 ± 0.35 (4)
Free Kicks	8.03 ± 5.77 (241)	9.13 ± 5.69 (274)	14.10 ± 10.34 (423)
Successful Free Kicks	3.09 ± 3.22 (117)	5.80 ± 3.96 (174)	7.17 ± 5.75 (215)*
Unsuccessful Free Kicks	4.13 ± 3.42 (124)	3.33 ± 2.72 (100)	6.93 ± 5.71 (208)*
Passes	165.80 ± 95.66 (4974)	222.50 ± 129.87 (6765)	297.63 ± 195.03 (8929)*
Successful Passes	126.40 ± 77.89 (3792)	176.60 ± 104.41 (5298)	228.87 ± 153.31 (6866)*
Unsuccessful Passes	39.40 ± 23.06 (1182)	48.90 ± 27.53 (1467)	68.77 ± 43.83 (2063)*
Shots	6.73 ± 4.76 (202)	8.47 ± 5.16 (254)	11.50 ± 7.95 (345)*
Goals	1.17 ± 1.21 (35)	0.53 ± 0.63 (16)	1.13 ± 0.43 (34)**
On-Target Shots	3.03 ± 2.41 (91)	2.57 ± 1.77 (77)	4.17 ± 2.91 (125)
Off-Target Shots	2.57 ± 2.82 (77)	3.98 ± 2.82 (118)	4.87 ± 3.71 (146)*
Blocked Shots	1.13 ± 1.57 (34)	1.97 ± 1.94 (59)	2.47 ± 2.49 (74)*
Clearances	29.50 ± 15.56 (885)	17.13 ± 11.41 (514)	38.87 ± 26.62 (1166)**
Successful Clearances	24.57 ± 12.62 (737)	14.87 ± 9.78 (446)	32.47 ± 22.13 (974)**
Unsuccessful Clearances	4.93 ± 3.77 (148)	2.27 ± 2.12 (68)	6.40 ± 5.04 (192)**
Fouls Committed	8.20 ± 5.01 (246)	7.40 ± 5.07 (222)	13.17 ± 9.93 (395)
Fouls Received	7.33 ± 5.03 (220)	7.87 ± 4.65 (236)	12.40 ± 9.49 (372)
Easy Passes	59.80 ± 40.38 (1794)	88.93 ± 58.10 (2668)	111.03 ± 78.79 (3331)*
Difficult Passes	70.40 ± 40.24 (2112)	90.53 ± 51.32 (2716)	122.73 ± 81.14 (3682)*
Very Difficult Passes	34.53 ± 19.29 (1036)	44.33 ± 25.56 (1330)	61.80 ± 37.78 (1854)**
Forward Passes	97.30 ± 55.04 (2919)	132.63 ± 75.54 (3979)	173.30 ± 116.16 (5199)*
Sideways Passes	25.87 ± 18.04 (776)	39.60 ± 25.41 (1188)	49.63 ± 33.69 (1489)**
Backward Passes	42.63 ± 25.24 (1279)	53.27 ± 30.71 (1598)	74.70 ± 47.68 (2241)*

*$p<0.05$; **$p<0.01$

4.3 Performance Indicators for Case Study

Table 4.9 shows the means, standard deviations, and frequencies for the technical and tactical performance indicators performed by the case-study team.

4.3.1 Technical Indicators as a Function of Game Location

The sample of games home and away (n=6 and n=9 respectively) were analysed using a Mann Whitney U test (Table 4.10). At home, more successful aerial challenges (Mean Rank = 6.00, 11.00; U = 9.00; $p<0.05$), blocked shots (Mean Rank = 6.00, 11.00; U = 9.00; $p<0.05$), unsuccessful crosses (Mean Rank = 6.17, 10.75; U = 10.50; $p<0.05$), and corners were performed (Mean Rank = 6.00, 11.00; U = 9.00; $p<0.05$). When away, more clearances (Mean Rank = 10.11, 4.83; U = 8.00; $p<0.05$) and successful clearances were performed (Mean Rank = 10.00, 5.00; U = 9.00; $p<0.05$) and more offside decisions were awarded (Mean Rank = 9.94, 5.08; U = 9.50; $p<0.05$). The remaining performance indicators were found not to differ significantly ($p>0.05$).

Table 4.9: Means, standard deviations and frequencies of performance indicators.

Performance Indicators	Means, Standard Deviations and Frequencies
Losses of Control	19.80 ± 5.17 (297)
Tackles	42.93 ± 8.98 (644)
Successful Tackles	25.40 ± 4.27 (381)
Unsuccessful Tackles	12.80 ± 6.38 (192)
Crosses	18.27 ± 8.72 (274)
Successful Crosses	4.00 ± 3.30 (60)
Unsuccessful Crosses	14.27 ± 6.35 (214)
Dribbles	112.73 ± 25.69 (1691)
Successful Dribbles	98.60 ± 24.65 (1479)
Unsuccessful Dribbles	14.13 ± 3.93 (212)
Interceptions	36.33 ± 7.31 (545)
Corners	5.93 ± 3.17 (89)
Successful Corners	2.67 ± 1.54 (40)
Unsuccessful Corners	3.27 ± 2.09 (49)
Goal Kicks	7.67 ± 2.53 (115)
Successful Goal Kicks	2.60 ± 1.68 (39)
Unsuccessful Goal Kicks	5.07 ± 2.60 (76)
Offsides	2.40 ± 1.76 (36)
Tackled	17.60 ± 4.58 (264)
Gk Kick Distribution	1.73 ± 1.22 (26)
Gk Arm Distribution	8.20 ± 2.60 (123)
Aerial Challenges	61.73 ± 11.63 (926)
Successful Aerial Challenges	29.13 ± 4.90 (437)

Performance Indicators	Means, Standard Deviations and Frequencies
Yellow Cards	1.13 ± 1.13 (17)
Red Cards	0
Free Kicks	12.20 ± 2.37 (183)
Successful Free Kicks	7.67 ± 2.16 (115)
Unsuccessful Free Kicks	4.53 ± 2.03 (68)
Passes	430.27 ± 89.18 (6454)
Successful Passes	349.13 ± 86.80 (5237)
Unsuccessful Passes	81.13 ± 13.50 (1217)
Shots	13.80 ± 5.21 (207)
Goals	2.07 ± 1.58 (31)
On-Target Shots	5.40 ± 2.75 (81)
Off-Target Shots	5.47 ± 3.14 (82)
Blocked Shots	2.93 ± 1.91 (44)
Clearances	39.80 ± 11.34 (597)
Successful Clearances	33.80 ± 9.82 (507)
Unsuccessful Clearances	6.00 ± 2.83 (90)
Fouls Committed	12.60 ± 4.39 (189)
Fouls Received	10.67 ± 2.26 (160)
Easy Passes	180.07 ± 54.62 (2701)
Difficult Passes	159.87 ± 32.32 (2398)
Very Difficult Passes	87.47 ± 14.58 (1312)
Forward Passes	241.00 ± 45.53 (3615)
Sideways Passes	76.13 ± 22.76 (1142)
Backward Passes	113.13 ± 29.17 (1697)

Table 4.10: Means, standard deviations and frequencies of performance indicators in relation to game location.

Performance Indicators	Means, Standard Deviations and Frequencies	
	Team Away	Team Home
Loss of Control	21.33 ± 5.83 (192)	17.50 ± 3.15 (105)
Tackles	41.22 ± 8.23 (371)	45.50 ± 10.21 (273)
Successful Tackles	25.22 ± 4.15 (227)	25.67 ± 4.84 (154)
Unsuccessful Tackles	11.89 ± 7.10 (107)	14.17 ± 5.46 (85)
Crosses	14.33 ± 5.50 (129)	24.17 ± 9.75 (145)
Successful Crosses	2.89 ± 1.27 (26)	5.67 ± 4.72 (34)
Unsuccessful Crosses	11.44 ± 5.03 (103)	18.50 ± 6.06 (111)*
Dribbles	111.11 ± 29.70 (1000)	115.17 ± 20.62 (691)
Successful Dribbles	96.56 ± 28.97 (869)	101.67 ± 18.40 (610)
Unsuccessful Dribbles	14.56 ± 4.22 (131)	13.50 ± 3.73 (81)
Interceptions	38.78 ± 6.70 (349)	32.67 ± 7.12 (196)
Corners	4.67 ± 3.00 (42)	7.83 ± 2.56 (47)*
Successful Corners	2.11 ± 1.62 (19)	3.50 ± 1.05 (21)
Unsuccessful Corners	2.56 ± 1.94 (23)	4.33 ± 1.97 (26)
Goal Kicks	8.44 ± 2.07 (76)	6.50 ± 2.88 (39)
Successful Goal Kicks	3.00 ± 2.06 (27)	2.00 ± 0.63 (12)
Unsuccessful Goal Kicks	5.44 ± 2.74 (49)	4.50 ± 2.51 (27)
Offsides	3.11 ± 1.62 (28)	1.33 ± 1.51 (8)*
Tackled	18.11 ± 4.01 (163)	16.83 ± 5.64 (101)
Gk Kick Distribution	2.00 ± 1.22 (18)	1.33 ± 1.21 (8)
Gk Arm Distribution	8.67 ± 1.73 (78)	7.50 ± 3.62 (45)
Aerial Challenges	59.44 ± 14.26 (535)	65.17 ± 5.49 (391)
Successful Aerial Challenges	27.00 ± 4.50 (243)	32.33 ± 3.78 (194)*
Yellow Cards	1.00 ± 1.00 (9)	1.33 ± 1.37 (8)
Free Kicks	11.78 ± 1.56 (106)	12.83 ± 3.31 (77)
Successful Free Kicks	7.44 ± 1.81 (67)	8.00 ± 2.76 (48)
Unsuccessful Free Kicks	4.33 ± 1.73 (39)	4.83 ± 2.56 (29)
Passes	424.89 ± 110.55 (3824)	438.33 ± 50.82 (2630)
Successful Passes	348.11 ± 108.31 (3133)	350.67 ± 48.21 (2104)
Unsuccessful Passes	76.78 ± 10.34 (691)	87.67 ± 15.93 (526)
Shots	11.89 ± 4.99 (107)	16.67 ± 4.46 (100)
Goals	2.33 ± 1.58 (21)	1.67 ± 1.63 (10)
On-Target Shots	5.78 ± 3.23 (52)	4.83 ± 1.94 (29)
Off-Target Shots	4.11 ± 2.26 (37)	7.50 ± 3.33 (45)
Blocked Shots	2.00 ± 1.41 (18)	4.33 ± 1.75 (26)*
Clearances	45.00 ± 9.01 (405)	32.00 ± 9.01 (192)*
Successful Clearances	38.44 ± 7.23 (346)	26.83 ± 9.45 (161)*
Unsuccessful Clearances	6.56 ± 2.40 (59)	5.17 ± 3.43 (31)
Fouls Committed	12.00 ± 4.58 (108)	13.50 ± 4.32 (81)
Fouls Received	10.33 ± 1.94 (93)	11.17 ± 2.79 (67)
Easy Passes	181.67 ± 68.36 (1635)	177.67 ± 29.43 (1066)
Difficult Passes	157.11 ± 38.72 (1414)	164.00 ± 22.15 (984)
Very Difficult Passes	82.44 ± 14.20 (742)	95.00 ± 12.62 (570)
Forward Passes	231.11 ± 49.61 (2080)	255.83 ± 37.79 (1535)
Sideways Passes	74.44 ± 29.17 (670)	78.67 ± 8.73 (472)
Backward Passes	119.33 ± 35.45 (1074)	103.83 ± 14.09 (623)

*$p<0.05$; **$p<0.01$

4.3.2 Strategic Behaviours

Analysis of tactical behaviours was conducted using a Mann Whitney U test (Table 4.11; 4.12). In the defensive third, at home, there were significantly more losses of control (Mean Rank = 9.94, 5.08; U = 9.50; $p<0.05$) and more interceptions (Mean Rank = 10.22, 4.67; U = 7.00; $p<0.05$). When away, players were tackled more often (Mean Rank = 10.22, 4.67; U = 7.00; $p<0.05$) with more clearances performed (Mean Rank = 10.39, 4.42; U = 5.50; $p<0.01$). In the attacking third, at home, more dribbles (Mean Rank = 5.89, 11.17; U = 8.00; $p<0.05$), aerial challenges (Mean Rank = 5.00, 12.50; U = 0.00; $p<0.01$) and very difficult passes were made (Mean Rank = 5.67, 11.50; U = 6.00; $p<0.05$). For the use of width, in central areas at home there were more successful aerial challenges (Mean Rank = 5.89, 11.17; U = 8.00; $p<0.05$) while there were significantly more clearances when away (Mean Rank = 10.11, 4.83; U = 8.00; $p<0.05$). In wide areas the only significant difference was found in crosses with more at home (Mean Rank = 5.94, 11.08; U = 8.50; $p<0.05$). In respect to the ratios between wide and central areas (Table 4.12) the performance indicators showed no differences at home compared to away.

Table 4.11: Means, standard deviations and frequencies of performance indicators relative to thirds of the pitch as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies Defensive Third		Middle Third		Attacking Third	
	Team Away	Team Home	Team Away	Team Home	Team Away	Team Home
Losses of Control	4.11 ± 2.62 (37)	1.67 ± 1.51 (10)*	8.11 ± 2.62 (73)	6.50 ± 3.83 (39)	9.11 ± 3.55 (82)	9.33 ± 2.16 (56)
Tackles	19.78 ± 4.74 (178)	18.33 ± 4.18 (110)	17.33 ± 6.20 (156)	21.17 ± 10.19 (127)	4.11 ± 2.26 (37)	6.00 ± 2.00 (36)
Crosses	–	–	0.44 ± 0.73 (4)	0	13.89 ± 5.58 (125)	24.17 ± 9.75 (145)
Dribbles	27.89 ± 6.39 (251)	26.67 ± 7.58 (160)	60.78 ± 20.49 (547)	56.83 ± 10.21 (341)	22.44 ± 8.46 (202)	31.67 ± 7.31 (190)*
Interceptions	24.56 ± 6.62 (221)	15.83 ± 4.22 (95)*	12.44 ± 3.09 (112)	14.33 ± 5.79 (86)	1.78 ± 1.92 (16)	2.50 ± 1.87 (15)
Offsides	–	–	0.67 ± 0.87 (6)	0.17 ± 0.41 (1)	2.44 ± 2.01 (22)	1.17 ± 1.60 (7)
Tackled	2.56 ± 1.81 (23)	0.67 ± 0.52 (4)*	7.44 ± 2.01 (67)	6.33 ± 2.88 (38)	8.11 ± 2.89 (73)	9.83 ± 3.66 (59)
Aerial Challenges	17.44 ± 6.84 (157)	14.67 ± 7.76 (88)	32.00 ± 8.37 (288)	33.33 ± 5.75 (200)	10.00 ± 2.50 (90)	17.17 ± 1.47 (103)**
Free Kicks	3.89 ± 1.27 (35)	5.00 ± 2.19 (30)	4.67 ± 1.50 (42)	5.00 ± 2.10 (30)	3.22 ± 1.56 (29)	2.83 ± 1.83 (17)
Passes	98.44 ± 17.30 (886)	89.33 ± 19.79 (536)	256.00 ± 78.45 (2304)	255.67 ± 25.73 (1534)	70.44 ± 31.85 (634)	93.33 ± 31.92 (560)
Clearances	44.22 ± 8.42 (398)	30.50 ± 9.38 (183)**	0.78 ± 0.83 (7)	1.50 ± 1.38 (9)	–	–
Fouls Committed	2.89 ± 2.32 (26)	3.00 ± 1.41 (18)	6.22 ± 3.03 (56)	6.00 ± 3.74 (36)	2.89 ± 1.05 (26)	4.50 ± 1.64 (27)
Fouls Received	2.56 ± 1.51 (23)	3.33 ± 2.42 (20)	4.78 ± 1.39 (43)	5.83 ± 1.94 (35)	3.00 ± 1.50 (27)	2.00 ± 1.55 (12)
Easy Passes	40.44 ± 11.49 (364)	37.67 ± 11.50 (226)	114.00 ± 47.62 (1026)	104.67 ± 13.06 (628)	27.22 ± 18.16 (245)	35.33 ± 14.25 (212)
Difficult Passes	28.78 ± 5.14 (259)	27.67 ± 5.05 (166)	93.67 ± 29.40 (843)	92.50 ± 11.88 (555)	34.67 ± 13.06 (312)	43.83 ± 15.42 (263)
Very Difficult Passes	28.78 ± 5.14 (259)	24.00 ± 8.25 (144)	46.56 ± 12.22 (419)	57.67 ± 8.16 (346)	7.11 ± 2.85 (64)	13.33 ± 4.80 (80)*
Forward Passes	65.89 ± 11.75 (593)	62.00 ± 13.81 (372)	133.11 ± 36.31 (1198)	149.00 ± 23.46 (894)	32.11 ± 12.81 (289)	44.83 ± 15.28 (269)
Sideways Passes	13.67 ± 4.33 (123)	12.83 ± 3.66 (77)	46.00 ± 18.99 (414)	45.00 ± 4.00 (270)	14.78 ± 8.29 (133)	20.83 ± 6.05 (125)
Backward Passes	18.89 ± 5.73 (170)	14.50 ± 6.53 (87)	76.89 ± 28.21 (692)	61.67 ± 13.38 (370)	23.56 ± 12.92 (212)	27.67 ± 12.13 (166)

