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Situational Variables

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SITUATIONAL VARIABLES

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Summary

Notational analysis in sport is used to investigate teams’ and players’ performance across different sports. Research in this area, especially when focussing on the determinants of success, has grown rapidly in the last few years. During this time, the role of a new concept, ‘situational variables’, has emerged. This term includes the different game/situational conditions that may influence performance at a behavioural level. These situational variables need to be analysed in depth to understand their influence in team sports. In order to do so, we have included the main situational conditions that may affect the team’s or player’s performance. These are game location, match status, quality of opposition, game quarter or game period and type of competition. We also address the importance of a combination of these situational variables and their interactive effects. Finally, we suggest directions for further research within this topic and how improved knowledge of situational variables can be used to refine the impact of notational analysis on sports performance.

Game location

Home advantage has been in existence since the dawn of professional sport in the late-nineteenth century and continues to play a significant role in determining the outcome of sporting events. This has been quantified annually since 1872 for the main professional team sports in North America and in England (Pollard and Pollard, 2005). General reviews of the home advantage phenomenon have been made by Courneya and Carron (1992) and Carron et al. (2005). A recent meta-analysis confirms that home advantage exists in a wide variety of sports, both individual and team, and at different levels of play (Jamieson, 2010). The benefits of playing at home appear to be greatest for football (soccer) and rugby. Table 21.1 shows the current home advantage in the five major sports leagues in the USA, as well as the Premier League for football in England. Home advantage was quantified as the proportion of all games that were won by the home team or, where ties are permitted, the proportion of all points. The advantage ranges in North America from 54.1 per cent in ice hockey to 62.7 per cent in soccer, with the Premier League in England also higher than the other sports and similar to the advantage found...
in the other main football leagues of Europe (Pollard and Gómez, 2009). Since a home advantage value of 60 per cent would mean that the home team is averaging 50 per cent more success than the away team, an objective analysis of performance clearly needs to take game location into account. This is not always done. For example, the algorithm from which FIFA calculates its world rankings does not incorporate game location, so that a home win is given the same weight as an away win (Pollard and Stefani, 2007). This is an extraordinary omission, given the prominence that home advantage has always received in football. Home advantage can be magnified or diminished by other factors. For example, it varies greatly between the domestic football leagues of Europe, with teams from Balkan countries having a much higher advantage, while it is lower in northern Europe (Pollard, 2006). Similarly, individual teams show considerable variation, with teams from isolated, ethnically distinct locations tending to see a greater home advantage than teams from large metropolitan areas (Pollard and Gómez, 2009). Crowd size and travel distance have also been shown to modify home advantage in a number of sports.

In addition, analysis of team performance spanning or comparing different time periods needs to allow for the fact that home advantage has declined in most sports over the last two decades.

Turning to non-outcome measures of team performance, several authors have shown that, in football, shots, corners and other offensive performance measures follow a similar pattern to game outcome with regards to home advantage (Carmichael and Thomas, 2005; Poulter, 2007; Seckin and Pollard, 2008). However, similar effects for other measures, such as off-sides and fouls, were less convincing. Tactics and strategies in football have also been investigated, with significant differences found between home and away teams (Tenga et al., 2010; Tucker et al., 2005). In basketball, Gómez et al. (2010) found differences between home and away teams in performance indicators (fouls and turnover percentages) and defensive strategies used in Spanish men’s basketball. Also, in volleyball, Marcelino et al. (2009b) found that numerical indicators for success at attack, serves, reception and set performance were higher for home teams.

There is sparse research with regards to home advantage at the individual player level. In international cricket, Indian spin bowlers such as Kumble and Harbhajan Singh have been shown to have bowling averages that are well over ten runs per wicket better at home than away, a huge difference (Pollard, 2005). In contrast, other elite bowlers worldwide were generally equally effective at home and away. In football, Poulter (2007) has shown that in the Premier League in England game location effects for goal scoring were greater for foreign-born players than for those that were native born.

In summary, there is sufficient evidence to conclude that the performance analyst needs to carefully consider and incorporate the effects of game location when assessing performance both of teams and of individual athletes.