*p<0.05; **p<0.01

Table 4.12: Means, standard deviations and frequencies of performance indicators relative to wide and central areas as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies Central		Wide		Ratios (Central: Wide)	
	Team Away	Team Home	Team Away	Team Home	Team Away	Team Home
Losses of Control	13.00 ± 4.06 (117)	11.67 ± 1.97 (70)	8.33 ± 3.04 (75)	5.83 ± 3.54 (35)	13:8	12:6
Tackles	25.78 ± 8.54 (232)	27.17 ± 6.37 (163)	15.44 ± 4.56 (139)	18.33 ± 6.62 (110)	26:15	27:18
Crosses	4.11 ± 2.76 (37)	5.67 ± 3.08 (34)	10.22 ± 3.03 (92)	18.50 ± 7.40 (111)*	4:10	6:19
Dribbles	65.11 ± 19.45 (586)	65.50 ± 17.41 (393)	46.00 ± 14.09 (414)	49.67 ± 5.61 (298)	65:46	66:50
Interceptions	24.67 ± 4.87 (222)	22.00 ± 5.87 (132)	14.11 ± 3.62 (127)	10.67 ± 3.01 (64)	25:14	22:11
Offsides	2.33 ± 1.00 (21)	1.17 ± 1.17 (7)	0.78 ± 0.97 (7)	0.17 ± 0.41 (1)	2:1	1:0
Tackled	11.11 ± 4.73 (100)	9.50 ± 4.09 (57)	7.00 ± 3.71 (63)	7.33 ± 1.75 (44)	11:7	10:7
Aerial Challenges	46.67 ± 11.12 (420)	53.33 ± 5.65 (320)*	12.78 ± 6.80 (115)	11.83 ± 4.31 (71)	47:13	53:12
Successful Aerial Challenges	20.56 ± 4.28 (185)	26.00 ± 3.52 (156)	6.44 ± 2.40 (58)	6.33 ± 2.73 (38)	21:6	26:6
Free Kicks	7.22 ± 2.05 (65)	8.50 ± 1.38 (51)	4.56 ± 1.51 (41)	4.33 ± 2.50 (26)	7:5	9:4
Passes	263.00 ± 64.46 (2367)	276.67 ± 37.03 (1660)	161.89 ± 51.00 (1457)	161.67 ± 20.93 (970)	263:162	277:162
Clearances	35.89 ± 6.64 (323)	25.67 ± 9.42 (154)*	9.11 ± 7.06 (82)	6.33 ± 1.97 (38)	36:9	26:6
Fouls Committed	6.44 ± 3.47 (58)	7.67 ± 5.16 (46)	5.56 ± 3.50 (50)	5.83 ± 1.47 (35)	6:6	8:6
Fouls Received	6.00 ± 2.18 (54)	6.50 ± 2.07 (39)	4.33 ± 2.06 (39)	4.67 ± 3.20 (28)	6:4	7:5
Easy Passes	109.56 ± 39.14 (986)	111.83 ± 18.67 (671)	72.11 ± 33.76 (649)	65.83 ± 14.96 (395)	110:72	112:66
Difficult Passes	102.89 ± 26.98 (926)	109.17 ± 18.84 (655)	54.22 ± 15.51 (488)	54.83 ± 6.40 (329)	103:54	109:55
Very Difficult Passes	47.56 ± 9.93 (428)	54.50 ± 7.64 (327)	34.89 ± 7.85 (314)	40.50 ± 7.26 (243)	48:35	55:41
Forward Passes	150.33 ± 33.50 (1353)	165.83 ± 32.10 (995)	80.78 ± 18.91 (727)	90.00 ± 9.65 (540)	150:81	166:90
Sideways Passes	48.89 ± 18.11 (440)	51.17 ± 2.99 (307)	25.56 ± 12.90 (230)	27.50 ± 7.94 (165)	49:26	51:28
Backward Passes	63.78 ± 16.55 (574)	59.67 ± 7.58 (358)	55.56 ± 21.96 (500)	44.17 ± 7.88 (265)	64:56	60:44

*p<0.05; **p<0.01

4.3.3 Home Advantage and Additional Factors

4.3.3.1 Weather Conditions

The sample of fifteen games was divided into wet and dry conditions (n=2 and n=13 respectively) and analysed using a Mann Whitney U test (Table 4.13). More unsuccessful goal kicks were found to be performed in dry conditions (Mean Rank = 1.50, 9.00; U = 0.00; $p<0.05$) while there were significantly more yellow cards received in the wet (Mean Rank = 14.00, 7.08; U = 1.00; $p<0.05$). With respect to game location (see Appendix E for the performance indicators), at home more successful crosses were performed (Mean Rank = 5.19, 9.90; U = 5.50; $p<0.05$) while away more offside decisions were received (Mean Rank = 9.25, 3.40; U = 2.00; $p<0.01$).

4.3.3.2 Kick-off Times

With respect to kick-off times (Table 4.14) the sample was divided into morning, afternoon, and evening games (n=6, n=6 and n=3 respectively) and analysed using a Kruskal Wallis test. Significant differences were revealed only for goalkeeper arm distributions (Mean Rank = 4.17, 10.00, 11.67; Chi-square = 7.81; $p<0.05$). Further analysis was conducted on kick-off times as a function of game location (see Appendix E for the performance indicators) with the sample divided into home and away for morning (n=3 and n=3 respectively), afternoon (n=1 and n=5 respectively) and evening games (n=2 and n=1 respectively). A Mann Whitney U test was used with no significant differences found on any of the performance indicators within each kick-off time ($p>0.05$).

4.3.3.3 Game Status

For game status (i.e., winning, losing, and drawing; see Table 4.15) a Kruskal Wallis test was used to analyse the data. Significant differences were found for unsuccessful crosses, dribbles, successful and unsuccessful dribbles, corners, free kicks, successful and unsuccessful free kicks, passes, successful passes, easy, difficult, forward, sideways and backward passes ($p<0.05$). Significant differences ($p<0.01$) were also found for losses of control, tackles, successful and unsuccessful tackles, interceptions, unsuccessful corners, goal kicks, successful and unsuccessful goal kicks, tackled, goalkeeper kick and arm distributions, aerial challenges, successful aerial challenges, unsuccessful passes, clearances, successful and unsuccessful clearances, fouls committed and received and very difficult passes (see Appendix F for all significance values).

Further analysis examined game status as a function of game location (see Appendix E for the performance indicators) using a Mann Whitney U test. Differences were only found when the team was winning. Specifically, when away more interceptions were performed (Mean Rank = 9.89, 5.17; $U = 10.00$; $p<0.05$) and the team was tackled more often (Mean Rank = 9.83, 5.25; $U = 10.50$; $p<0.05$).

Table 4.13: Means, standard deviations and frequencies of performance indicators with respect to weather conditions.

Performance Indicators	Means, Standard Deviations and Frequencies	
	Wet	Dry
Loss of Control	23.00 ± 4.24 (46)	19.31 ± 5.27 (251)
Tackles	50.50 ± 0.71 (101)	41.77 ± 9.11 (543)
Successful Tackles	30.00 ± 4.24 (60)	24.69 ± 3.97 (321)
Unsuccessful Tackles	15.50 ± 4.95 (31)	12.38 ± 6.64 (161)
Crosses	16.50 ± 7.78 (33)	18.54 ± 9.12 (241)
Successful Crosses	3.00 ± 1.41 (6)	4.15 ± 3.51 (54)
Unsuccessful Crosses	13.50 ± 9.19 (27)	14.38 ± 6.32 (187)
Dribbles	92.00 ± 31.11 (184)	115.92 ± 24.64 (1507)
Successful Dribbles	76.50 ± 27.58 (153)	102.00 ± 23.48 (1326)
Unsuccessful Dribbles	15.50 ± 3.54 (31)	13.92 ± 4.07 (181)
Interceptions	36.00 ± 1.41 (72)	36.38 ± 7.88 (473)
Corners	4.50 ± 3.54 (9)	6.15 ± 3.21 (80)
Successful Corners	2.50 ± 2.12 (5)	2.69 ± 1.55 (35)
Unsuccessful Corners	2.00 ± 1.41 (4)	3.46 ± 2.15 (45)
Goal Kicks	5.00 ± 2.83 (10)	8.08 ± 2.33 (105)
Successful Goal Kicks	4.00 ± 2.83 (8)	2.38 ± 1.50 (31)
Unsuccessful Goal Kicks	1.00 ± 0.00 (2)	5.69 ± 2.18 (74)*
Offsides	4.00 ± 0.00 (8)	2.15 ± 1.77 (28)
Tackled	16.00 ± 1.41 (32)	17.85 ± 4.88 (232)
Gk Kick Distribution	1.50 ± 2.12 (3)	1.77 ± 1.17 (23)
Gk Arm Distribution	8.00 ± 2.83 (16)	8.23 ± 2.68 (107)
Aerial Challenges	50.00 ± 15.56 (100)	63.54 ± 10.55 (826)
Successful Aerial Challenges	24.50 ± 7.78 (49)	29.85 ± 4.34 (388)
Yellow Cards	3.00 ± 0.00 (6)	0.85 ± 0.90 (11)*
Free Kicks	15.00 ± 4.24 (30)	11.77 ± 1.88 (153)
Successful Free Kicks	9.50 ± 0.71 (19)	7.38 ± 2.18 (96)
Unsuccessful Free Kicks	5.50 ± 3.54 (11)	4.38 ± 1.89 (57)
Passes	420.50 ± 67.18 (841)	431.77 ± 94.26 (5613)
Successful Passes	321.00 ± 46.67 (642)	353.46 ± 91.96 (4595)
Unsuccessful Passes	99.50 ± 20.51 (199)	78.31 ± 10.62 (1018)
Shots	11.00 ± 7.07 (22)	14.23 ± 5.10 (185)
Goals	0.50 ± 0.71 (1)	2.31 ± 1.55 (30)
On-Target Shots	2.50 ± 0.71 (5)	5.85 ± 2.67 (76)
Off-Target Shots	4.50 ± 4.95 (9)	5.62 ± 3.04 (73)
Blocked Shots	4.00 ± 1.41 (8)	2.77 ± 1.96 (36)
Clearances	31.00 ± 25.46 (62)	41.15 ± 9.01 (535)
Successful Clearances	26.00 ± 21.21 (52)	35.00 ± 7.96 (455)
Unsuccessful Clearances	5.00 ± 4.24 (10)	6.15 ± 2.76 (80)
Fouls Committed	15.50 ± 4.95 (31)	12.15 ± 4.34 (158)
Fouls Received	12.50 ± 2.12 (25)	10.38 ± 2.22 (135)
Easy Passes	169.50 ± 28.99 (339)	181.69 ± 58.22 (2362)
Difficult Passes	152.50 ± 13.44 (305)	161.00 ± 34.54 (2093)
Very Difficult Passes	94.50 ± 27.58 (189)	86.38 ± 13.23 (1123)
Forward Passes	239.50 ± 40.31 (479)	241.23 ± 47.78 (3136)
Sideways Passes	71.00 ± 15.56 (142)	76.92 ± 24.07 (1000)
Backward Passes	110.00 ± 11.31 (220)	113.62 ± 31.31 (1477)

*p<0.05; **p<0.01

Table 4.14: Means, standard deviations and frequencies of performance indicators with respect to kick-off times.

Performance Indicators	Means, Standard Deviations and Frequencies		
	Morning	Afternoon	Evening
Losses of Control	21.17 ± 4.12 (127)	21.83 ± 3.82 (131)	13.00 ± 4.58 (39)
Tackles	43.67 ± 12.40 (262)	42.67 ± 7.31 (256)	42.00 ± 6.56 (126)
Successful Tackles	24.67 ± 5.61 (148)	26.33 ± 3.78 (158)	25.00 ± 3.00 (75)
Unsuccessful Tackles	15.00 ± 7.87 (90)	12.33 ± 5.16 (74)	9.33 ± 5.51 (28)
Crosses	21.50 ± 10.43 (129)	16.17 ± 7.31 (129)	16.00 ± 8.66 (48)
Successful Crosses	4.83 ± 5.19 (29)	3.33 ± 1.21 (20)	3.67 ± 1.15 (11)
Unsuccessful Crosses	16.67 ± 5.43 (100)	12.83 ± 7.03 (77)	12.33 ± 7.51 (37)
Dribbles	110.17 ± 23.25 (661)	121.67 ± 29.83 (730)	100.00 ± 23.30 (300)
Successful Dribbles	96.17 ± 21.44 (577)	106.67 ± 29.41 (640)	87.33 ± 23.18 (262)
Unsuccessful Dribbles	14.00 ± 5.44 (84)	15.00 ± 2.19 (90)	12.67 ± 4.04 (38)
Interceptions	37.17 ± 9.87 (223)	38.50 ± 4.46 (231)	30.33 ± 3.21 (91)
Corners	5.83 ± 3.25 (35)	5.83 ± 3.06 (35)	6.33 ± 4.51 (19)
Successful Corners	2.83 ± 1.47 (17)	2.50 ± 1.87 (15)	2.67 ± 1.53 (8)
Unsuccessful Corners	3.00 ± 2.37 (18)	3.33 ± 1.63 (20)	3.67 ± 3.06 (11)
Goal Kicks	7.33 ± 2.50 (44)	8.33 ± 3.01 (50)	7.00 ± 2.00 (21)
Successful Goal Kicks	2.33 ± 0.82 (14)	3.50 ± 2.17 (21)	1.33 ± 1.15 (4)
Unsuccessful Goal Kicks	5.00 ± 1.90 (30)	4.83 ± 3.60 (29)	5.67 ± 2.31 (17)
Offsides	2.50 ± 2.43 (15)	2.83 ± 0.98 (17)	1.33 ± 1.53 (4)
Tackled	18.67 ± 4.93 (112)	17.50 ± 2.88 (105)	15.67 ± 7.51 (47)
Gk Kick Distribution	2.00 ± 1.10 (12)	1.50 ± 1.38 (9)	1.67 ± 1.53 (5)
Gk Arm Distribution	6.17 ± 2.48 (37)	9.33 ± 1.97 (56)	10.00 ±1.00 (30)*
Aerial Challenges	63.50 ± 9.77 (381)	60.50 ± 13.91 (363)	60.67 ± 14.47 (182)
Successful Aerial Challenges	30.50 ± 4.37 (183)	27.83 ± 4.96 (167)	29.00 ± 6.93 (87)
Yellow Cards	0.67 ± 1.21 (4)	1.50 ± 1.22 (9)	1.33 ± 0.58 (4)
Free Kicks	11.17 ± 1.47 (67)	13.00 ± 2.97 (78)	12.67 ± 2.52 (38)
Successful Free Kicks	7.00 ± 1.79 (42)	8.67 ± 1.63 (52)	7.00 ± 3.61 (21)
Unsuccessful Free Kicks	4.17 ± 1.94 (25)	4.33 ± 2.42 (26)	5.67 ± 1.53 (17)
Passes	422.50 ± 96.18 (2535)	468.50 ± 64.21 (2811)	369.33 ± 110.01 (1108)
Successful Passes	339.83 ± 91.16 (2039)	385.83 ± 72.25 (2315)	294.33 ± 100.57 (883)
Unsuccessful Passes	82.67 ± 10.88 (496)	82.67 ± 18.03 (496)	75.00 ± 9.85 (225)
Shots	14.50 ± 6.66 (87)	13.83 ± 4.22 (83)	12.33 ± 5.51 (37)
Goals	2.83 ± 1.94 (17)	1.50 ± 1.05 (9)	1.67 ± 1.53 (5)
On-Target Shots	6.17 ± 3.06 (37)	5.50 ± 2.43 (33)	3.67 ± 2.89 (11)
Off-Target Shots	6.00 ± 4.10 (36)	5.17 ± 2.71 (31)	5.00 ± 2.65 (15)
Blocked Shots	2.33 ± 2.16 (14)	3.17 ± 1.60 (19)	3.67 ± 2.31 (11)
Clearances	37.17 ± 4.83 (223)	42.00 ± 16.73 (252)	40.67 ± 10.26 (122)
Successful Clearances	32.00 ± 4.20 (192)	35.50 ± 13.69 (213)	34.00 ± 12.00 (102)
Unsuccessful Clearances	5.17 ± 2.40 (31)	6.50 ± 3.39 (39)	6.67 ± 3.06 (20)
Fouls Committed	11.83 ± 5.95 (71)	12.33 ± 3.88 (74)	14.67 ± 0.58 (44)
Fouls Received	9.67 ± 1.75 (58)	11.00 ± 2.00 (66)	12.00 ± 3.46 (36)
Easy Passes	169.33 ± 50.46 (1016)	208.67 ± 49.33 (1252)	144.33 ± 61.01 (433)
Difficult Passes	160.00 ± 37.64 (960)	166.83 ± 22.80 (1001)	145.67 ± 44.96 (437)
Very Difficult Passes	90.83 ± 11.62 (545)	88.83 ± 18.69 (533)	78.00 ± 10.15 (234)
Forward Passes	244.00 ± 50.43 (1464)	250.33 ± 28.69 (1502)	216.33 ± 69.98 (649)
Sideways Passes	73.00 ± 24.70 (438)	84.83 ± 16.58 (509)	65.00 ± 31.18 (195)
Backward Passes	105.50 ± 24.14 (633)	133.33 ± 27.46 (800)	88.00 ± 16.37 (264)

*p<0.05; **p<0.01

Table 4.15: Means, standard deviations and frequencies of performance indicators with respect to game status.

Performance Indicators	Means, Standard Deviations and Frequencies		
	Team Winning	Team Losing	Team Drawing
Losses of Control	7.47 ± 7.24 (112)	2.93 ± 6.04 (44)	9.40 ± 5.88 (141)**
Tackles	14.07 ± 13.22 (211)	5.87 ± 13.39 (88)	23.00 ± 14.42 (345)**
Successful Tackles	8.87 ± 7.96 (133)	3.47 ± 7.56 (52)	13.07 ± 9.00 (196)**
Unsuccessful Tackles	3.73 ± 4.82 (56)	1.93 ± 4.91 (29)	7.13 ± 5.13 (107)**
Crosses	4.27 ± 4.61 (64)	4.13 ± 5.73 (62)	9.87 ± 9.23 (148)
Successful Crosses	1.00 ± 1.13 (15)	0.73 ± 0.88 (11)	2.27 ± 3.20 (34)
Unsuccessful Crosses	3.27 ± 3.81 (49)	3.40 ± 5.26 (51)	7.60 ± 6.67 (114)*
Dribbles	40.13 ± 37.10 (602)	18.60 ± 32.53 (279)	54.00 ± 35.17 (810)*
Successful Dribbles	34.53 ± 32.49 (518)	16.20 ± 27.41 (243)	47.87 ± 31.44 (718)*
Unsuccessful Dribbles	5.60 ± 5.37 (84)	2.40 ± 5.22 (36)	6.13 ± 4.12 (92)*
Interceptions	12.40 ± 11.79 (186)	4.47 ± 9.20 (67)	19.47 ± 11.00 (292)**
Corners	2.07 ± 2.46 (31)	0.73 ± 1.58 (11)	3.13 ± 3.16 (47)*
Successful Corners	1.07 ± 1.39 (16)	0.47 ± 0.92 (7)	1.13 ± 0.99 (17)
Unsuccessful Corners	1.00 ± 1.41 (15)	0.27 ± 0.80 (4)	2.00 ± 2.27 (30)**
Goal Kicks	3.33 ± 3.50 (50)	0.40 ± 1.06 (6)	3.93 ± 3.10 (59)**
Successful Goal Kicks	0.87 ± 1.36 (13)	0.20 ± 0.56 (3)	1.53 ± 1.60 (23)**
Unsuccessful Goal Kicks	2.47 ± 2.67 (37)	0.20 ± 0.56 (3)	2.40 ± 2.50 (36)**
Offsides	1.00 ± 1.46 (15)	0.47 ± 1.06 (7)	0.93 ± 0.88 (14)
Tackled	6.33 ± 6.45 (95)	2.73 ± 5.30 (41)	8.53 ± 5.18 (128)**
Gk Kick Distribution	0.93 ± 1.16 (14)	0	0.80 ± 1.15 (12)**
Gk Arm Distribution	2.87 ± 2.72 (43)	0.93 ± 2.58 (14)	4.40 ± 2.97 (66)**
Aerial Challenges	19.40 ± 18.05 (291)	10.47 ± 19.89 (157)	31.87 ± 20.67 (478)**
Successful Aerial Challenges	9.40 ± 8.78 (141)	4.80 ± 9.06 (72)	14.93 ± 10.26 (224)**
Yellow Cards	0.27 ± 0.46 (4)	0.13 ± 0.52 (2)	0.73 ± 1.03 (11)
Free Kicks	4.00 ± 3.80 (60)	2.47 ± 4.85 (37)	5.73 ± 4.06 (86)*
Successful Free Kicks	2.67 ± 2.61 (40)	1.53 ± 2.75 (23)	3.47 ± 2.61 (52)*
Unsuccessful Free Kicks	1.33 ± 1.68 (20)	0.93 ± 2.25 (14)	2.27 ± 2.25 (34)*
Passes	150.07 ± 136.72 (2251)	74.47 ± 140.94 (1117)	205.73 ± 127.99 (3086)*
Successful Passes	123.87 ± 116.09 (1858)	59.80 ± 111.50 (897)	165.47 ± 105.72 (2482)*
Unsuccessful Passes	26.02 ± 24.28 (393)	14.67 ± 30.74 (220)	40.27 ± 23.88 (604)**
Shots	5.13 ± 5.22 (77)	2.67 ± 4.15 (40)	6.00 ± 4.72 (90)
Goals	0.87 ± 1.19 (13)	0.40 ± 0.51 (6)	0.80 ± 0.56 (12)
On-Target Shots	2.53 ± 2.61 (38)	0.87 ± 1.06 (13)	2.00 ± 4.51 (30)
Off-Target Shots	1.53 ± 2.00 (23)	1.13 ± 2.17 (17)	2.80 ± 2.86 (42)
Blocked Shots	1.07 ± 1.62 (16)	0.67 ± 1.35 (10)	1.20 ± 1.32 (18)
Clearances	15.20 ± 12.88 (228)	3.00 ± 6.16 (45)	21.60 ± 14.79 (324)**
Successful Clearances	12.53 ± 10.50 (188)	2.80 ± 5.78 (42)	18.47 ± 12.47 (277)**
Unsuccessful Clearances	2.67 ± 2.85 (40)	0.20 ± 0.56 (3)	3.13 ± 2.77 (47)**
Fouls Committed	4.20 ± 3.73 (63)	1.87 ± 4.26 (28)	6.53 ± 5.62 (98)**
Fouls Received	3.33 ± 2.99 (50)	1.80 ± 3.55 (27)	5.53 ± 3.89 (83)**
Easy Passes	64.20 ± 62.40 (963)	29.73 ± 56.82 (446)	86.13 ± 55.60 (1292)*
Difficult Passes	55.67 ± 49.69 (835)	28.07 ± 52.74 (421)	76.13 ± 50.30 (1142)*
Very Difficult Passes	29.07 ± 26.86 (436)	16.20 ± 31.56 (243)	42.20 ± 25.75 (633)**
Forward Passes	81.27 ± 73.87 (1219)	43.47 ± 80.52 (652)	116.27 ± 75.55 (1744)*
Sideways Passes	25.73 ± 24.83 (386)	13.33 ± 26.89 (200)	37.07 ± 25.47 (556)*
Backward Passes	43.07 ± 40.22 (646)	17.67 ± 33.77 (265)	52.40 ± 29.28 (786)*

*$p<0.05$; **$p<0.01$

4.4 Summary of the Thesis Findings

For the league sample, the home team performed more successful crosses, unsuccessful passes, successful tackles and shots on goal, while the away team performed more goal kicks, successful goal kicks, clearances and unsuccessful clearances. For tactical behaviours, in the defensive third, the away team performed more interceptions, aerial challenges and clearances. In the middle third, the away team was tackled more, while in the attacking third, the home team performed more aerial challenges and committed more fouls. When the effects of the different confounding variables were examined only game status revealed significant differences. Specifically, the raw data showed more attacking indicators (e.g., crossing and shooting) and less defensive indicators (goal kicks and clearances) were performed when losing compared to when winning. When each confounding variable was considered as a function of game location, on wet pitches the away team received more offside decisions and performed more clearances (both successful and unsuccessful), while on dry pitches, the home team performed more crosses, successful crosses and unsuccessful passes. For kick-off times, more differences were found in morning compared to afternoon and evening games. With respect to game status, when winning, the away team performed more goal kicks and successful goal kicks. When losing, the home team performed more successful crosses and off-target shots compared to the away side.

For the case study, at home, more unsuccessful crosses, successful aerial challenges and blocked shots were performed and more corners and offside decisions were received. When playing away, more clearances and successful clearances were performed. With respect to tactical behaviours, in the defensive third, more losses of control, interceptions, clearances and the number of times tackled were observed when playing away. In the

attacking third, more dribbles, aerial challenges and very different passes were performed at home. In central areas, more successful aerial challenges were performed at home and when away more clearances were performed. In wide areas more crosses were performed at home compared to away. Analysis of the effect of confounding variables on the performance indicators revealed no differences for weather conditions and kick-off times as a function of game location. For game status, however, trends in the data showed more technical behaviours occurred when the team was winning compared to losing. With respect to game location, when the team was winning, more interceptions were performed and the team was tackled more often when away compared to at home.

Table 4.16: Summary of the main findings from studies 1 and 2.

League sample (Study 1)		**Case-study (Study 2)**	
HWP[abc]	[a]44.00 (61.86), [b]45.00 (58.88), [c]44.71 (59.69)	HWP[abc]	[a](55.10), [b](54.03), [c](53.10)
HGP	44.71 (56.35)	HGP	(50.90)
Game location		**Game location**	
Performance Indicators	↑ successful tackles and crosses, unsuccessful passes and shots (home). ↑ goal kicks (gk), successful gk, clearances and unsuccessful clearances (away).	Performance Indicators	↑ unsuccessful crosses, corners, successful aerial challenges and blocked shots (home). ↑ offside decisions, clearances and successful clearances (away).
Strategic Behaviours	Defensive third: ↑ interceptions, aerial challenges and clearances (away). Midfield third: away team was tackled more often. Attacking third: ↑ aerial challenges and fouls (home). Wide: ↑ clearances (away).	Strategic Behaviours	Defensive third: ↑ losses of control, interceptions, times tackled and clearances (away). Attacking third: ↑ dribbles, aerial challenges and very difficult passes (home). Wide: ↑ crosses (home). Central: ↑ aerial challenges and ↓ clearances (home).
Additional Factors		**Additional Factors**	
Weather Conditions	Dry: ↑ crosses, successful crosses, corners, unsuccessful corners and on-target shots. Wet: ↑ interceptions and difficult passes. Wet: ↑ offside, clearances, successful and unsuccessful clearances (away). Dry: ↑ crosses, successful crosses and unsuccessful passes (home).	Weather Conditions	Dry: ↑ unsuccessful gk. Wet: ↑ yellow cards. Dry: ↑ successful crosses and ↓ offsides (home).
Kick-Off Times	Morning: ↑ successful, unsuccessful crosses, corners, unsuccessful corners, successful free kicks (fk), unsuccessful passes, shots and blocked shots and ↓ unsuccessful gk and unsuccessful fk (home). Afternoon: ↑ tackles, successful tackles and fouls and ↓ successful fk and fouled (home). Evening: ↑ successful tackles and ↓ unsuccessful tackles and successful gk (home).	Kick-Off Times	Differences in goalkeeper arm distributions. No differences as a function of game location.
Game Status	Losing: ↑ attacking indicators (crosses, dribbles, corners, passes and shots). Winning: ↑ defensive indicators (tackles, gk and clearances). Winning: ↑ gk and successful gk (away). Losing: ↑ successful crosses and off-target shots (home). Drawing: ↑ successful crosses, red cards and fouls and ↓ fouled (home).	Game Status	↑ performance indicators when winning than losing. Winning: ↑ interceptions and times tackled (away).

[a]statistic calculated by wins out of total wins; [b]statistic calculated by ties included; [c]statistic calculated by points (2001/02-2002/03 seasons)
↑ = more/greater; ↓ = less/fewer

5. Discussion

The aim of this thesis was to investigate the effects of home advantage upon team performance within professional soccer. Specifically, technical and tactical performance indicators of teams were examined as a function of game location and several confounding variables (Bray, 1999; James *et al.*, 2002). Study one analysed a sample of games from the domestic season of the English Premiership and found that a number of technical indicators associated with the functional aggressive response were performed more frequently by the home team and less often by the away team. Differences were also evident in tactical behaviours and when variables such as kick-off times, game status, and weather conditions were considered. Study two examined home advantage in a professional soccer team and found a number of technical indicators occurred more frequently when the team played at home compared to away. For tactical behaviours, more attacking indicators were performed at home in the attacking third, while more defensive indicators were performed in the defensive third when away. Few differences in technical and tactical behaviours were found when potential confounding variables were considered. The overall findings of this thesis suggest that in addition to influencing match outcome (i.e., HWP) the home advantage appears to exist at a behavioural and strategic level within soccer. The following sections discuss the main findings of the thesis in relation to the home advantage statistic, technical and tactical behaviours, and the influence of potential confounding variables. The section concludes with a discussion of practical implications, thesis limitations, and future research possibilities.

5.1 Home Advantage Statistic

All the HWP's for study one were found to be below 50%, but when the whole league was examined over both seasons, HWP's were found to be above 50%. This finding

agrees with previous research that has reported HWP's in professional soccer of between 62-66% (Clarke and Norman, 1995; Nevill *et al.*, 1996; Neave and Wolfson, 2003). In study two, the individual team exhibited HWP's above 50% over the both seasons. This finding agrees with previous literature, for example, Brown *et al.* (2002) studied 32 World Cup teams and found all but one exhibited a home advantage, while in ice-hockey Agnew and Carron (1994) observed that 13 out of 15 NHL teams had a home advantage over a two-year period. When HGP's were calculated, study one reported a figure of 44.71%, compared to 56.35% for the whole league, while in study two the statistic was 50.90%. These findings are lower than the existing literature, for example, Clarke and Norman (1995) found that home teams scored 59.90% of the total number of goals, Neave and Wolfson (2003) reported home goals to be higher on average than away goals, while Sutter and Kocher (2004) found that home teams scored 0.62 more goals than away teams. In summary, therefore, while an advantage was present for the entire league, a lower home advantage statistic occurred for both samples when compared to that of the overall population. An explanation for this maybe that over a full domestic season the analysed schedule of matches would be balanced (i.e., all of the teams would play each other both home and away). This, therefore, could reduce the existence of any bias due to inequalities in team strengths and weaknesses.

5.2. Technical Indicators

The results for the league sample showed that home teams performed more successful tackles and crosses, unsuccessful passes, and shots on goal compared to away teams. For the case sample, more unsuccessful crosses, corners, successful aerial challenges, and blocked shots were performed at home compared to away. The findings agreed with those of Sasaki *et al.* (1999) who found a significant difference in favour of the home team in

goal attempts, shots on target, shots blocked and successful crosses. The thesis results are also similar to those reported in basketball by Varca (1980) who observed that the home team outplayed their opponents in terms of behaviors such as rebounds, steals and blocked shots. They would also appear to support the notion that the home environment is associated with an increased functional aggressive response (Glamser, 1990). Specifically, a greater number of functional aggressive behaviors (i.e., behaviours related to aggression and assertion that aim to improve performance such as shots, passes, successful tackles and crosses) appear to be performed in front of the home crowd. Schwartz and Barsky (1977) stated that aggression was manifested more in offensive than defensive behaviours and that teams won more games at home because they played more aggressively in their home territories. In addition, McGuire *et al.* (1992) showed that home teams were more aggressive during games they won. Varca (1980) also suggested that matches that contain increased levels of aggression would be beneficial to the home side, as they would secure the social support of the crowd. Specifically, the increased aggression levels would make the crowd more engaged in the match, which may possibly cause changes in the motivation and arousal levels of the home players, and lead to the performance of more functional behaviours. This was explained in the research with Nevill *et al.* (1996) showing that the percentage of home wins increased as crowd sizes increased, while Nevill and Holder (1999) stated that crowds could raise performances of home competitors relative to away competitors. Playing at home also made players feel they played better and were more self confident and motivated (Jurkovac, 1985; as cited in Courneya and Carron, 1992). In addition, Bray *et al.* (2002) showed that in a female field hockey team, players reported lower cognitive and somatic anxiety and higher levels of self-confidence and efficacy at home.

The away team would be affected in a similar way, but with a detrimental effect on motivation and arousal from the crowd, and a subsequent increase in the exhibition of dysfunctional aggressive responses (i.e., behaviours that decrease the performance of teams such as fouls, free kicks and bookings). Thuot *et al.* (1998) showed this with female players stated to experience higher somatic anxiety while both male and female players experienced lower self-confidence in away matches. The other mechanism by which levels of aggression favour the home team may be through bias in officiating decisions. Studies by Nevill and colleagues (e.g., Nevill *et al.*, 2002) have found that if the away team behaves aggressively they are more likely to be penalized than the home side. In this thesis, however, in both samples, while differences were evident across several technical indicators there were no significant differences in the number of free kicks, fouls, or penalties awarded. This may indicate that these findings are contrary to the belief that the crowd causes the referee to bias towards the home team and leads to increased dysfunctional aggressive responses by the away team (Glamser, 1990; Nevill *et al.*, 1999; 2002a; 2002b). In addition, this thesis also found no differences in the number of yellow and red cards received by the home and away sides. This finding disagrees with those of Sutter and Kocher (2004) who showed home teams were significantly penalised fewer times by yellow and red cards than away teams. This finding could be due to the fact that referees were of a higher standard (compared to referees in Sutter and Kocher's study) and so may have been influenced to a lesser degree by the crowds. Similarly, the players may possibly be of a higher standard compared to those examined by Sutter and Kocher, and may therefore have been able to cope with any anxiety or concerns related to pressures (i.e., taunting) from the home crowd (Nevill *et al.*, 1996).

5.3 Strategic Behaviours

Strategic or tactical differences were investigated by examining technical performance indicators within different areas (thirds, wide, and central) as a function of game location. This analysis was based on previous studies that found different playing styles adopted by coaches away from home (i.e., Pollard, 1986; Pace and Carron, 1992). In study one, the away side performed more interceptions, clearances, and aerial challenges within defensive areas whereas in attacking areas the home team challenged for the ball higher up the field leading to more aerial challenges and more fouls being committed. In study two differences were also found in the defensive third, with more losses of control, interceptions, tackles received, and clearances made by the team away compared to at home. These differences suggest that home teams may push more players into advanced positions to increase the chance of scoring goals and put more pressure on opposition players in their 'back third' to force turnovers of possession (Harris and Reilly, 1988; Garganta *et al.*, 1997). Indeed, Bate (1988) and Dooan *et al.* (2001) have also stated that after gaining possession the aim of teams should be to reach the opponents' half of the field as quickly as possible to increase the chances of scoring. Equally, however, the findings may also be indicative of the away teams placing more players behind the ball, which makes it more difficult to break them down. James *et al.* (2002) further explained that 'dropping deep' within matches might actually be a tactical choice that is necessitated by the strength of the opposition. Pollard (1986) though stated that if visiting teams adopt defensive strategies it could provide the home team with a territorial and psychological advantage. The only study conducted on the differences in strategies adopted indicative of game location was conducted by Dennis and Carron (1999). They examined ice-hockey and found that coaches instructed their teams to perform more assertive fore-checking styles at home compared to away. This suggested that coaches'

decision-making (i.e., the tactics employed) was affected by game location. Dennis and Carron (1999) also stated that a more assertive rather than a more passive approach provided more offensive opportunities to a team thus more chances to score. With increased offensive success Schwartz and Barsky (1977) suggested that a crowd displays increased excitement while McGuire *et al.* (1992) explained that increased aggression or assertion favoured the home team as it entices the crowd to become more actively involved in a contest, which energises and motivates home players. Therefore if home teams behave more functionally aggressive they could possibly create more behaviours that aim to improve performance with the help of increased crowd support as Cox (1998) stated that the presence of an audience increases arousal thus enhancing the performance of a skilled individual.

The fact that only a small number of differences were found in midfield areas suggests that defensive and attacking areas were more important in influencing home advantage within soccer. Hughes *et al.* (2001) explained this notion by examining perturbations (i.e., an aspect of play that creates an important action such as a shot at goal) and their importance within soccer. Hughes *et al.* identified that defensive and attacking areas were the most important in soccer, as most perturbations tended to exist within these areas (i.e., defensive mistake, piece of individual skill, and final goal scoring pass).

In study one, the lack of differences found between wide and central areas may have been due to the different strategies employed by the teams in the analysis. Several studies have shown differences between the playing styles of teams of similar quality (e.g., Reep *et al.*, 1988). The quality of the team or teams being analysed has also been suggested to affect the degree of home advantage (Schwartz and Barsky, 1977). For example, Madrigal and

James' (1999) analysis of home advantage in basketball found strong teams won most of their games against poor teams (95%) and other strong teams (70%). Poor teams though won most of their matches' against other poor teams (60%) and only a quarter against strong teams.

When the tactics of the single team were considered in study two, in wide areas, more crosses were performed at home while in central areas more aerial challenges were performed at home and more clearances away. The results may possibly suggest that at home the case team would get into more attacking positions by dribbling and crossing the ball from wide areas into the penalty area where attackers would challenge for the ball. Using the wings has shown to be important within soccer; Ali (1988), for example, found that such tactics provided more scoring opportunities than any other form of attack. In addition, Hughes and Pettit (2001) showed that in the 1998 soccer World Cup it was important for teams to use wing attacks, as defenders stayed central in an attempt to push the ball away from the danger area.

5.4 Home Advantage and Additional Factors

Different weather conditions (wet and dry) were initially examined for their effect on the overall frequencies of technical indicators. For study one, significantly more on-target shots, crosses, corners, and successful crosses and corners were found to be performed in dry conditions than in the wet. There were also significantly more difficult passes and interceptions made in the wet compared to the dry. For study two, significantly more unsuccessful goal kicks were found in the dry while more yellow cards were found in the wet. These findings indicate that it could be easier to create time and space for attacking indicators when conditions were dry due to the pitches being in better playing condition.

In addition, as wet conditions tend to produce pitches of poorer quality the ability to offload the ball quickly may have been reduced allowing the opposition more time to close players down. Some support for this suggestion has come from Ali (1988) who explained that weather conditions may affect the strategies teams adopt as certain patterns or tactics may be more successful on wet and muddy pitches compared to drier conditions.

When the weather conditions were examined as a function of game location, in study one, in the dry, home teams were able to create more space in attacking positions and were found to perform more crosses than away teams. In addition, in the wet, the away teams performed more clearances than home teams. In study two, in the dry, more successful crosses were performed at home and more offside decisions were given away. The theory that home teams are more familiar with their surroundings due to familiarity with climatic changes and playing surfaces (Pollard, 2002) has not been conclusive. However, Moore and Brylinsky (1995) did find that in basketball the home advantage existed even though the playing conditions (home courts) analysed were different for a single team. This suggests that familiarity might not be as influential as other variables in influencing any home advantage effects.