<table>
<thead>
<tr>
<th>Table 21.1</th>
<th>Home advantage in professional sports leagues for the most recent five seasons up to 1 January 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sport</td>
<td>League</td>
</tr>
<tr>
<td>Baseball</td>
<td>MLB</td>
</tr>
<tr>
<td>Basketball</td>
<td>NBA</td>
</tr>
<tr>
<td>American football</td>
<td>NFL</td>
</tr>
<tr>
<td>Ice hockey</td>
<td>NHL</td>
</tr>
<tr>
<td>Football (soccer)</td>
<td>MLS</td>
</tr>
<tr>
<td>Football (soccer)</td>
<td>EPL</td>
</tr>
</tbody>
</table>
Situational variables

Match status

Performance accomplishments are a powerful source of efficacy expectations and such expectations determine the task-related effort that has to be expended (Bandura, 1977). In sport, the match status may be viewed as a measure of performance accomplishment and hence may influence the effort made by a player (O’Donoghue and Tenga, 2001). Match status is determined by whether a team or a player is winning, losing or drawing at the time a particular behaviour is recorded (Bloomfield et al., 2005a, 2005b; Jones et al., 2004; Taylor et al., 2008). According to Bloomfield et al. (2005a), Lago and Martin (2007) and Taylor et al. (2008), the importance of this situational variable is reflected in changes in team and player’s strategies in response to the score-line. For low-scoring team sports like soccer, there are just three major levels of match status to be considered during analysis (team winning, losing or drawing). However, for high-scoring team sports like volleyball, handball or basketball, final scores can be viewed as narrow, intermediate or large margins (Marcelino et al., 2011).

Existing notational analysis has provided information on the effects of match status on player and team performance. For example, it has been demonstrated that soccer players perform less high-intensity activity when winning than when losing (Bloomfield et al., 2005b; Castellano et al., 2011; Lago et al., 2010; Shaw and O’Donoghue, 2004). These results suggest that players do not always use their maximal physical capacity during the match. In fact, given that winning is a comfortable state for a team, it is possible that players assume a ball retention strategy, slowing down the game and resulting in lower speeds (Bloomfield et al., 2005b). On the other hand, when losing, players try to reach their maximal activity in order to draw or win the match. Other studies have considered match status in relation to the tactical aspects of performance. The influence of this factor is reflected in changes in team strategies and tactics as a response to match situations (Taylor et al., 2008). Teams often show a more defensive strategy when winning than when losing, and vice versa. For example, James et al. (2002) and Lago and Martin (2007) found that in soccer successful and unsuccessful teams had longer periods of possession in matches when they were losing than when they were winning. When ahead, teams decreased their possession, suggesting they preferred to play counter-attacking or direct play (that is, move the ball quickly to within scoring range, often using long passes downfield). However, when behind, they increased their possession, suggesting they preferred to control the game by dictating play. Moreover, Lago (2009) demonstrated that time spent in possession of the ball in different zones of the pitch (defensive third, middle third, attacking third) was influenced by match status: when teams were losing, possession of the ball was less in the defensive zone and more in the attacking zone than when winning or drawing.

In volleyball, it has been shown that match status has an effect on tactical indicators and this relationship interacted with quality of opposition (Marcelino et al., 2011). In men’s singles tennis, Scully and O’Donoghue (1999) found that some players reduce the percentage of points where they attack the net once they have achieved a break of serve. Finally, the relationship between match status and technical performances in team sports is still inconclusive. For example, in soccer, Taylor et al. (2008) found that playing at home and winning resulted in a decreased number of aerial challenges, dribbles, losses of control, passes, tackles and times tackled, whereas the frequency of these behaviours increased when playing at home and losing. However, the outcomes of most behaviours were not influenced by the situation variables. In the same way, in volleyball, it has been suggested that technical variables are not affected by situational variables (Eom and Schutz, 1992; Marcelino et al., 2011). Further research is needed in order to clarify the effects of match status on technical performances.

Consideration should also be given to the fact that performance analysis has often tended to aggregate the performances of different players, of different teams and over dif-
different match situations. Study designs of this type may have limitations because these aggregated data sets potentially mask the factors that determine or contribute to each team’s success or failure. It would therefore appear that case studies of performance over a sustained time period may represent a more fruitful approach to analysis, with comparisons between case studies offering specific insight into the characteristics of interest (e.g. Taylor et al., 2008). In this context, the conclusions of prior studies might have to be re-assessed. For example, such a study might be one in which the overall percentage of time spent in different score-line situations was reported in the context of the total match statistics, rather than what individual players or specific teams did in the different score-line situations.