For kick-off times, no differences were found for the case study sample. This may have been due to the fact that only a small number of games were available for analysis in the morning, afternoon, and evening groups (n=6, n=6 and n=3 respectively). However, for the league sample differences were found between the various groups. Further analysis with respect to game location found more differences within morning matches compared to the other times of the day. Potential reasons for these differences may have been be due

to travel and disruption of routines. For morning games, away teams may have had less time to adjust to the new routines compared to games played later in the day. Schlenker *et al.* (1995a) suggested that this could prove an advantage as players at home could capitalise on their routines, have no problems of travel inconvenience and have family and friends available for support. Courneya and Carron (1992) and Nevill and Holder (1999) have also suggested that disruption of routines may contribute to the home advantage but no actual research has been conducted on the affects on performance.

Further examples of travel differences have been shown by Snyder and Purdy (1985) who found that home advantage increased when visiting basketball teams travelled over 200 miles compared to teams travelling under 200 miles. In addition, Brown *et al.* (2002) analysed international soccer teams and found that for games that were won teams travelled shorter distances and more days had elapsed from the previous game, while the further the teams travelled the worse their performance. Within this study, as the English Premiership was analysed the distances teams needed to travel were not comparable with the distances needed to travel within American sports, consequently the effects of travel may not be the same. For example, Pollard (1986) showed that in English soccer teams travelling above and below 200 miles both exhibited similar home advantages of 64.3%. The number of days between games though may have more of an impact on home advantage, as fatigue may have reduced performances along with increased travel over a small period of time. Therefore, the actual travelling, number of days between games, and changes in routine, overall, may have affected home advantage found within morning, afternoon, and evening games.

When investigating the effect of game status on performance behaviours the statistics highlighted significant differences between technical indicators for teams when winning, losing, and drawing. For the league sample, trends in the data indicated that more attacking indicators (crossing, dribbling, passing, and shooting) and fewer defensive indicators (goal kicks and clearances) were collected when losing compared to when winning. These findings agree with those of Church and Hughes (1987) who showed that a greater number of passes were attempted and more shots were made by losing compared to winning teams. In addition, losing teams have been reported to push more players into forward positions to create scoring opportunities, and consequently shots at goal (Abt *et al.*, 2002). However, in the case study, the raw data indicated that more attacking indicators were collected when the team was winning compared to losing. This could have been due to the consistency of style of play within the case study team as opposed to a greater variation within the league sample. Additionally, the case study contained a greater number of winning matches compared to losing matches (n=9 and n=4 respectively), suggesting that the case study team may have had more opportunity to perform within a winning context. More matches, therefore, need to be analysed to get a clearer picture of behaviours in different contexts. Further, future research should consider a more dynamic and temporal approach that investigates the outcome of such attacking behaviours when winning and losing.

For the league sample, when game status was examined as a function of game location, when winning, the away teams were found to perform significantly more goal kicks and successful goal kicks than home teams. When losing, the home teams performed significantly more successful crosses and off-target shots compared to the away teams when losing. For the case study, when winning, more interceptions were performed and

the team was tackled more often away compared to at home. One potential explanation for these findings could be due to changes in the tactics of the teams that were analysed. For example, Pollard (1986) concluded that different strategies were employed depending on game location (e.g., more defensive in Europe as opposed to domestic competition), while Stanhope (2001) stated that when losing some teams tended to gamble to get back into the match. In this thesis, therefore, when home teams were losing they may have been more likely to gamble to try to equalise, which may have led to more successful crosses and off-target shots being performed.

5.5 Practical Implications

The results and conclusions from this thesis have several practical implications. One of the principal findings in both studies was that the home teams performed more attacking and fewer defensive indicators. Further, these were performed in more attacking areas of the field. This indicates that when teams behave more assertively it will lead to more functional performance behaviours as McGuire *et al.* (1992) showed that home team players were more aggressive during games they won. In addition, using aggression and assertion in a positive way along with involving the crowd to increase support increases performance (Dennis and Carron, 1999). Nevill and Holder (1999) explained this by stating crowds could raise performances of home competitors relative to away competitors. Pollard (1986) stated that if visiting teams adopt defensive strategies it could provide the home team with a territorial and psychological advantage. In addition, game location could effect strategic and tactical decisions (e.g., type of defence used and the nature and timing of substitutions) and could serve to contribute to any home advantage (Courneya and Carron, 1992; Dennis and Carron, 1999). Coaches should therefore select playing styles and tactics based on the strengths of their players and possible weaknesses

of their opponents (Luhtanen *et al.*, 2001) and not due to game location (i.e., a successful 4-4-2 formation should not be changed because of game location). Due to the differences found between the performance behaviours within different areas the tactics employed by coaches need to reduce any game location effects (i.e., away teams don't necessarily defend more because of where the game is played).

The effects of other potential confounding variables upon game location and performance also present several implications. Firstly, for kick-off times, more technical and strategic differences were apparent in game location for morning compared to afternoon and evening games. Coaches should therefore attempt to make the routines away from home as similar as possible to the routines employed at home (e.g., preparation schedule, regular hours, and friends and family support) as being in an unfamiliar venue can affect certain players (Bray and Carron, 1993). This will aid players in adjusting to away games by helping them to relax and focus on the game itself even when there is less time to prepare for the match (i.e., within morning games). For the effect of game status on performance, in this thesis it was found that teams performed more attacking indicators when losing compared to when winning. Consequently, when teams are winning, adopting the tactic of 'possession' football could reduce the amount of time losing teams have to create scoring opportunities and therefore enhance the winning teams' chance of securing victory. When game location is considered, if away teams play more positively when winning (e.g., create scoring opportunities instead of just defending) their chances of winning could also be enhanced. However, if teams become more defensive it may cause them to become disadvantaged. For example, a hockey team continuing to shoot the puck out of its own end to avoid an opponent's offensive pressure reduces their ability to score themselves (Courneya and Carron, 1990). Finally, although fewer actual differences

were found in respect of weather conditions than originally hypothesised, intuitively, it would be expected that when deciding on a particular strategy coaches require some consideration of the playing environment. For example, wet muddy pitches may not allow possession football so a more direct style may be required (Ali, 1988). If conditions are not taken into account then performances could be reduced due to the strategies employed not being suitable to the playing conditions (e.g., playing the ball in the air in windy conditions).

5.6 Thesis Limitations and Future Research Suggestions

A limitation with the analysis procedure could be that by increasing the number of tests conducted the risk of finding a significant difference when one doesn't exist (increased type 1 error) is increased. To overcome this either a more robust statistical test (i.e., the non-parametric equivalent of multivariate analysis such as MANOVA which would be log linear modelling or multiple frequency analysis) or a more conservative alpha level through Bonferroni Correction should be set. That way the analyst could be more confident when a significant difference occurs. Co-variate analysis would also need to be conducted to fully account for home advantage effects when weather, kick-off times etc are controlled. In addition, the form of the analysis conducted only allowed the analyst to establish if differences existed (i.e., between winning, losing and drawing) and that further research studies would need to conduct additional analysis to identify where differences lie (i.e., Mann Whitney).

From a methodological perspective, although this thesis has considered the home advantage effect in greater depth than any previous investigation the findings are limited to a certain extent by the sample size. For example, while study two investigated home

advantage in a single team some of the fine-grained analysis of the potential confounding variables was limited due to the small cell size numbers of certain indicators (e.g., morning, afternoon and evening games; n=6, n=6, and n=3 respectively). In addition, when examining differences in performance behaviours based on game location, observed home advantage wasn't found within the sample investigated. To improve the study future investigations should adopt in-depth analysis of individual case and league samples across an entire domestic season and beyond to provide substantial numbers for co-variate analysis and allow an examination of a sample that has a home advantage (i.e., within a whole league). This would enable a more holistic approach that ties in behaviours to an outcome, which may better indicate home advantage.

A further methodological limitation was the procedure used in examining tactical or strategic differences between home and away teams (i.e., the division of pitch). Previous tactical analyses have focused upon the specific areas of the pitch teams operate (Ali, 1988; James *et al.*, 2002). In the current thesis the pitch areas were separated into thirds and wide and central divisions. Making pitch areas smaller allows subtle tactical differences between teams, especially within central areas, to become apparent (James *et al.*, 2002). However, by reducing the sizes the reliability in differentiating between the areas is also reduced (i.e., increases areas of uncertainty). In addition, different levels of accuracy are expected for a number of variables, as some observations are more difficult to make than others (Hughes *et al.*, 2002). Future research should therefore consider assessing strategy through other detailed markers. For example, James *et al.* (2002) examined playing strategy as a function of the different competitions competed in (European and domestic) and in relation to individual player comparisons. To explain strategic differences further, coaches' opinions could also be collected on the strategies

employed home and away and corroborated with the objective individual performance and team strategic behaviour statistics. This would explain whether the behaviours were performed based on what coaches implemented or indicative of other factors (i.e., crowd, game status, opposition etc). To achieve this questionnaires could be given to coaches on what tactics or strategies were used in specific games and then those games analysed to see if the coaches' instructions were followed. One example of this approach was Dennis and Carron's (1999) study of coaches' strategic decision-making in ice-hockey, which found that teams played differently home and away via the implementation of differing coaching strategies.

One of the reasons for the lack of explanation regarding discrepancies in technical performance and tactical strategies in the existing notational analysis and home advantage literature has been a failure to consider potential confounding variables that may serve to obscure any findings (Bray, 1999; James *et al.*, 2002). In the current thesis, several potential confounding variables differed as a function of game location (e.g., weather conditions, kick-off times, and game status). Any future research into home advantage should therefore consider the effects of these and other variables that have been suggested by various researchers to influence performance such as team quality, team form, distances travelled, days between games and crowd attendances (Schwartz and Barsky, 1977; Pollard, 1986; Courneya and Carron, 1992; Nevill and Holder, 1999; Brown *et al.*, 2002).

One specific problem that may have reduced the home advantage effects in study one was the presence of teams of different quality. Several studies have shown that team quality affects the degree of home advantage obtained (Schwartz and Barsky, 1977; Madrigal and

James, 1999). Indeed, Schwartz and Barsky (1977) concluded that game location and team quality were equally important in determining performance outcomes in sport due to strong teams having higher home advantages than weaker teams. In study one this limitation may have been overcome by recording the qualities of teams. Any bias of the results due to grouping all home and away teams together could therefore be reduced consequently improving the validity of any home advantage. To remove some of the potential confounding effects of assessing the home advantage of different teams, an individual team was examined in study two. Further analysis could therefore also examine a number of different case studies of varying quality within the same league. This would allow the researchers to determine whether home advantage occurs in all teams or if it only appears within higher quality teams (c.f. Bray, 1999).

Among the reasons given for home advantage has been the effect of crowds and travel (Nevill *et al.*, 1996; Brown *et al.*, 2002; Nevill *et al.*, 1999; 2002a; 2002b). Future research should therefore consider the effect of crowd size on home advantage with respect to the performance indicators and playing strategies assessed in this thesis. The attendances of the analysed games could be collected and the differences in performance indicators compared within small and large attendances (i.e., with respect to absolute and relative numbers). In addition, league differences could be examined by comparing leagues from different countries (i.e., top divisions from England, Spain, France etc) and testing any differences with respect to game location. Courneya and Carron (1992) suggested that game location affected players of different abilities, while Salminen (1993) showed that home advantage was less important in professional teams than national and amateur games. This could be investigated by examining leagues from different levels (i.e., English Premiership, League 2 and non league). When examining the effect of travel

on home advantage the actual distances covered by the away teams could also be collected and the differences in the performance indicators as a function of game location between long and short distances examined (Brown *et al.*, 2002). In addition, questionnaires from coaches and players could be used to investigate whether changes in routines affect how they performed both before and during matches.

Finally, although the findings of this thesis suggest that technical and tactical behaviours differ as a function of game location, there is a need to corroborate these findings with the resultant individual and collective cognitive and affective responses of the players. Studies in other sports have questioned both athletes and coaches on the nature of the home advantage (Sasaki *et al.*, 1999; Bray and Widmeyer, 2000; Gayton *et al.*, 2001) and the subsequent psychological effects (Thuot *et al.*, 1998; Bray and Widmeyer, 2000). Questionnaires would allow physiological and psychological responses of players to be collected before home and away matches (e.g., whether players feel more aggressive or assertive at home and if they feel more confident and less anxious). Future studies should therefore aim to identify the appropriate thoughts and feelings players' perceive to be important in influencing performance indicators and the subsequent home advantage. Such investigations will also allow coaches and practitioners to design intervention strategies relevant to the specific environmental conditions (i.e., game location).

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APPENDIX A:

ETHICAL

APPROVAL

UNIVERSITY OF WALES SWANSEA
DEPARTMENT OF SPORTS SCIENCE
DEPARTMENTAL ETHICS ADVISORY COMMITTEE

APPLICATION FOR ETHICAL COMMITTEE APPROVAL OF A RESEARCH PROJECT

In accordance with Departmental Safety Policy, all research undertaken in the department must be approved by the Departmental Ethics Advisory Committee **prior to** data collection. **Applications for approval should be typewritten on this form using the template available in the Public Folders.** The researcher(s) should complete the form in consultation with the project supervisor. Where appropriate, the application must include the following appendices:
(A) subject information sheet;
(B) subject consent form;
(C) subject health questionnaire.

After completing sections 1-12 of the form, seven copies of the form should be handed into the Department Administrator who will submit the application for consideration by the Departmental Ethics Advisory Committee. The applicant(s) will be informed of the decision of the Committee in due course.

1. DRAFT TITLE OF PROJECT

An investigation into the effects of game location upon performance in professional soccer.

2. NAMES AND STATUS OF RESEARCH TEAM

Wayne Tucker (Postgraduate)
Dr Stephen Mellalieu (Supervisor)
Dr Nic James (Supervisor)

3. RATIONALE

Home advantage refers to "the consistent findings that home teams in sport competitions tend to win over 50% of the games played under a balanced home and away schedule" (Courneya and Carron, 1992; p. 13). Home advantage has been found in a variety of sports including soccer, basketball, ice hockey and american football at amateur and professional levels (Bray, 1999; Nevill, Newell and Gale, 1996; Varca, 1980). A framework for home advantage was proposed by Courneya and Carron (1992), which suggested the phenomenon, was influenced by the crowd (attendances and social support), travel (distances travelled), familiarity of surroundings and rules. In addition studies into the emotional and strategic effects of location have been conducted that suggest anxiety, confidence and team strategies differ depending on game location (Bray, Jones and Owen, 2002; Dennis and Carron, 1999; Pollard, 1986).

Many studies have also conducted in-depth analysis of performance behaviours as a function of game location in sports such as basketball, ice-hockey and baseball with most finding that the home team performs better on average than away teams (Madrigal and James, 1999; Pickens, 1994; Schwartz and Barsky, 1977). In soccer, however there is a paucity of literature with only a limited number of key performance indicators (goals scored, sendings-off and penalties) being investigated. For example, Clarke and Norman (1995) and Pollard (1986) found that home advantage was worth just over 0.5 and 0.6 of a goal per game respectively within English professional soccer. Nevill *et al.*, (1996) noted that sendings-off were lower for the home team while penalties scored favoured the home team. Only one study has examined a broader sample of key performance indicators such as shots, crosses and goal kicks (Sasaki, Nevill and Reilly, 1999). Investigating an English Premier League club over the 1996-97 season and at home significant differences were found in favour of the home team with respect to goal attempts, shots on target, shots blocked, shots wide, successful crosses and goal kicks. Although Sasaki *et al's* study provided some insight into the specific behaviours performed at home compared to away, more research is needed into a broader sample of key performance indicators. In addition how each of the indicators is affected by game location factors (crowd, travel, etc) also needs further research.

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5. AIMS and OBJECTIVES

Using key performance indicators the aim of the study is to investigate home advantage in professional soccer by comparing behaviours of teams in professional soccer playing at home when compared to away

The objectives of the study are:

1. Identify and categorise key performance indicators within professional soccer.
2. Compare key performance indicators as a function of home advantage within and across teams in the English Premiership.
3. Investigate the effects of other variables on the performance indicators as a function of home advantage (i.e. travel, crowd, etc).

6. METHODOLOGY

6.1 Study Design

Matches played by Professional soccer players will be analysed via a computerised video analysis system, the Noldus Observer Video Pro behavioural measurement package. 30 matches from the 2001/02 and 2002/03 seasons of the English Premiership will be analysed to examine the differences in performance patterns and behaviours between teams playing at home when compared to away. In addition, to examine the notion of individual home advantage 16 matches from one Premiership club will be analysed.

6.2 Experimental Procedures

Based upon a review of soccer notational analysis literature and using professional soccer coach feedback key performance indicators were developed to examine the effects of the home advantage. Premiership matches will be recorded from Terrestrial and Satellite television onto a VHS tape and converted onto a PC using a Clipmaster

MPEG converter and the dazzle MovieStar Digital Video Creator version 4.22 software. This MPEG format is then transferred to CD using the Roxio Easy CD Creator 5 programme.

A computerised notation system will be devised using the Noldus Observer Video Pro package with the key performance indicators given a coding structure (one, two or three key code), including the team being studied, the area of the pitch (nine separate areas), the action and the outcome of the behaviour. The system will be piloted before any analysis so areas of doubt can be decreased and a reliability study will be conducted using intra-observer and inter-observer reliability. Following completion of coding each game an observer file is created that contains the match data that is opened in a Microsoft Word document. A self written macro then converts the data to a numerical format, which is then pasted into a ready prepared SPSS Inc file and converted back into its original format. The other variables including crowd size (absolute and relative attendance), distances travelled (away team), kick-off time, game time (number of days between the studied game and the previous four games), weather, quality of teams being studied (final position and form) and game status (winning losing or drawing) will be entered into the SPSS Inc file in addition to the data produced from the Observer analysis.

6.3 Data Analysis Techniques

In order to conduct reliability analysis percentage errors will be calculated for each of the groups of data (subjects, areas, actions and outcomes). In order for the system to be reliable each of the groups must show errors below 5%. If errors are above 5% appropriate steps will be taken to amend the definitions and the system to reduce the errors that are produced. To test for differences between the data collected for each performance indicator home and away statistical tests will be carried out including chi-squared tests. Differences in the other variables (crowd attendances, distances travelled, etc) against the performance indicators and game location will also be conducted using multivariate tests including Analysis of Variance (ANOVA's).

7. LOCATION OF THE PREMISES WHERE THE RESEARCH WILL BE CONDUCTED.

Notational Analysis Laboratory, University of Wales Swansea
Cognition and Behaviour in Sports Performance, Postgraduate Centre, University of Wales Swansea

8. SUBJECT RISKS AND DISCOMFORTS

No risks or discomforts are anticipated

9. INFORMATION SHEET AND INFORMED CONSENT

Have you included a Subject Information Sheet for the participants of the study? N/A

Have you included a Subject Consent Form for the participants of the study? N/A

Written consent will not be required for the research being conducted. The nature of the research requires professional soccer matches to be recorded onto VHS tapes before analysis. Therefore the subjects will not be directly involved in the research and their identities will be kept anonymous.

10. COMPUTERS

Are computers to be used to store data? YES

If so, is the data registered under the Data Protection Act? YES

11. STUDENT DECLARATION

Please read the following declarations carefully and provide details below of any ways in which your project deviates from them. Having done this, each student listed in section 2 is required to sign where indicated.