**Quality of opposition**

The opponent level has been considered from different methodological perspectives. For example, teams and players have been categorized as ‘successful’ and ‘unsuccessful’ according to their standings within a particular tournament (Grant et al., 1999), or classified as ‘strong’ or ‘weak’ based on symmetric division of end-of-season classification (O’Donoghue et al., 2008; Taylor et al., 2008). Lago et al. (2010) defined the quality of opposition as the differences in the end-of-season ranking between opposing teams. Recently, team performance has been classified using cluster analysis procedures, which improve the classification by using more valid cut-off values (Sampaio et al., 2010a; Marcelino et al., 2011).

In a previous section, we noted the importance of allowing for the effects of home advantage when assessing performance. Several studies have emphasized the need to adjust for team ability when quantifying the magnitude of home advantage for individual teams in sports such as football (Barnett and Hilditch, 1993; Clarke and Norman, 1995; Pollard and Gómez, 2009) and basketball (Pollard and Gómez, 2007). For example, when the calculation of home advantage is based on the results of games and hence points, a problem arises. If a strong team plays against a weak team, their difference in ability is likely to outweigh the relatively small effect of home advantage in influencing the result. The greater the difference in ability, the more likely the stronger team will be able to win both at home and away and hence mask the effect of home advantage. In comparisons of individual teams in European football and basketball leagues, team ability was quantified for each team each season as its winning percentage (Pollard and Gómez, 2009; Gómez and Pollard, 2011) and regression analysis used to adjust for the effect of team ability. For the performance analyst, the implication is that, when considering the effect of home advantage on performance, the quality of the opponent should also be taken into account.

**Game period**

The game period is also a situational variable of great importance in team sports, as suggested by research considering the critical moments of a game. Bar-Eli and Tracinsky (2000) established that, during such critical moments, players may create a state of psychological crisis that decreases their effective performance. The coach then needs to break up an opponent’s momentum so that players can return to their previous performance levels during these critical periods of the game. In this way, Bar-Eli and Tenenbaum (1988) found that, during basketball and handball games, there were three psychologically meaningful phases of each half: a beginning, main and end phase. In particular, there is research identifying the end of a game (the last five minutes) as being the most critical (Bar-Eli and Tracinsky, 2000; Mechikoff et al., 1990; Kozar et al., 1993; Navarro et al., 2009). According to these authors, during the last minutes of
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A game a decrease in players’ quality of decision making may be expected. Recently, Navarro et al. (2009) identified 41 critical moments in basketball games and found that free throws and three-point field-goals discriminated between winning and losing teams. Thus, during these periods of the game, teams should try to be more effective in their ball possessions, selecting better field-goal positions or drawing fouls that allow going to the free-throw line.

There is also recent research addressing the importance of the starting periods of the game (Sampaio et al., 2010a, 2010b). In particular, Sampaio et al. (2010b) studied the influence of game quarter in starting score-line in Spanish basketball. Their results showed that the influence of game location and quality of opposition on the starting score-line was stronger at the beginning of a game. The authors suggested that, at the beginning of a game (first quarter), the crowd effects and familiarity with the home facility were stronger than during the other game quarters. In the same way, Sampaio et al. (2010a) studied the dominance of the United States of America in basketball at the Beijing Olympic Games in 2008. Their results showed the importance of game periods, whereby the USA team performed better in assertive game indicators during the first half of the game. According to these authors, the importance of game period should be considered not only in the last phase of a game, but also at the beginning of a game when the performance of both individual players and of teams may be affected by this situational variable.

The importance of game period has been investigated in other team sports. In volleyball, Marcellino et al. (2009a) studied team performance according to game location and set number during the 2005 Men’s Senior World League. Their results showed that home teams have more advantage at the beginning of the game (first set) and in the two last sets of the game (fourth and fifth sets), probably due to facility familiarity and crowd effects. Similarly, Jones (2007) showed that the strength of home advantage in basketball in the National Basketball Association (NBA) varied throughout the game and that it was strongest in the first quarter. In summary, these studies have shown that the performance of both players and teams are influenced by game periods, reflecting especially the importance of the beginning and the end of a game. Further research should control for this variable when analysing the interactions and effects of situational variables in performance analysis.

Type of competition

Another situational variable that has great importance in sports competition and in the performance of teams and players is the type of competition, especially differences between regular season and playoff games. Different strategies may be used when teams are playing to add points to their championship regular season standings, as opposed to when they are struggling directly with another team facing elimination from a playoff series. In the same way, this specific game context may lead to performance differences, for example, between a close playoff game and an early season game with little immediate significance (see Gómez et al., 2008; Sampaio and Janeira, 2003).