1. I have ensured that there will be no active deception of participants.
2. I have ensured that no data will be personally identifiable.
3. I have ensured that no participant should suffer any undue physical or psychological discomfort
4. I certify that there will be no administration of potentially harmful drugs, medicines or foodstuffs.
5. I will obtain written permission from an appropriate authority before recruiting members of any outside institution as participants.
6. I certify that the participants will not experience any potentially unpleasant stimulation or deprivation.
7. I certify that any ethical considerations raised by this proposal have been discussed in detail with my supervisor.
8. I certify that the above statements are true with the following exception(s):

Student signature: Date:

Student signature: Date:

Student signature: Date:

12. SUPERVISOR'S DECLARATION

In the supervisor's opinion, this project (delete those that do not apply):

- Does not raise any significant issues.
- Raises some ethical issues, but I consider that appropriate steps and precautions have been taken and I have approved the proposal.
- Raises ethical issues that need to be considered by the Departmental Ethics Committee.
- Raises ethical issues such that it should not be allowed to proceed in its current form.

Supervisor's signature: Date:

13. ETHICS COMMITTEE DECISION (COMMITTEE USE ONLY)

ETHICAL APPROVAL: GRANTED REJECTED (delete as appropriate)

The ethical issues raised by this project have been considered by members of the Departmental Ethical Approval Committee who made the following comments:

.....

.....

.....

.....

Please ensure that you take account of these comments and prepare a revised submission that should be shown to your supervisor/ resubmitted to the Department Ethical Approval Committee (delete as appropriate).

Signed: Date:

(Chair, Departmental Ethics Advisory Committee)

APPENDIX B:

NOTATED

GAMES

Notated Games

Overall League Sample

Game Number	Date	Game	Score
	2001/02 Season		
1	13/10/2001	Liverpool vs. Leeds United	1-1
2	21/10/2001	Leeds United vs. Chelsea	0-0
3	21/10/2001	Newcastle United vs. Tottenham Hotspur	0-2
4	22/10/2001	Middlesbrough vs. Sunderland	2-0
5	28/10/2001	Ipswich Town vs. West Ham United	2-3
6	28/10/2001	Derby County vs. Chelsea	1-1
7	04/11/2001	Liverpool vs. Manchester United	3-1
8	01/12/2001	Manchester United vs. Chelsea	0-3
9	02/12/2001	Everton vs. Southampton	2-0
10	26/12/2001	Arsenal vs. Chelsea	2-1
11	02/01/2002	Manchester United vs. Newcastle United	3-1
12	20/01/2002	Chelsea vs. West Ham United	5-1
13	22/01/2002	Manchester United vs. Liverpool	0-1
14	30/01/2002	Chelsea vs. Leeds United	2-0
15	03/02/2002	Leeds United vs. Liverpool	0-4
16	10/02/2002	Everton vs. Arsenal	0-1
17	16/03/2002	Middlesbrough vs. Liverpool	1-2
18	20/04/2002	Chelsea vs. Manchester United	0-3
19	27/04/2002	Ipswich Town vs. Manchester United	0-1
	2002/03 Season		
20	21/10/2002	Aston Villa vs. Southampton	0-1
21	04/11/2002	Newcastle United vs. Middlesbrough	2-0
22	16/12/2002	Bolton Wanderers vs. Leeds United	0-3
23	18/01/2003	Manchester United vs. Chelsea	2-1
24	09/02/2003	Newcastle United vs. Arsenal	1-1
25	23/02/2003	Birmingham City vs. Liverpool	2-1
26	24/02/2003	Tottenham Hotspur vs. Fulham	1-1
27	03/03/2003	Aston Villa vs. Birmingham City	0-2
28	07/04/2003	Fulham vs. Blackburn Rovers	0-4
29	12/04/2003	Newcastle United vs. Manchester United	2-6
30	03/05/2003	Manchester United vs. Charlton Athletic	4-1

Case Study Sample

Game Number	Date	Game	Score
	2001/02 Season		
1	27/10/2001	Manchester United vs. Leeds United	1-1
2	25/11/2001	Arsenal vs. Manchester United	3-1
3	26/12/2001	Everton vs. Manchester United	0-2
4	13/01/2002	Southampton vs. Manchester United	1-3
5	19/01/2002	Manchester United vs. Blackburn Rovers	2-1
6	29/01/2002	Bolton Wanderers vs. Manchester United	0-4
7	02/02/2002	Manchester United vs. Sunderland	4-1
8	10/02/2002	Charlton Athletic vs. Manchester United	0-2
9	16/03/2002	West Ham United vs. Manchester United	3-5
10	23/03/2002	Manchester United vs. Middlesbrough	0-1
	2002/03 Season		
11	11/09/2002	Manchester United vs. Bolton Wanderers	0-1
12	07/10/2002	Manchester United vs. Everton	3-0
13	26/12/2002	Middlesbrough vs. Manchester United	3-1
14	15/03/2003	Aston Villa vs. Manchester United	0-1
15	16/04/2003	Arsenal vs. Manchester United	2-2

APPENDIX C:

CALCULATIONS OF HOME WINNING PERCENTAGES AND HOME GOAL PERCENTAGES

Numerical Examples of Types of HWP's

Home/Away Differential (H/AD)

(Bray, 1999)

- H/AD = Home Winning Percentage – Away Winning Percentage
- H/AD = HWP – AWP
- H/AD = 51.85 – 34.59
- H/AD = 17.26 (Positive Home/Away winning percentage differential)

Percentage Difference (% diff)

(Bray and Carron, 1993)

- % diff = [(Home wins – Away wins) / Home wins] * 100
- % diff = [(53.5 – 46.5) / 53.4] * 100
- % diff = 13.1% (1 decimal place; 1d.p)

Home Wins Expressed as a Percentage of the Total Number of Wins

(Pollard, 2002)

- (Home Team in Basketball: Played = 6316, Won = 3388, Lost = 2928)
- HWP = (Home Wins / Total Wins) * 100
- HWP = (3388 / 6316) * 100
- HWP = 53.6% (1 d.p)

Points Gained at Home Expressed as a Percentage of the Total Number of Points Gained

(Pollard, 2002)

- (Home Team in Ice-Hockey: Played = 2520, Won = 1328, Drew = 361, Lost = 831)
- (2 points for a win and 1 for a draw)
- HWP = [Home Points / Total Points] * 100
- HWP = [((1328 * 2) + 361) / (2520 * 2)] * 100
- HWP = 59.9% (1 d.p)

Percentage Reduction (% reduction)

(Pollard, 2002)

- HWP before change = 60%, HWP after change = 57%
- % reduction = [Reduction in Percentage / (Original HWP – No HA)] * 100
- % reduction = [3 / (60 – 50)] * 100
- % reduction = 30% (Reduction in HA)

HWP's and HGP's for 2001/02 and 2002/03 (Table 3.1)

English Premiership (2001/02)

- (Played = 380, Home Wins = 165, Home Draws = 101, Home Losses = 114, Home Points = 596, Total Points = 1039, Home Goals = 557, Total Goals = 1000)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (165 / 279) * 100
- HWP^a = 59.14% (2 d.p)

- HWP^b = [(Home Wins + (Home Draws / 2)) / Total Games] * 100
- HWP^b = [(165 + (101 / 2)) / 380] * 100
- HWP^b = 56.71% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [596 / 1039] * 100
- HWP^c = 57.36% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [557 / 1000] * 100
- HGP = 55.70% (2 d.p)

English Premiership (2002/03)

- (Played = 380, Home Wins = 187, Home Draws = 90, Home Losses = 103, Home Points = 651, Total Points = 1000, Home Goals = 570, Total Goals = 1000)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (187 / 290) * 100
- HWP^a = 64.48% (2 d.p)

- HWP^b = [(Home Wins + (Home Draws / 2)) / Total Games] * 100
- HWP^b = [(187 + (90 / 2)) / 380] * 100
- HWP^b = 61.05% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [651 / 1000] * 100
- HWP^c = 62.00% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [570 / 1000] * 100
- HGP = 57.00% (2 d.p)

Case Study Team (2001/02)

- (Played = 38, Home Wins = 11, Home Draws = 2, Home Losses = 6, Away Wins = 13, Away Draws = 3, Away Losses = 3, Home Points = 35, Total Points = 77, Home Goals = 40, Total Goals = 87)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (11 / 24) * 100
- HWP^a = 45.80% (2 d.p)

- HWP^b = [(Home Wins + (Total Draws / 2)) / (Total Wins + Total Draws)] * 100
- HWP^b = [(11 + (5 / 2)) / (24 + 5)] * 100
- HWP^b = 46.55% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [35 / 77] * 100
- HWP^c = 45.45% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [40 / 87] * 100
- HGP = 45.90% (2 d.p)

Case Study Team (2002/03)

- (Played = 38, Home Wins = 16, Home Draws = 2, Home Losses = 1, Away Wins = 9, Away Draws = 6, Away Losses = 4, Home Points = 50, Total Points = 83, Home Goals = 42, Total Goals = 74)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (16 / 25) * 100
- HWP^a = 64.00% (2 d.p)

- HWP^b = [(Home Wins + (Total Draws / 2)) / (Total Wins + Total Draws)] * 100
- HWP^b = [(16 + (8 / 2)) / (25 + 8)] * 100
- HWP^b = 60.61% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [50 / 83] * 100
- HWP^c = 60.24% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [42 / 74] * 100
- HGP = 56.80% (2 d.p)

League Sample (2001/02)

- (Played = 19, Home Wins = 7, Home Draws = 3, Home Losses = 9, Home Points = 24, Total Points = 54, Home Goals = 24, Total Goals = 50)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (7 / 16) * 100
- HWP^a = 43.75% (2 d.p)

- HWP^b = [(Home Wins + (Total Draws / 2)) / (Total Wins + Total Draws)] * 100
- HWP^b = [(7 + (3 / 2)) / (16 + 3)] * 100
- HWP^b = 44.74% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [24 / 54] * 100
- HWP^c = 44.44% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [24 / 50] * 100
- HGP = 48.00% (2 d.p)

League Sample (2002/03)

- (Played = 11, Home Wins = 4, Home Draws = 2, Home Losses = 5, Home Points = 14, Total Points = 31, Home Goals = 14, Total Goals = 35)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (4 / 9) * 100
- HWP^a = 44.44% (2 d.p)

- HWP^b = [(Home Wins + (Total Draws / 2)) / (Total Wins + Total Draws)] * 100
- HWP^b = [(4 + (2 / 2)) / (9 + 2)] * 100
- HWP^b = 45.45% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [14 / 31] * 100
- HWP^c = 45.16% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [14 / 35] * 100
- HGP = 40.00% (2 d.p)

HWP's and HGP's for the League Sample, Total League and Case Study Team during 2001/02-2002/03 (Table 4.1)

League Sample (2001/02-2002/03)

- (Played = 30, Home Wins = 11, Home Draws = 5, Home Losses = 14, Home Points = 38, Total Points = 85, Home Goals = 38, Total Goals = 85)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (11 / 25) * 100
- HWP^a = 44.00% (2 d.p)

- HWP^b = [(Home Wins + (Home Draws / 2)) / Total Games] * 100
- HWP^b = [(11 + (5 / 2)) / 30] * 100
- HWP^b = 45.00% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [38 / 85] * 100
- HWP^c = 44.71% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [38 / 85] * 100
- HGP = 44.71% (2 d.p)

English Premiership (2001/02-2002/03)

- (Played = 760, Home Wins = 352, Home Draws = 191, Home Losses = 217, Home Points = 1247, Total Points = 2039, Home Goals = 1127, Total Goals = 2000)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (352 / 569) * 100
- HWP^a = 61.86% (2 d.p)

- HWP^b = [(Home Wins + (Home Draws / 2)) / Total Games] * 100
- HWP^b = [(352 + (191 / 2)) / 760] * 100
- HWP^b = 58.88% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [1247 / 2039] * 100
- HWP^c = 53.10% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [1127 / 2000] * 100
- HGP = 56.35% (2 d.p)

Case Study team (2001/02-2002/03)

- (Played = 76, Home Wins = 27, Home Draws = 4, Home Losses = 7, Away Wins = 22, Away Draws = 9, Away Losses = 7, Home Points = 85, Total Points = 160, Home Goals = 82, Total Goals = 161)

- HWP^a = (Home Wins / Total Wins) * 100
- HWP^a = (27 / 49) * 100
- HWP^a = 55.10% (2 d.p)

- HWP^b = [(Home Wins + (Total Draws / 2)) / (Total Wins + Total Draws)] * 100
- HWP^b = [(27 + (13 / 2)) / (49 + 13)] * 100
- HWP^b = 54.03% (2 d.p)

- HWP^c = [Home Points / Total Points] * 100
- HWP^c = [85 / 160] * 100
- HWP^c = 53.10% (2 d.p)

- HGP = [Home Goals / Total Goals] * 100
- HGP = [82 / 161] * 100
- HGP = 50.90% (2 d.p)

APPENDIX D:

RELIABILITY

RESULTS

Intra-reliability Test

		Stages of coding process			
	Number of entries per stage	Subjects Number of errors (% error)	Areas Number of errors (% error)	Actions Number of errors (% error)	Outcomes Number of errors (% error)
Game 1: 1st Half	948	14 (1.48)	39 (4.11)	59 (4.22)	25 (2.64)
Game 1: 2nd Half	899	5 (0.56)	45 (4.01)	54 (4.01)	16 (1.78)
Game 2: 1st Half	1063	5 (0.47)	54 (4.08)	62 (4.83)	14 (1.32)
Game 2: 2nd Half	1053	6 (0.57)	55 (5.22)	61 (4.79)	20 (1.90)

Inter-reliability Tests

			Stages of coding process			
		Number of entries per stage	Subjects Number of errors (% error)	Areas Number of errors (% error)	Actions Number of errors (% error)	Outcomes Number of errors (% error)
Researcher 1	Game 1: 1st Half	948	16 (1.69)	110 (11.60)	119 (12.55)	25 (2.54)
	Game 1: 2nd Half	899	16 (1.78)	100 (11.12)	107 (11.90)	20 (2.22)
	Game 2: 1st Half	1063	17 (1.60)	109 (10.25)	177 (16.65)	45 (4.23)
	Game 2: 2nd Half	1053	12 (1.54)	97 (9.21)	120 (11.40)	33 (3.13)
Researcher 2	Game 1: 1st Half	948	6 (0.63)	84 (8.86)	100 (10.55)	26 (2.74)
	Game 1: 2nd Half	899	14 (1.56)	80 (8.90)	97 (10.79)	26 (2.89)
	Game 2: 1st Half	1063	16 (1.51)	104 (9.78)	130 (12.23)	27 (2.54)
	Game 2: 2nd Half	1053	7 (0.66)	93 (8.83)	142 (13.49)	15 (1.42)

APPENDIX E:

TABLES OF RESULTS

Overall League Sample

Means, standard deviations and frequencies of technical indicators with respect to weather conditions as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies			
	Wet		Dry	
	Away	Home	Away	Home
Losses of Control	24.67 ± 4.46 (148)	24.50 ± 6.38 (147)	22.58 ± 4.23 (542)	21.04 ± 5.31 (505)
Tackles	43.83 ± 10.98 (263)	47.33 ± 15.06 (284)	44.46 ± 9.82 (1067)	44.38 ± 10.34 (1065)
Successful Tackles	22.50 ± 7.34 (135)	29.00 ± 9.65 (174)	23.63 ± 6.11 (567)	24.88 ± 6.10 (597)
Unsuccessful Tackles	15.50 ± 5.17 (93)	13.33 ± 7.81 (80)	16.00 ± 5.68 (384)	14.88 ± 4.86 (357)
Crosses	12.17 ± 6.37 (73)	13.83 ± 8.98 (83)	14.50 ± 5.34 (348)	18.92 ± 5.79 (454)*
Successful Crosses	2.17 ± 1.17 (13)	1.83 ± 1.60 (11)	2.79 ± 1.64 (67)	4.38 ± 2.12 (105)*
Unsuccessful Crosses	10.00 ± 5.97 (60)	12.00 ± 7.72 (72)	11.71 ± 4.61 (281)	14.54 ± 4.58 (349)
Dribbles	84.50 ± 31.42 (507)	100.00 ± 41.02 (600)	92.38 ± 24.86 (2217)	100.33 ± 23.73 (2408)
Successful Dribbles	67.50 ± 23.97 (405)	81.50 ± 39.32 (489)	75.96 ± 24.52 (1823)	84.08 ± 23.90 (2018)
Unsuccessful Dribbles	17.00 ± 7.95 (102)	18.50 ± 2.66 (111)	16.42 ± 4.92 (394)	16.25 ± 5.41 (390)
Interceptions	46.83 ± 11.41 (281)	43.00 ± 11.93 (258)	39.08 ± 9.63 (938)	35.00 ± 7.20 (840)
Corners	3.50 ± 1.64 (21)	5.00 ± 2.53 (30)	5.17 ± 2.10 (124)	6.21 ± 2.84 (149)
Successful Corners	2.00 ± 1.10 (12)	2.33 ± 1.63 (14)	2.08 ± 1.44 (50)	2.25 ± 1.57 (54)
Unsuccessful Corners	1.50 ± 1.38 (9)	2.67 ± 1.37 (16)	3.08 ± 1.67 (74)	3.96 ± 1.97 (95)
Goal Kicks	8.83 ± 2.64 (53)	6.83 ± 2.79 (41)	10.29 ± 4.63 (247)	8.00 ± 3.36 (192)
Successful Goal Kicks	4.00 ± 1.90 (24)	2.67 ± 1.21 (16)	4.33 ± 2.53 (104)	3.00 ± 1.89 (72)
Unsuccessful Goal Kicks	4.83 ± 2.64 (29)	4.17 ± 2.14 (25)	5.96 ± 3.51 (143)	5.00 ± 2.50 (120)
Offsides	5.17 ± 1.17 (31)	2.17 ± 1.72 (13)*	3.08 ± 2.15 (74)	3.33 ± 2.76 (80)
Tackled	21.50 ± 8.02 (129)	16.83 ± 5.19 (101)	18.29 ± 4.31 (439)	16.88 ± 4.80 (405)
Gk Kick Distribution	5.67 ± 3.50 (34)	3.50 ± 2.07 (21)	4.79 ± 3.30 (115)	5.33 ± 4.00 (128)
Gk Arm Distribution	4.50 ± 1.87 (27)	3.83 ± 3.87 (23)	5.33 ± 3.24 (128)	4.92 ± 2.95 (118)
Aerial Challenges	63.67 ± 23.54 (382)	63.67 ± 23.54 (382)	69.04 ± 14.80 (1657)	69.04 ± 14.80 (1657)
Successful Aerial Challenges	28.33 ± 10.61 (170)	28.67 ± 9.87 (172)	31.88 ± 7.59 (765)	30.08 ± 8.62 (722)
Yellow Cards	2.17 ± 1.47 (13)	1.83 ± 1.17 (11)	1.63 ± 1.17 (99)	1.54 ± 1.18 (86)
Red Cards	0.17 ± 0.41 (1)	0.33 ± 0.82 (2)	0.08 ± 0.28 (2)	0.17 ± 0.38 (4)
Free Kicks	16.50 ± 4.85 (99)	18.50 ± 6.38 (111)	15.50 ± 4.95 (372)	14.83 ± 4.81 (356)
Successful Free Kicks	9.83 ± 4.26 (59)	8.17 ± 3.25 (49)	8.38 ± 4.59 (201)	8.21 ± 2.78 (197)
Unsuccessful Free Kicks	6.67 ± 3.39 (40)	10.33 ± 6.80 (62)	7.13 ± 3.21 (171)	6.63 ± 3.55 (159)

Passes	344.00 ± 90.32 (2064)	352.00 ± 110.99 (2113)	334.21 ± 93.30 (8021)	352.92 ± 88.77 (8470)
Successful Passes	262.33 ± 78.55 (1574)	265.67 ± 98.39 (1594)	260.46 ± 87.75 (6251)	272.38 ± 83.10 (6537)
Unsuccessful Passes	81.67 ± 15.71 (490)	86.50 ± 18.97 (519)	73.75 ± 10.27 (1770)	80.54 ± 9.49 (1933)*
Shots	9.00 ± 3.10 (54)	14.50 ± 5.68 (87)	12.75 ± 4.32 (306)	14.75 ± 4.57 (354)
Goals	1.50 ± 1.05 (9)	1.17 ± 2.04 (7)	1.58 ± 1.50 (38)	1.29 ± 1.16 (31)
On-Target Shots	3.50 ± 1.22 (21)	4.17 ± 4.96 (25)	5.08 ± 2.36 (122)	5.21 ± 2.21 (125)
Off-Target Shots	3.17 ± 2.79 (19)	7.17 ± 3.76 (43)	5.21 ± 2.77 (125)	6.42 ± 2.98 (154)
Blocked Shots	2.33 ± 2.58 (14)	3.17 ± 2.56 (19)	2.46 ± 1.72 (59)	3.13 ± 2.19 (75)
Clearances	48.50 ± 18.10 (291)	29.30 ± 11.60 (176)*	46.21 ± 12.10 (1109)	41.21 ± 13.10 (989)
Successful Clearances	40.33 ± 15.64 (242)	25.67 ± 9.42 (154)*	38.54 ± 10.33 (925)	34.83 ± 10.89 (836)
Unsuccessful Clearances	8.17 ± 2.79 (49)	3.67 ± 2.80 (22)*	7.67 ± 2.93 (184)	6.38 ± 3.32 (153)
Fouls Committed	15.00 ± 5.25 (90)	15.17 ± 4.26 (91)	14.08 ± 5.22 (338)	14.33 ± 4.46 (344)
Fouls Received	14.83 ± 3.97 (89)	14.83 ± 5.19 (89)	13.88 ± 4.33 (333)	13.21 ± 4.63 (317)
Easy Passes	122.33 ± 40.13 (734)	127.17 ± 64.96 (763)	129.00 ± 55.45 (3096)	133.33 ± 51.74 (3200)
Difficult Passes	152.67 ± 45.26 (916)	152.67 ± 37.79 (916)	135.13 ± 31.92 (3243)	143.13 ± 32.82 (3435)
Very Difficult Passes	66.67 ± 7.81 (400)	69.00 ± 23.88 (414)	67.79 ± 15.53 (1627)	74.13 ± 12.70 (1779)
Forward Passes	199.83 ± 50.87 (1199)	209.00 ± 60.27 (1254)	194.13 ± 46.19 (4659)	207.71 ± 48.35 (4985)
Sideways Passes	57.33 ± 24.32 (344)	57.50 ± 25.60 (345)	56.63 ± 24.45 (1359)	58.54 ± 23.82 (1405)
Backward Passes	86.83 ± 19.51 (521)	85.67 ± 26.52 (514)	83.46 ± 26.35 (2003)	86.67 ± 21.43 (2080)

*$p<0.05$; **$p<0.01$

Means, standard deviations and frequencies of technical indicators with respect to kick-off times as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies					
	Morning		Afternoon		Evening	
	Away	Home	Away	Home	Away	Home
Losses of Control	23.00 ± 3.67 (207)	21.56 ± 4.03 (194)	23.27 ± 3.72 (256)	21.00 ± 3.97 (231)	22.70 ± 5.62 (227)	22.70 ± 8.21 (227)
Tackles	47.67 ± 11.07 (429)	43.89 ± 11.38 (395)	44.91 ± 7.06 (494)	51.45 ± 8.85 (566)*	40.70 ± 11.10 (407)	38.80 ± 10.33 (388)
Successful Tackles	27.33 ± 6.76 (246)	24.44 ± 6.25 (220)	23.27 ± 5.61 (256)	29.09 ± 7.34 (320)*	20.00 ± 4.69 (200)	23.10 ± 6.19 (231)*
Unsuccessful Tackles	16.11 ± 6.94 (145)	16.11 ± 6.39 (145)	16.27 ± 4.36 (179)	16.09 ± 4.25 (177)	15.30 ± 5.74 (153)	11.50 ± 4.84 (115)*
Crosses	12.00 ± 3.77 (108)	19.22 ± 6.57 (173)	15.18 ± 6.60 (167)	17.91 ± 5.39 (197)	14.60 ± 5.58 (146)	16.70 ± 8.37 (167)
Successful Crosses	2.22 ± 1.30 (20)	4.00 ± 2.00 (36)*	2.91 ± 1.87 (32)	3.64 ± 2.11 (40)	2.80 ± 1.48 (28)	4.00 ± 2.79 (40)
Unsuccessful Crosses	9.78 ± 3.11 (88)	15.22 ± 5.40 (137)*	12.27 ± 6.03 (135)	14.27 ± 4.52 (157)	11.80 ± 4.78 (118)	12.70 ± 6.17 (127)
Dribbles	86.00 ± 20.14 (774)	113.44 ± 21.77 (1021)	103.55 ± 29.29 (1139)	101.45 ± 28.26 (1116)	81.10 ± 22.82 (811)	87.10 ± 26.41 (871)
Successful Dribbles	70.00 ± 19.74 (630)	97.33 ± 23.49 (876)	84.45 ± 27.49 (929)	84.55 ± 26.83 (930)	66.90 ± 22.41 (669)	70.10 ± 25.29 (701)
Unsuccessful Dribbles	16.00 ± 6.00 (144)	16.11 ± 5.06 (145)	19.09 ± 5.07 (210)	16.91 ± 3.30 (186)	14.20 ± 4.73 (142)	17.00 ± 6.78 (170)
Interceptions	43.44 ± 8.53 (391)	34.67 ± 8.66 (312)	42.27 ± 12.33 (465)	40.27 ± 6.07 (443)	36.30 ± 8.69 (363)	34.30 ± 10.58 (343)
Corners	4.22 ± 1.64 (38)	6.78 ± 3.31 (61)*	5.73 ± 2.69 (63)	5.64 ± 2.80 (62)	4.40 ± 1.51 (44)	5.60 ± 2.37 (56)
Successful Corners	1.89 ± 1.05 (17)	2.33 ± 1.41 (21)	2.91 ± 1.58 (32)	2.18 ± 2.04 (24)	1.30 ± 0.82 (13)	2.30 ± 1.16 (23)
Unsuccessful Corners	2.33 ± 1.41 (21)	4.44 ± 2.51 (40)*	2.82 ± 1.83 (31)	3.45 ± 1.63 (38)	3.10 ± 1.91 (31)	3.30 ± 1.57 (33)
Goal Kicks	10.78 ± 5.78 (97)	6.56 ± 3.00 (59)	8.55 ± 2.81 (94)	8.91 ± 3.75 (98)	10.90 ± 4.15 (109)	7.60 ± 2.67 (76)
Successful Goal Kicks	3.89 ± 3.33 (35)	2.56 ± 1.33 (23)	3.73 ± 1.79 (41)	3.91 ± 2.17 (43)	5.20 ± 1.87 (52)	2.20 ± 1.14 (22)
Unsuccessful Goal Kicks	6.89 ± 3.02 (62)	4.00 ± 2.12 (36)*	4.82 ± 3.06 (53)	5.00 ± 2.45 (55)	5.70 ± 3.89 (57)	5.40 ± 2.67 (54)
Offsides	3.11 ± 2.37 (28)	3.00 ± 2.06 (27)	3.73 ± 1.98 (41)	3.36 ± 2.54 (37)	3.60 ± 2.37 (36)	2.90 ± 3.28 (29)
Tackled	19.00 ± 5.48 (171)	19.56 ± 3.81 (176)	21.00 ± 5.20 (231)	17.18 ± 4.51 (189)	16.60 ± 4.55 (166)	14.10 ± 4.75 (141)
Gk Kick Distribution	5.22 ± 4.09 (47)	3.78 ± 2.54 (34)	4.27 ± 2.94 (47)	5.36 ± 4.01 (59)	5.50 ± 3.10 (55)	5.60 ± 4.40 (56)
Gk Arm Distribution	4.67 ± 2.83 (42)	4.67 ± 2.12 (42)	6.00 ± 3.07 (66)	4.36 ± 2.69 (48)	4.70 ± 3.20 (47)	5.10 ± 4.33 (51)
Aerial Challenges	66.78 ± 10.28 (601)	66.78 ± 10.28 (601)	65.64 ± 22.24 (722)	65.64 ± 22.24 (722)	71.60 ± 14.71 (716)	71.60 ± 14.71 (716)
Successful Aerial Challenges	31.22 ± 7.87 (281)	29.78 ± 6.61 (268)	30.18 ± 8.28 (332)	28.45 ± 11.10 (313)	32.20 ± 9.11 (322)	31.30 ± 8.00 (313)
Yellow Cards	1.11 ± 1.05 (10)	1.33 ± 1.50 (12)	1.91 ± 1.58 (21)	1.82 ± 1.08 (20)	2.10 ± 0.74 (21)	1.60 ± 0.97 (16)
Red Cards	0	0	0.09 ± 0.30 (1)	0.09 ± 0.30 (1)	0.20 ± 0.42 (2)	0.50 ± 0.71 (5)
Free Kicks	12.89 ± 4.46 (116)	13.56 ± 5.59 (122)	17.45 ± 4.46 (192)	15.09 ± 4.11 (166)	16.30 ± 4.95 (163)	17.90 ± 5.65 (179)
Successful Free Kicks	5.44 ± 1.74 (49)	8.78 ± 3.03 (79)*	11.55 ± 3.70 (127)	7.73 ± 2.00 (85)*	8.40 ± 5.15 (84)	8.20 ± 3.52 (82)
Unsuccessful Free Kicks	7.44 ± 3.84 (67)	4.78 ± 3.19 (43)*	5.91 ± 3.02 (65)	7.36 ± 4.06 (81)	7.90 ± 2.64 (79)	9.70 ± 5.01 (97)
Passes	332.11 ± 98.95 (2989)	415.11 ± 69.13 (3736)	371.64 ± 69.76 (4088)	339.91 ± 85.43 (3739)	300.80 ± 98.86 (3008)	310.80 ± 92.62 (3108)

Successful Passes	258.44 ± 91.17 (2326)	328.22 ± 68.18 (2954)	292.27 ± 73.05 (3215)	256.27 ± 77.58 (2819)	228.40 ± 86.16 (2284)	235.80 ± 85.51 (2358)
Unsuccessful Passes	73.67 ± 9.59 (663)	86.89 ± 7.30 (782)*	79.36 ± 9.04 (873)	83.64 ± 14.49 (920)	72.40 ± 15.33 (724)	75.00 ± 9.33 (750)
Shots	10.33 ± 4.00 (93)	14.22 ± 4.02 (128)*	14.00 ± 4.71 (154)	14.09 ± 5.79 (155)	11.30 ± 3.65 (113)	15.80 ± 4.21 (158)
Goals	2.22 ± 1.79 (20)	1.67 ± 1.32 (15)	1.27 ± 1.01 (14)	1.18 ± 1.54 (13)	1.30 ± 1.34 (13)	1.00 ± 1.15 (10)
On-Target Shots	5.00 ± 3.39 (45)	4.78 ± 1.72 (43)	5.36 ± 1.63 (59)	5.27 ± 3.72 (58)	3.90 ± 1.37 (39)	4.90 ± 2.92 (49)
Off-Target Shots	3.89 ± 2.20 (35)	6.33 ± 3.16 (57)	6.18 ± 3.34 (68)	5.18 ± 1.72 (57)	4.10 ± 2.38 (41)	8.30 ± 3.59 (83)
Blocked Shots	1.44 ± 1.33 (13)	3.11 ± 1.90 (28)*	2.45 ± 2.11 (27)	3.64 ± 2.69 (40)	3.30 ± 1.70 (33)	2.60 ± 2.01 (26)
Clearances	46.89 ± 10.03 (422)	40.78 ± 11.28 (367)	39.91 ± 7.87 (439)	35.55 ± 16.85 (391)	53.90 ± 16.93 (539)	40.70 ± 11.81 (407)
Successful Clearances	38.56 ± 7.83 (347)	33.67 ± 9.67 (303)	33.27 ± 7.42 (366)	31.27 ± 14.48 (344)	45.40 ± 14.46 (454)	34.30 ± 8.67 (343)
Unsuccessful Clearances	8.33 ± 3.00 (75)	7.11 ± 2.32 (64)	6.64 ± 2.38 (73)	4.27 ± 2.87 (47)	8.50 ± 3.10 (85)	6.40 ± 4.20 (64)
Fouls Committed	12.67 ± 5.61 (114)	11.44 ± 3.50 (103)	13.82 ± 4.31 (152)	16.45 ± 4.50 (181)*	16.20 ± 5.45 (162)	15.10 ± 3.67 (151)
Fouls Received	11.00 ± 3.43 (99)	12.11 ± 4.91 (109)	16.06 ± 4.21 (177)	13.00 ± 4.10 (143)*	14.60 ± 3.50 (146)	15.40 ± 4.99 (154)
Easy Passes	127.00 ± 49.88 (1143)	167.78 ± 47.80 (1510)	149.09 ± 51.48 (1640)	125.64 ± 50.62 (1382)	104.70 ± 49.71 (1047)	107.10 ± 48.06 (1071)
Difficult Passes	134.33 ± 39.59 (1209)	168.56 ± 20.38 (1517)	155.09 ± 22.37 (1706)	136.82 ± 33.64 (1505)	124.40 ± 37.18 (1244)	132.90 ± 34.19 (1329)
Very Difficult Passes	68.56 ± 16.02 (617)	76.44 ± 11.81 (688)	65.82 ± 9.98 (724)	74.55 ± 15.99 (820)	68.60 ± 17.51 (686)	68.50 ± 17.25 (685)
Forward Passes	189.67 ± 50.53 (1707)	241.56 ± 35.40 (2174)	216.45 ± 29.09 (2381)	202.45 ± 45.19 (2381)	177.00 ± 52.41 (1770)	183.80 ± 52.87 (1838)
Sideways Passes	57.56 ± 24.65 (518)	71.00 ± 22.25 (639)	63.91 ± 21.23 (703)	53.73 ± 21.33 (591)	48.20 ± 25.91 (482)	52.00 ± 25.26 (520)
Backward Passes	84.89 ± 26.08 (764)	102.56 ± 16.64 (923)	91.27 ± 24.76 (1004)	83.73 ± 21.82 (921)	75.60 ± 23.70 (756)	75.00 ± 19.38 (750)

*$p<0.05$; **$p<0.01$

Means, standard deviations and frequencies of technical indicators with respect to game status as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies					
	Winning		Losing		Drawing	
	Away	Home	Away	Home	Away	Home
Losses of Control	7.03 ± 7.36 (211)	5.07 ± 7.79 (152)	5.60 ± 8.70 (168)	7.37 ± 8.14 (221)	10.37 ± 6.90 (311)	9.30 ± 7.14(279)
Tackles	15.13 ± 16.88 (454)	11.10 ± 15.66 (333)	9.93 ± 14.46 (298)	13.57 ± 15.28 (407)	19.27 ± 11.79 (578)	20.30 ± 15.24 (609)
Successful Tackles	8.33 ± 9.28 (250)	6.50 ± 9.83 (195)	4.87 ± 7.03 (146)	7.80 ± 8.90 (234)	10.20 ± 6.92 (306)	11.40 ± 8.62 (342)
Unsuccessful Tackles	4.90 ± 6.24 (147)	3.53 ± 4.88 (106)	3.83 ± 6.11 (115)	4.47 ± 5.30 (134)	7.17 ± 4.24 (215)	6.57 ± 5.51 (197)
Crosses	3.27 ± 3.92 (98)	2.30 ± 3.92 (69)	3.97 ± 6.22 (119)	7.40 ± 8.22 (222)	6.80 ± 5.73 (204)	8.20 ± 5.68 (246)
Successful Crosses	0.63 ± 1.00 (19)	0.50 ± 0.86 (15)	0.77 ± 1.55 (23)	1.53 ± 1.66 (46)*	1.27 ± 1.31 (38)	1.83 ± 1.51 (55)*
Unsuccessful Crosses	2.63 ± 3.26 (79)	1.80 ± 3.18 (54)	3.20 ± 4.91 (96)	5.87 ± 6.95 (176)	5.53 ± 4.90 (166)	6.37 ± 4.67 (191)
Dribbles	25.93 ± 29.16 (778)	18.50 ± 27.08 (555)	26.00 ± 37.14 (780)	40.30 ± 45.89 (1209)	38.87 ± 30.94 (1166)	41.47 ± 29.35 (1244)
Successful Dribbles	20.53 ± 23.61 (616)	14.67 ± 21.96 (440)	22.07 ± 32.01 (662)	34.40 ± 39.64 (1032)	31.67 ± 25.60 (950)	34.50 ± 25.85 (1035)
Unsuccessful Dribbles	5.40 ± 6.30 (162)	3.83 ± 5.50 (115)	3.93 ± 5.70 (118)	5.90 ± 7.07 (177)	7.20 ± 6.43 (216)	6.97 ± 5.23 (209)
Interceptions	14.23 ± 16.16 (427)	9.30 ± 14.81 (279)	8.13 ± 12.37 (244)	10.80 ± 12.65 (324)	18.27 ± 13.77 (548)	16.50 ± 11.21 (495)
Corners	1.23 ± 1.70 (37)	1.07 ± 2.24 (32)	1.13 ± 1.80 (34)	2.23 ± 2.70 (67)	2.47 ± 2.30 (74)	2.67 ± 2.59 (80)
Successful Corners	0.73 ± 1.44 (22)	0.47 ± 1.14 (14)	0.40 ± 0.72 (12)	0.87 ± 1.11 (26)	0.93 ± 0.98 (28)	0.93 ± 1.23 (28)
Unsuccessful Corners	0.50 ± 0.73 (15)	0.60 ± 1.22 (18)	0.73 ± 1.31 (22)	1.37 ± 1.87 (41)	1.53 ± 1.91 (46)	1.73 ± 1.78 (52)
Goal Kicks	4.67 ± 5.38 (140)	1.97 ± 3.20 (59)*	1.67 ± 2.83 (50)	2.00 ± 2.48 (60)	3.67 ± 2.78 (110)	3.80 ± 3.21 (114)
Successful Goal Kicks	1.83 ± 2.13 (55)	0.60 ± 1.33 (18)*	0.80 ± 1.56 (24)	0.73 ± 1.05 (22)	1.63 ± 1.59 (49)	1.60 ± 1.67 (48)
Unsuccessful Goal Kicks	2.83 ± 3.72 (85)	1.37 ± 2.20 (41)	0.87 ± 1.63 (26)	1.27 ± 1.87 (38)	2.03 ± 1.87 (61)	2.20 ± 2.17 (66)
Offsides	1.30 ± 1.90 (39)	1.03 ± 1.99 (31)	0.90 ± 1.75 (27)	0.87 ± 1.46 (26)	1.30 ± 1.42 (39)	1.20 ± 1.85 (36)
Tackled	5.87 ± 6.69 (176)	3.30 ± 4.97 (99)	5.03 ± 7.53 (151)	6.07 ± 6.80 (182)	8.03 ± 6.29 (241)	7.50 ± 5.25 (225)
Gk Kick Distribution	1.77 ± 2.69 (53)	1.90 ± 3.38 (57)	0.90 ± 1.58 (27)	0.90 ± 1.40 (27)	2.30 ± 2.61 (69)	2.17 ± 2.02 (65)
Gk Arm Distribution	1.47 ± 2.18 (44)	0.97 ± 1.94 (29)	0.97 ± 1.56 (29)	1.73 ± 2.30 (52)	2.73 ± 2.99 (82)	2.00 ± 2.56 (60)
Aerial Challenges	20.80 ± 22.91 (624)	16.27 ± 23.71 (488)	16.27 ± 23.71 (488)	20.80 ± 22.91 (624)	30.90 ± 21.51 (927)	30.90 ± 21.51 (927)
Successful Aerial Challenges	10.07 ± 11.52 (302)	7.57 ± 11.09 (227)	7.00 ± 10.29 (210)	8.83 ± 9.65 (265)	14.10 ± 9.42 (423)	13.40 ± 10.42 (402)
Yellow Cards	0.47 ± 0.73 (14)	0.27 ± 0.58 (8)	0.40 ± 0.77 (12)	0.60 ± 1.00 (18)	0.87 ± 1.07 (26)	0.73 ± 1.01 (22)
Red Cards	0.03 ± 0.18 (1)	0.03 ± 0.18 (1)	0.07 ± 0.25 (2)	0.03 ± 0.18 (1)	0	0.13 ± 0.35 (4)*