In considering this variable, we have to take into account the influence of team sport characteristics. High-scoring team sports (e.g. volleyball or basketball) that are divided into game quarters or sets may be less affected by this situational variable because teams can modify their strategies and tactical behaviours several times during the game. In this context, coaches can play a special role in controlling the influence of this situational variable (Sampaio et al., 2010b). In particular, basketball research has described differences in teams’ and players’ performances according to the type of competition. In regular season play, the game-related statistics that can influence the final outcome are field-goals and defensive rebounds (Sampaio and Janeira, 2003; Sampaio et al., 2004). However, in specific game contexts such as close games, other game-
related statistics such as fouls and free throws exhibit higher importance (Kozar et al., 1993). On the other hand, studies that have used samples from the European Championships have identified the same game-related statistics associated with the winning teams (both defensive rebounds and field-goal percentage) (Dežman et al., 2002; Trminč et al., 2002). Analysing the Women’s National Basketball League (WNBA, USA) during the 2004 season, Gómez et al. (2009) and Gómez et al. (2007) found differences between players’ performances during the regular season and the playoff games. The authors suggested that the type of competition affects both the pace of the game and the playing styles. Conversely, some authors studied the teams’ performances during the Spanish professional men’s basketball league during the 2006–2007 regular season (Gómez et al., 2010) and playoff games (Gómez et al., 2006). Their results mainly reflected the different defensive systems used during each type of competition, where the playoff games involved more pressure defences and a more controlled game style. Therefore, according to these authors, the coaches’ decisions have a great influence on this situational variable during a game played during a playoff series where a substitution or a called timeout has an immediate effect on players’ performances. Conversely, the coaches’ decisions during regular season games may be focussed on regulating and better preparing for the next round of games by using more substitutions, or by experimenting with new game tactics during a blowout game.

In contrast, the low-scoring team sports, such as football, may be more affected by this situational variable, probably because the coaches cannot stop the game so that opportunity for information transfer to players is reduced. Furthermore, when each type of competition is considered, the situational variable ‘quality of opposition’ should be considered because, for example, during a typical basketball playoff phase only the top eight best teams of the regular season might participate. The performance profiles of teams in such games would be different from those obtained during the regular season, where the best teams play against all the others in the league, with quality ranging from best to worst. In this case, the type of competition should be simultaneously studied with the quality of the opposition in order to incorporate and investigate any interactive effect.

Finally, the importance of international competitions for national teams, such as a World Cup or European Championships, was reflected by differences in players’ and teams’ performances in different team sports, such as basketball (Mexas et al., 2005), football (Sainz de Baranda and López Riquelme, 2012; Sainz de Baranda et al., 2008), handball (Rogulj et al., 2004), rugby (Ortega et al., 2009; Vaz et al., 2010) and volleyball (Marcelino et al., 2009a). These studies pointed out the influence of top elite competitions that influenced different game patterns, with special relevance given to coaches’ and players’ decision making during these games.

**Interactive effects**

Existing notational analysis has provided preliminary information on the effects of situational variables such as match location, match status, quality of the opponent and game period on sports performance at a behavioural level (Bloomfield et al., 2005a, 2005b; Jones et al., 2004; O’Donoghue and Tenga, 2001; Sasaki et al., 1999). Nonetheless, with the exception of Lago and Martin (2007), Taylor et al. (2008), Lago (2009), Castellano et al. (2011) and Marcelino et al. (2011), previous research has examined situational variables independently, not accounting for the possibility of higher-order interactions (e.g. playing at home and losing). However, the examination of situational variables in isolation would appear to provide limited insight into the complex nature of team sports performance (McGarry and Franks, 2003; Reed and O’Donoghue, 2005). For example, in volleyball, it has been shown that teams took more risky decisions when scores were unbalanced and adopted safer tactical options when scores were
balanced or there was a moderate advantage or disadvantage (Marcelino et al., 2011). However, this tendency was affected by the quality of opposition, as more offensive strategies were adopted at the highest level (1st–4th) and safer strategies at the lowest level (8th–12th) when scores were balanced. In soccer, Lago (2009) demonstrated variations in ball possession as a function of match location and match status, with home teams having more possession when drawing than away teams. Taylor et al. (2008) showed that the frequency of on-the-ball behaviours (passes, shots, tackles, clearances, crosses, dribbles, losses of control and aerial challenges) performed by a professional soccer team was explained by the interaction between the variables of match location and match status. Lago et al. (2010) examined the effects of match location, quality of opposition and match status on distance covered at various speeds in elite soccer. As can be seen in Table 21.2, physical performance was influenced by the situational variables, either independently or interactively. These results emphasize the need for notational analysis and for coaches to consider the potential interactive effects of situational variables during the assessment of tactical, technical and physical performances.

One interesting factor that should be considered when investigating the interactive effects is the sample size for the study. This should certainly be increased in proportion to the number of situational variables whose effects are being studied, especially if interactions are to be included. However, there are few existing guidelines as to exactly how much larger the sample size should be. Hughes et al. (2001) established a method to decide the minimum number of games needed to profile the performance of players and teams. This approach has been used in studies investigating the isolated effects of several situational variables, but needs to be extended if interactions are to be incorporated. In a detailed discussion of sample size, Hopkins (2006) reiterated that, with more than one effect, a larger sample size is needed to constrain the overall chance of error. He also noted that the size of the increase in sample size needed to allow for interacting effects is hard to estimate. We therefore suggest that, when considering two or more effects and their interactions, care should be taken to avoid a situation in which the sample size is not large enough. In addition, the inclusion of possible confounding variables in the study design should be considered, to reduce the likelihood of error and increase the validity of the interpretation of the results.

Concluding remarks

In conclusion, previous studies have emphasized the importance of accounting for situational variables during the assessment of sport performance (Carling et al., 2005). The importance of these factors is reflected in changes in the teams’ and players’ activities as a response to match situations. As Taylor and co-workers (2008) explained, the implications for match analysts and coaches for evaluating performance and developing relevant training drills are important. Existing recommendations suggest that the scouting of upcoming opposition should be carried out under circumstances that are reflective of the conditions under which the future match will occur. However, such procedures are unlikely to be practical due to time and resource constraints. Consequently, by establishing the impact of particular situational variables on performance, teams and players can be observed, when possible, with appropriate adjustments being made to analyses based on knowledge of such effects (Taylor et al., 2008). Similarly, post-match assessments of the technical, tactical and physical aspects of performance can be made more objective by factoring in the effects of situational variables (Carling et al., 2005; Kormelinink and Seeverens, 1999). Finally, if a match analyst or coach has identified that the technical, physical or tactical aspects of performance are adversely influenced by specific situational variables, possible causes can be examined and match preparation focussed on reducing such effects.
Table 21.2 Simulated distance covered (m) at different speeds depending on match location, quality of opposition and match status

<table>
<thead>
<tr>
<th>Match status</th>
<th>Quality of opposition</th>
<th>Home matches</th>
<th></th>
<th></th>
<th></th>
<th>Away matches</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0–11 km/h</td>
<td>11.1–14 km/h</td>
<td>14.1–19 km/h</td>
<td>19.1–23 km/h</td>
<td>&gt;23 km/h</td>
<td>0–11 km/h</td>
<td>11.1–14 km/h</td>
</tr>
<tr>
<td>Winning 90 min</td>
<td>Strong</td>
<td>11140</td>
<td>7050</td>
<td>1744</td>
<td>1649</td>
<td>481</td>
<td>217</td>
<td>10856</td>
<td>6911</td>
</tr>
<tr>
<td>Winning 90 min</td>
<td>Weak</td>
<td>10824</td>
<td>6727</td>
<td>1662</td>
<td>1665</td>
<td>540</td>
<td>231</td>
<td>10540</td>
<td>6587</td>
</tr>
<tr>
<td>Losing 90 min</td>
<td>Strong</td>
<td>10856</td>
<td>6853</td>
<td>1678</td>
<td>1653</td>
<td>555</td>
<td>281</td>
<td>10641</td>
<td>6713</td>
</tr>
<tr>
<td>Losing 90 min</td>
<td>Weak</td>
<td>10540</td>
<td>6529</td>
<td>1596</td>
<td>1669</td>
<td>614</td>
<td>295</td>
<td>10325</td>
<td>6390</td>
</tr>
</tbody>
</table>

Source: Lago et al. (2010).
Situational variables

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teams’ wins and losses according to a different index of ball possessions’, International Journal of Performance Analysis in Sport, 3(1): 40–9.