Free Kicks	4.20 ± 5.07 (126)	3.83 ± 6.29 (115)	3.93 ± 6.17 (118)	5.20 ± 5.81 (156)	7.57 ± 6.05 (227)	6.53 ± 4.95 (196)
Successful Free Kicks	1.97 ± 2.85 (59)	1.93 ± 3.16 (58)	2.73 ± 4.59 (82)	3.07 ± 3.28 (92)	3.97 ± 3.73 (119)	3.20 ± 2.72 (96)
Unsuccessful Free Kicks	2.23 ± 2.74 (67)	1.90 ± 3.54 (57)	1.20 ± 1.85 (36)	2.13 ± 3.01 (64)	3.60 ± 3.32 (108)	3.33 ± 3.46 (100)
Passes	94.40 ± 106.89 (2832)	71.40 ± 105.10 (2142)	94.37 ± 139.93 (2831)	131.13 ± 147.0 (3934)	147.40 ± 97.89 (4422)	150.23 ± 104.25 (4507)
Successful Passes	72.20 ± 83.05 (2166)	54.20 ± 83.26 (1626)	74.37 ± 111.51 (2231)	102.23 ± 115.90 (3067)	114.27 ± 78.81 (3428)	114.60 ± 82.58 (3438)
Unsuccessful Passes	22.20 ± 26.12 (666)	17.20 ± 24.40 (516)	20.00 ± 29.52 (600)	28.90 ± 31.87 (867)	33.13 ± 20.12 (994)	35.63 ± 24.12 (1069)
Shots	3.53 ± 4.22 (106)	3.20 ± 5.29 (96)	3.20 ± 4.87 (96)	5.27 ± 5.67 (158)	5.27 ± 4.39 (158)	6.23 ± 4.45 (187)
Goals	0.67 ± 1.12 (20)	0.50 ± 0.94 (15)	0.23 ± 0.43 (7)	0.30 ± 0.53 (9)	0.67 ± 0.55 (20)	0.47 ± 0.57 (14)
On-Target Shots	1.73 ± 2.41 (52)	1.30 ± 2.17 (39)	1.03 ± 1.50 (31)	1.53 ± 1.72 (46)	2.00 ± 1.62 (60)	2.17 ± 1.91 (65)
Off-Target Shots	1.33 ± 2.02 (40)	1.23 ± 2.70 (37)	1.23 ± 2.19 (37)	2.70 ± 3.05 (81)*	2.23 ± 2.28 (67)	2.63 ± 2.28 (79)
Blocked Shots	0.47 ± 0.73 (14)	0.67 ± 1.60 (20)	0.93 ± 1.84 (28)	1.03 ± 1.52 (31)	1.03 ± 1.19 (31)	1.43 ± 1.65 (43)
Clearances	17.50 ± 17.98 (525)	12.00 ± 18.00 (360)	8.40 ± 13.61 (252)	8.73 ± 9.45 (262)	20.77 ± 14.83 (623)	18.10 ± 13.18 (543)
Successful Clearances	14.60 ± 14.78 (438)	9.97 ± 15.04 (299)	7.10 ± 11.57 (213)	7.77 ± 8.41 (233)	17.20 ± 12.16 (516)	15.27 ± 11.13 (458)
Unsuccessful Clearances	2.90 ± 3.57 (87)	2.03 ± 3.45 (61)	1.30 ± 2.23 (39)	0.97 ± 1.40 (29)	3.57 ± 3.05 (107)	2.83 ± 2.52 (85)
Fouls Committed	4.63 ± 5.20 (139)	3.57 ± 5.50 (107)	3.60 ± 5.72 (108)	3.80 ± 4.54 (114)	6.03 ± 4.69 (181)	7.13 ± 5.69 (214)*
Fouls Received	3.80 ± 4.48 (114)	3.53 ± 5.69 (106)	3.43 ± 5.24 (103)	4.43 ± 4.88 (133)	6.83 ± 5.53 (205)	5.57 ± 4.38 (167)*
Easy Passes	34.10 ± 41.55 (1023)	25.70 ± 40.39 (771)	36.70 ± 55.63 (1101)	52.23 ± 63.97 (1567)	56.87 ± 43.40 (1706)	54.87 ± 42.11 (1625)
Difficult Passes	40.27 ± 45.35 (1208)	30.13 ± 44.36 (904)	38.03 ± 56.89 (1141)	52.50 ± 57.47 (1575)	60.33 ± 40.75 (1810)	62.40 ± 43.30 (1872)
Very Difficult Passes	19.33 ± 21.39 (580)	15.20 ± 22.24 (456)	18.80 ± 28.03 (564)	25.53 ± 28.34 (766)	29.43 ± 17.28 (883)	32.37 ± 21.50 (971)
Forward Passes	55.67 ± 62.90 (1670)	41.63 ± 60.45 (1249)	55.57 ± 81.63 (1667)	77.07 ± 86.13 (2312)	84.03 ± 56.55 (2521)	89.27 ± 63.17 (2678)
Sideways Passes	14.10 ± 16.47 (423)	11.77 ± 19.69 (353)	16.87 ± 26.45 (506)	22.73 ± 26.70 (682)	25.80 ± 19.26 (774)	23.83 ± 18.11 (715)
Backward Passes	24.63 ± 28.61 (739)	18.00 ± 26.16 (540)	21.93 ± 32.63 (658)	31.33 ± 35.03 (940)	37.57 ± 24.29 (1127)	37.13 ± 24.97 (1114)

*$p<0.05$; **$p<0.01$

Case Study Sample

Means, standard deviations and frequencies of technical indicators with respect to weather conditions and game location.

Performance Indicators	Means, Standard Deviations and Frequencies			
	Wet		Dry	
	Team Away	Team Home	Team Away	Team Home
Loss of Control	26	20	20.75 ± 5.95 (166)	17.00 ± 3.24 (85)
Tackles	51	50	40.00 ± 7.87 (320)	44.60 ± 11.15 (223)
Successful Tackles	33	27	24.25 ± 3.15 (194)	25.40 ± 5.37 (127)
Unsuccessful Tackles	12	19	11.88 ± 7.59 (95)	13.20 ± 5.50 (66)
Crosses	11	22	14.75 ± 5.73 (118)	24.60 ± 10.83 (123)
Successful Crosses	4	2	2.75 ± 1.28 (22)	6.40 ± 4.88 (32)*
Unsuccessful Crosses	7	20	12.00 ± 5.07 (96)	18.20 ± 6.72 (91)
Dribbles	70	114	116.25 ± 27.14 (930)	115.40 ± 23.05 (577)
Successful Dribbles	57	96	101.50 ± 26.61 (812)	102.80 ± 20.34 (514)
Unsuccessful Dribbles	13	18	14.75 ± 4.46 (118)	12.60 ± 3.36 (63)
Interceptions	35	37	39.25 ± 7.01 (314)	31.80 ± 7.60 (159)
Corners	2	7	5.00 ± 3.02 (40)	8.00 ± 2.83 (40)
Successful Corners	1	4	2.25 ± 1.67 (18)	3.40 ± 1.14 (17)
Unsuccessful Corners	1	3	2.75 ± 1.98 (22)	4.60 ± 2.07 (23)
Goal Kicks	7	3	8.63 ± 2.13 (69)	7.20 ± 2.59 (36)
Successful Goal Kicks	6	2	2.63 ± 1.85 (21)	2.00 ± 0.71 (10)
Unsuccessful Goal Kicks	1	1	6.00 ± 2.33 (48)	5.20 ± 2.05 (26)
Offsides	4	4	3.00 ± 1.69 (24)	0.80 ± 0.84 (4)**
Tackled	15	17	18.50 ± 4.11 (148)	16.80 ± 6.30 (84)
Gk Kick Distribution	3	0	1.88 ± 1.25 (15)	1.60 ± 1.14 (8)
Gk Arm Distribution	6	10	9.00 ± 1.51 (72)	7.00 ± 3.81 (35)
Aerial Challenges	39	61	62.00 ± 12.85 (496)	66.00 ± 5.70 (330)
Successful Aerial Challenges	19	30	28.00 ± 3.59 (224)	32.80 ± 4.02 (164)
Yellow Cards	3	3	0.75 ± 0.71 (6)	1.00 ± 1.22 (5)
Free Kicks	12	18	11.75 ± 1.67 (94)	11.80 ± 2.39 (59)
Successful Free Kicks	9	10	7.25 ± 1.83 (58)	7.60 ± 2.88 (38)
Unsuccessful Free Kicks	3	8	4.50 ± 1.77 (36)	4.20 ± 2.28 (21)
Passes	373	468	431.38 ± 116.34 (3451)	432.40 ± 54.45 (2162)
Successful Passes	288	354	355.63 ± 113.25 (2845)	350.00 ± 53.87 (1750)
Unsuccessful Passes	85	114	75.75 ± 10.55 (606)	82.40 ± 10.45 (412)
Shots	6	16	12.63 ± 4.78 (101)	16.80 ± 4.97 (84)
Goals	1	0	2.50 ± 1.60 (20)	2.00 ± 1.58 (10)
On-Target Shots	2	3	6.25 ± 3.11 (50)	5.20 ± 1.92 (26)
Off-Target Shots	1	8	4.50 ± 2.07 (36)	7.40 ± 3.71 (37)
Blocked Shots	3	5	1.88 ± 1.46 (15)	4.20 ± 1.91 (21)
Clearances	49	13	44.50 ± 9.50 (356)	35.80 ± 5.22 (179)
Successful Clearances	41	11	38.13 ± 7.66 (305)	30.00 ± 6.04 (150)
Unsuccessful Clearances	8	2	6.38 ± 2.50 (51)	5.80 ± 3.42 (29)
Fouls Committed	19	12	11.13 ± 4.02 (89)	13.80 ± 4.76 (69)
Fouls Received	11	14	10.25 ± 2.05 (82)	10.60 ± 2.70 (53)
Easy Passes	149	190	185.75 ± 71.90 (1486)	175.20 ± 32.20 (876)
Difficult Passes	143	162	158.88 ± 41.01 (1271)	164.40 ± 24.74 (822)
Very Difficult Passes	75	114	83.38 ± 14.88 (667)	91.20 ± 9.52 (456)
Forward Passes	211	268	233.63 ± 52.42 (1869)	253.40 ± 41.72 (1267)
Sideways Passes	60	82	76.25 ± 30.64 (610)	78.00 ± 9.59 (390)
Backward Passes	102	118	121.50 ± 37.26 (972)	101.00 ± 13.71 (505)

*$p<0.05$; **$p<0.01$

Means, standard deviations and frequencies of technical indicators with respect to kick-off times as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies					
	Morning		Afternoon		Evening	
	Team Away	Team Home	Team Away	Team Home	Team Away	Team Home
Loss of Control	24.00 ± 3.61 (72)	18.33 ± 2.31 (51)	22.20 ± 4.15 (111)	20	9	15.00 ± 4.24 (30)
Tackles	41.33 ± 13.01 (124)	46.00 ± 14.11 (138)	41.20 ±7.12 (206)	50	41	42.50 ± 9.19 (85)
Successful Tackles	22.67 ± 4.16 (68)	26.67 ± 7.02 (80)	26.20 ± 4.21 (131)	27	28	23.50 ± 2.12 (47)
Unsuccessful Tackles	16.00 ± 10.15 (48)	14.70 ± 7.00 (42)	11.00 ± 4.47 (55)	19	4	12.00 ± 4.24 (24)
Crosses	14.33 ± 1.15 (43)	28.67 ± 10.79 (86)	15.00 ± 7.52 (75)	22	11	18.50 ± 10.61 (37)
Successful Crosses	1.67 ± 0.58 (5)	8.00 ± 6.08 (24)	3.60 ± 1.14 (18)	2	3	4.00 ± 1.41 (8)
Unsuccessful Crosses	12.67 ± 0.58 (38)	20.67 ± 5.03 (62)	11.40 ± 6.80 (57)	20	8	14.50 ± 9.19 (29)
Dribbles	97.00 ± 22.61 (291)	123.33 ± 17.90 (86)	123.20 ± 33.09 (616)	114	93	103.50 ± 31.82 (207)
Successful Dribbles	83.00 ± 20.07 (249)	109.33 ± 15.04 (328)	108.80 ± 32.35 (544)	96	76	93.00 ± 29.70 (186)
Unsuccessful Dribbles	14.00 ± 7.81 (42)	14.00 ± 3.61 (42)	14.40 ± 1.82 (72)	18	17	10.50 ± 2.12 (21)
Interceptions	40.33 ± 10.79 (121)	34.00 ± 9.85 (102)	38.80 ± 4.92 (194)	37	34	28.50 ± 0.71 (57)
Corners	4.00 ± 2.65 (12)	7.67 ± 3.06 (23)	5.60 ± 3.36 (28)	7	2	8.50 ± 3.54 (17)
Successful Corners	2.33 ± 1.53 (7)	3.33 ± 1.53 (10)	2.20 ± 1.92 (11)	4	1	3.50 ± 0.71 (7)
Unsuccessful Corners	1.67 ± 2.08 (5)	4.33 ± 2.08 (13)	3.40 ± 1.82 (17)	3	1	5.00 ± 2.83 (10)
Goal Kicks	7.33 ± 2.52 (22)	7.33 ± 3.06 (22)	9.40 ± 1.67 (47)	3	7	7.00 ± 2.83 (14)
Successful Goal Kicks	2.67 ± 0.58 (8)	2.00 ± 1.00 (6)	3.80 ± 2.28 (19)	2	0	2.00 ± 0.00 (4)
Unsuccessful Goal Kicks	4.67 ± 2.08 (14)	5.33 ± 2.08 (16)	5.60 ± 3.44 (28)	1	7	5.00 ± 2.83 (10)
Offsides	4.00 ± 2.65 (12)	1.00 ± 1.00 (3)	2.60 ± 0.89 (13)	4	3	0.50 ± 0.71 (1)
Tackled	18.33 ± 6.43 (55)	19.00 ± 4.36 (57)	17.60 ± 3.21 (88)	17	20	13.50 ± 9.19 (27)
Gk Kick Distribution	2.33 ± 1.53 (7)	1.67 ± 0.58 (5)	1.80 ± 1.30 (9)	0	2	1.50 ± 2.12 (3)
Gk Arm Distribution	7.67 ± 0.58 (23)	4.67 ± 2.89 (14)	9.20 ± 2.17 (46)	10	9	10.50 ± 0.71 (21)
Aerial Challenges	63.00 ± 13.75 (189)	64.00 ± 7.00 (192)	60.40 ± 15.55 (302)	61	44	69.00 ± 1.41 (138)
Successful Aerial Challenges	28.33 ± 1.15 (85)	32.67 ± 5.69 (98)	27.40 ± 5.41 (137)	30	21	33.00 ± 0.00 (66)
Yellow Cards	0.33 ± 0.58 (1)	1.00 ± 1.73 (3)	1.20 ± 1.10 (6)	3	2	1.00 ± 0.00 (2)
Free Kicks	11.00 ± 1.00 (33)	11.33 ± 2.08 (34)	12.00 ± 1.87 (60)	18	13	12.50 ± 3.54 (25)
Successful Free Kicks	6.33 ± 1.53 (19)	7.67 ± 2.08 (23)	8.40 ± 1.67 (42)	10	6	7.50 ± 4.95 (15)
Unsuccessful Free Kicks	4.67 ± 0.58 (14)	3.67 ± 2.89 (11)	3.60 ± 1.82 (18)	8	7	5.00 ± 1.41 (10)
Passes	407.00 ± 140.47 (1221)	438.00 ± 51.73 (1314)	468.60 ± 4.56 (2343)	468	260	424.00 ± 79.20 (848)

Successful Passes	325.33 ± 131.42 (976)	354.33 ± 53.59 (1063)	392.20 ± 78.87 (1961)	354	196	343.50 ± 75.66 (687)
Unsuccessful Passes	81.67 ± 9.29 (245)	83.67 ± 14.36 (251)	76.40 ± 10.57 (382)	114	64	80.50 ± 3.54 (161)
Shots	11.33 ± 5.86 (34)	17.67 ± 6.81 (53)	13.40 ± 4.56 (67)	16	6	15.50 ± 0.71 (31)
Goals	3.33 ± 2.52 (10)	2.33 ± 1.53 (7)	1.80 ± 0.84 (9)	0	2	1.50 ± 2.12 (3)
On-Target Shots	6.67 ± 4.73 (20)	5.67 ± 0.58 (17)	6.00 ± 2.35 (30)	3	2	4.50 ± 3.54 (9)
Off-Target Shots	3.67 ± 2.31 (11)	8.33 ± 4.51 (25)	4.60 ± 2.61 (23)	8	3	6.00 ± 2.83 (12)
Blocked Shots	1.00 ± 0.00 (3)	3.67 ± 2.52 (11)	2.80 ± 1.48 (14)	5	1	5.00 ± 0.00 (10)
Clearances	38.00 ± 3.46 (114)	36.33 ± 6.66 (109)	47.80 ± 9.88 (239)	13	52	35.00 ± 4.24 (70)
Successful Clearances	32.67 ± 3.51 (98)	31.33 ± 5.51 (94)	40.40 ± 7.37 (202)	11	46	28.00 ± 8.49 (56)
Unsuccessful Clearances	5.33 ± 1.53 (16)	5.00 ± 3.46 (15)	7.40 ± 2.88 (37)	2	6	7.00 ± 4.24 (14)
Fouls Committed	10.67 ± 6.43 (32)	13.00 ± 6.56 (39)	12.40 ± 4.34 (62)	12	14	15.00 ± 0.00 (30)
Fouls Received	9.00 ± 1.00 (27)	10.33 ± 2.31 (31)	10.40 ± 1.52 (52)	14	14	11.00 ± 4.24 (22)
Easy Passes	163.00 ± 71.86 (489)	175.67 ± 32.87 (527)	212.40 ± 54.20 (1062)	190	84	174.50 ± 44.55 (349)
Difficult Passes	156.00 ± 56.29 (468)	164.00 ± 18.00 (492)	167.80 ± 25.35 (839)	162	107	165.00 ± 42.43 (330)
Very Difficult Passes	84.67 ± 14.50 (254)	97.00 ± 3.61 (291)	83.80 ± 15.71 (419)	114	69	82.50 ± 9.19 (165)
Forward Passes	228.33 ± 69.92 (685)	259.67 ± 27.06 (779)	246.80 ± 30.58 (1234)	268	161	244.00 ± 72.12 (488)
Sideways Passes	71.33 ± 37.07 (214)	74.67 ± 11.93 (224)	85.40 ± 18.47 (427)	82	29	83.00 ± 0.00 (166)
Backward Passes	107.33 ± 33.50 (322)	103.67 ± 18.01 (311)	136.40 ± 29.53 (682)	118	70	97.00 ± 7.07 (194)

*$p<0.05$; **$p<0.01$

Means, standard deviations and frequencies of technical indicators with respect to game status as a function of game location.

Performance Indicators	Means, Standard Deviations and Frequencies					
	Winning		Losing		Drawing	
	Team Away	Team Home	Team Away	Team Home	Team Away	Team Home
Losses of Control	10.00 ± 7.38 (90)	3.67 ± 5.54 (22)	2.33 ± 5.24 (21)	3.83 ± 7.52 (23)	9.00 ± 5.83 (81)	10.00 ± 6.45 (60)
Tackles	17.44 ± 11.66 (157)	9.00 ± 14.83 (54)	3.44 ± 8.53 (31)	9.50 ± 18.95 (57)	20.33 ± 8.12 (183)	27.00 ± 21.09 (162)
Successful Tackles	11.33 ± 7.12 (102)	5.17 ± 8.30 (31)	1.89 ± 4.94 (17)	5.83 ± 10.48 (35)	12.00 ± 6.98 (108)	14.67 ± 11.98 (88)
Unsuccessful Tackles	4.44 ± 5.13 (40)	2.67 ± 4.55 (16)	1.11 ± 2.67 (10)	3.17 ± 7.28 (19)	6.33 ± 3.00 (57)	8.33 ± 7.50 (50)
Crosses	4.78 ± 3.87 (43)	3.50 ± 5.86 (21)	2.33 ± 3.77 (21)	6.83 ± 7.39 (41)	9.89 ± 8.52 (89)	13.83 ± 11.14 (83)
Successful Crosses	1.11 ± 1.05 (10)	0.83 ± 1.33 (5)	0.44 ± 0.73 (4)	1.17 ± 0.98 (7)	3.11 ± 4.99 (28)	3.67 ± 4.68 (22)
Unsuccessful Crosses	3.67 ± 3.46 (33)	2.67 ± 4.55 (16)	1.89 ± 3.30 (17)	5.67 ± 7.06 (34)	6.22 ± 5.76 (56)	10.17 ± 7.28 (61)
Dribbles	51.89 ± 33.68 (467)	22.50 ± 37.65 (135)	12.89 ± 26.44 (116)	27.17 ± 41.20 (163)	46.33 ± 30.68 (417)	65.50 ± 41.14 (393)
Successful Dribbles	44.67 ± 30.12 (402)	19.33 ± 32.27 (116)	11.33 ± 22.29 (102)	23.50 ± 34.67 (141)	40.56 ± 26.81 (365)	58.83 ± 37.11 (353)
Unsuccessful Dribbles	7.22 ± 4.99 (65)	3.17 ± 5.38 (19)	1.56 ± 4.30 (14)	3.67 ± 6.59 (22)	5.78 ± 4.21 (52)	6.67 ± 4.32 (40)
Interceptions	17.11 ± 11.72 (154)	5.33 ± 8.36 (32)*	2.89 ± 5.28 (26)	6.83 ± 13.45 (41)	18.78 ± 9.39 (169)	20.50 ± 13.98 (123)
Corners	2.11 ± 1.54 (19)	2.00 ± 3.63 (12)	0.22 ± 0.44 (2)	1.50 ± 2.35 (9)	2.33 ± 2.87 (21)	4.33 ± 3.44 (26)
Successful Corners	1.22 ± 1.30 (11)	0.83 ± 1.60 (5)	0.11 ± 0.33 (1)	1.00 ± 1.26 (6)	0.78 ± 0.97 (7)	1.67 ± 0.82 (10)
Unsuccessful Corners	0.89 ± 0.93 (8)	1.17 ± 2.04 (7)	0.11 ± 0.33 (1)	0.50 ± 1.22 (3)	1.56 ± 1.94 (14)	2.67 ± 2.73 (16)
Goal Kicks	4.56 ± 3.50 (41)	1.50 ± 2.81 (9)	0.33 ± 1.00 (3)	0.50 ± 1.22 (3)	3.56 ± 2.65 (32)	4.50 ± 3.89 (27)
Successful Goal Kicks	1.33 ± 1.58 (12)	0.17 ± 0.41 (1)	0.11 ± 0.33 (1)	0.33 ± 0.82 (2)	1.56 ± 1.94 (14)	1.50 ± 1.05 (9)
Unsuccessful Goal Kicks	3.22 ± 2.68 (29)	1.33 ± 2.42 (8)	0.22 ± 0.67 (2)	0.17 ± 0.41 (1)	2.00 ± 2.29 (18)	3.00 ± 2.90 (18)
Offsides	1.56 ± 1.67 (14)	0.17 ± 0.41 (1)	0.33 ± 0.50 (3)	0.67 ± 1.63 (4)	1.22 ± 0.83 (11)	0.50 ± 0.84 (3)
Tackled	8.78 ± 6.26 (79)	2.67 ± 5.20 (16)*	2.00 ± 5.27 (18)	3.83 ± 5.64 (23)	7.33 ± 3.97 (66)	10.33 ± 6.59 (62)
Gk Kick Distribution	1.11 ± 1.17 (10)	0.67 ± 1.21 (4)	0	0	0.89 ± 1.36 (8)	0.67 ± 0.82 (4)
Gk Arm Distribution	3.33 ± 2.18 (30)	2.17 ± 3.49 (13)	0.56 ± 1.67 (5)	1.50 ± 3.67 (9)	4.78 ± 2.64 (43)	3.83 ± 3.60 (23)
Aerial Challenges	23.33 ± 15.34 (210)	13.50 ± 21.56 (81)	8.67 ± 18.95 (78)	13.17 ± 22.77 (79)	27.44 ± 15.91 (247)	38.50 ± 26.51 (231)
Successful Aerial Challenges	11.22 ± 7.68 (101)	6.67 ± 10.33 (40)	3.56 ± 7.84 (32)	6.67 ± 11.17 (40)	12.22 ± 7.43 (110)	19.00 ± 13.16 (114)
Yellow Cards	0.44 ± 0.53 (4)	0	0	0.33 ± 0.82 (2)	0.56 ± 1.01 (5)	1.00 ± 1.10 (6)
Free Kicks	5.00 ± 3.54 (45)	2.50 ± 3.99 (15)	1.56 ± 3.24 (14)	3.83 ± 6.74 (23)	5.22 ± 3.15 (47)	6.50 ± 5.39 (39)
Successful Free Kicks	3.56 ± 2.60 (32)	1.33 ± 2.16 (8)	0.89 ± 1.83 (8)	2.50 ± 3.73 (15)	3.00 ± 1.87 (27)	4.17 ± 3.54 (25)
Unsuccessful Free Kicks	1.44 ± 1.13 (13)	1.17 ± 2.40 (7)	0.67 ± 1.41 (6)	1.33 ± 3.27 (8)	2.22 ± 2.05 (20)	2.33 ± 2.73 (14)
Passes	184.00 ± 119.98 (1656)	99.17 ± 155.32 (595)	57.44 ± 125.30 (517)	100.00 ± 170.87 (600)	183.44 ± 100.23 (1651)	239.17 ± 166.00 (1435)

Successful Passes	151.22 ± 103.42 (1361)	82.83 ± 13.35 (497)	48.44 ± 106.19 (436)	76.83 ± 127.33 (461)	148.44 ± 89.99 (1336)	191.00 ± 133.73 (1146)
Unsuccessful Passes	32.78 ± 22.30 (295)	16.33 ± 25.69 (98)	9.00 ± 19.14 (81)	23.17 ± 43.76 (139)	35.00 ± 14.12 (315)	48.17 ± 33.96 (289)
Shots	5.78 ± 4.35 (52)	4.17 ± 6.65 (25)	1.89 ± 3.14 (17)	3.83 ± 5.46 (23)	4.22 ± 3.31 (38)	8.67 ± 5.54 (52)
Goals	1.00 ± 1.32 (9)	0.67 ± 1.03 (4)	0.44 ± 0.53 (4)	0.33 ± 0.52 (2)	0.89 ± 0.33 (8)	0.67 ± 0.82 (4)
On-Target Shots	3.44 ± 2.74 (31)	1.17 ± 1.83 (7)	0.89 ± 1.27 (8)	0.83 ± 0.75 (5)	1.44 ± 1.13 (13)	2.83 ± 1.72 (17)
Off-Target Shots	1.56 ± 1.42 (14)	1.50 ± 2.81 (9)	0.67 ± 1.66 (6)	1.83 ± 2.79 (11)	1.89 ± 1.90 (17)	4.17 ± 3.66 (25)
Blocked Shots	0.78 ± 0.97 (7)	1.50 ± 2.35 (9)	0.33 ± 0.50 (3)	1.17 ± 2.04 (7)	0.89 ± 0.78 (8)	1.67 ± 1.86 (10)
Clearances	19.56 ± 11.41 (176)	8.67 ± 13.06 (52)	3.56 ± 7.49 (32)	2.17 ± 3.92 (13)	21.89 ± 14.03 (197)	21.17 ± 17.24 (127)
Successful Clearances	16.67 ± 9.55 (150)	6.33 ± 9.27 (38)	3.44 ± 7.16 (31)	1.83 ± 3.13 (11)	18.33 ± 11.17 (165)	18.67 ± 15.36 (112)
Unsuccessful Clearances	2.89 ± 2.20 (26)	2.33 ± 3.83 (14)	0.11 ± 0.33 (1)	0.33 ± 0.82 (2)	3.56 ± 2.96 (32)	2.50 ± 2.59 (15)
Fouls Committed	5.22 ± 2.91 (47)	2.67 ± 4.55 (16)	1.89 ± 4.65 (17)	1.83 ± 4.02 (11)	4.89 ± 3.76 (44)	9.00 ± 7.32 (54)
Fouls Received	4.11 ± 2.62 (37)	2.17 ± 3.37 (13)	1.11 ± 2.09 (10)	2.83 ± 5.12 (17)	5.11 ± 3.14 (46)	6.17 ± 5.08 (37)
Easy Passes	79.67 ± 58.85 (717)	41.00 ± 65.46 (246)	22.67 ± 50.75 (204)	40.33 ± 68.53 (242)	79.33 ± 48.41 (714)	96.33 ± 68.53 (578)
Difficult Passes	68.11 ± 42.59 (613)	37.00 ± 57.57 (222)	23.67 ± 51.76 (213)	34.67 ± 58.43 (208)	65.33 ± 35.63 (588)	92.33 ± 67.29 (554)
Very Difficult Passes	34.56 ± 22.94 (311)	20.83 ± 32.29 (125)	10.67 ± 21.98 (96)	24.50 ± 43.34 (147)	37.22 ± 19.84 (335)	49.67 ± 33.40 (298)
Forward Passes	99.00 ± 63.06 (891)	54.67 ± 86.62 (328)	32.89 ± 70.20 (296)	59.33 ± 98.82 (356)	99.22 ± 52.19 (893)	141.83 ± 101.56 (851)
Sideways Passes	28.67 ± 19.28 (258)	21.33 ± 33.06 (128)	11.33 ± 26.30 (102)	16.33 ± 30.00 (98)	34.44 ± 24.33 (310)	41.00 ± 28.95 (246)
Backward Passes	56.33 ± 38.94 (507)	23.17 ± 36.20 (139)	13.22 ± 28.86 (119)	24.33 ± 42.09 (146)	49.78 ± 25.36 (448)	56.33 ± 36.62 (338)

*$p<0.05$; **$p<0.01$

APPENDIX F:

STATISTICAL ANALYSIS TABLES

Overall League Sample

Statistical values for the differences between performance indicators as a function of game status (Independent Samples Test with a Kruskal Wallis Test).

Performance Indicators	Mean Rank Winning	Losing	Drawing	Chi-square	df
Tackles	42.67	38.22	55.62	7.190*	2
Successful Tackles	43.68	38.03	54.78	6.392*	2
Unsuccessful Tackles	40.37	39.45	56.68	8.301*	2
Crosses	29.35	49.48	57.67	18.752**	2
Successful Crosses	32.22	49.68	54.60	12.597**	2
Unsuccessful Crosses	29.98	49.33	57.18	17.308**	2
Dribbles	34.95	49.45	52.10	7.495*	2
Successful Dribbles	34.18	49.97	52.35	8.571*	2
Interceptions	43.97	37.00	55.53	7.713*	2
Corners	33.85	46.60	56.06	11.115**	2
Unsuccessful Corners	32.47	47.85	56.18	13.222**	2
Goal Kicks	49.95	33.88	52.67	9.134**	2
Successful Goal Kicks	47.18	36.65	52.67	6.012*	2
Unsuccessful Goal Kicks	51.05	34.03	51.42	8.806*	2
Gk Kick Distribution	47.93	34.13	54.43	9.640**	2
Aerial Challenges	39.83	39.83	56.83	8.482*	2
Successful Aerial Challenges	42.20	38.05	56.25	8.011*	2
Successful Free Kicks	36.08	48.58	51.83	6.123*	2
Unsuccessful Free Kicks	42.80	37.32	56.38	8.558*	2
Passes	34.85	46.90	54.75	8.834*	2
Successful Passes	35.15	47.12	54.23	8.177*	2
Unsuccessful Passes	36.12	44.47	55.92	8.691*	2
Shots	36.78	44.90	54.82	7.199*	2
Goals	48.42	33.47	54.62	12.343**	2
Off-Target Shots	35.25	48.42	52.83	7.474*	2
Blocked Shots	35.63	47.62	53.25	7.493*	2
Clearances	49.92	30.38	56.20	15.944**	2
Successful Clearances	49.45	30.92	56.13	15.015**	2
Unsuccessful Clearances	49.87	30.57	56.07	15.740**	2
Easy Passes	34.95	47.88	53.67	8.075*	2
Difficult Passes	35.83	46.07	54.60	7.763*	2
Very Difficult Passes	35.10	44.53	56.87	10.480**	2
Forward Passes	35.28	47.27	53.95	7.865*	2
Sideways Passes	34.13	47.98	54.38	9.425**	2
Backward Passes	36.43	44.67	55.40	7.955*	2

*$p<0.05$; **$p<0.01$

Case Study Sample

Statistical values for the differences between performance indicators as a function of game status (Independent Samples Test with a Kruskal Wallis Test).

Performance Indicators	Mean Rank Winning	Losing	Drawing	Chi-square	df
Losses of Control	23.93	14.90	30.17	10.584**	2
Tackles	23.33	14.80	30.87	11.528**	2
Successful Tackles	23.67	15.00	30.33	10.606**	2
Unsuccessful Tackles	22.30	14.27	32.43	15.123**	2
Unsuccessful Crosses	20.20	18.93	29.87	6.411*	2
Dribbles	23.40	15.73	29.87	8.876*	2
Successful Dribbles	23.30	15.73	29.97	8.990*	2
Unsuccessful Dribbles	24.73	15.30	28.97	8.802*	2
Interceptions	23.27	14.33	31.40	13.002**	2
Corners	24.27	15.70	29.03	8.670*	2
Unsuccessful Corners	23.80	15.50	29.70	10.620**	2
Goal Kicks	26.20	13.47	29.33	13.701**	2
Successful Goal Kicks	22.77	16.27	29.97	10.234**	2
Unsuccessful Goal Kicks	27.13	13.83	28.03	12.531**	2
Tackled	23.60	15.03	30.37	10.551**	2
Gk Kick Distribution	26.93	16.00	26.07	9.594**	2
Gk Arm Distribution	24.43	13.43	31.13	14.920**	2
Aerial Challenges	22.77	15.30	30.93	10.845**	2
Successful Aerial Challenges	22.77	15.57	30.67	10.121**	2
Free Kicks	23.37	15.73	29.90	9.106*	2
Successful Free Kicks	23.60	16.50	28.90	7.116*	2
Unsuccessful Free Kicks	23.50	16.63	28.87	7.356*	2
Passes	23.47	15.73	29.80	8.728*	2
Successful Passes	23.47	15.93	29.60	8.239*	2
Unsuccessful Passes	22.87	15.50	30.63	10.158**	2
Clearances	25.00	12.77	31.23	15.673**	2
Successful Clearances	24.90	13.17	30.93	14.489**	2
Unsuccessful Clearances	26.07	13.03	29.90	15.193**	2
Fouls Committed	24.37	14.50	30.13	11.412**	2
Fouls Received	23.10	15.33	30.57	10.455**	2
Easy Passes	23.43	15.87	29.70	8.506*	2
Difficult Passes	23.70	15.67	29.63	8.642*	2
Very Difficult Passes	22.97	15.80	30.23	9.236**	2
Forward Passes	23.33	15.83	29.83	8.633*	2
Sideways Passes	22.70	16.17	30.13	8.622*	2
Backward Passes	24.10	15.37	29.53	9.054*	2

*$p<0.05$; **$p<0.01$