Football in Recent Times: What We Can Learn From the Newspapers

Ian Frank

Electrotechnical Laboratory
Umezono 1-1-4, Tsukuba
Ibaraki, Japan 305
ianf@etl.go.jp

Abstract. This paper uses a basic statistical analysis of newspaper articles to gain an insight into the game of football. Basic features of the game are established and examined in a way that should give insights to the designers of RoboCup teams and also suggest future developments for the regulations that determine the RoboCup environment. As concrete examples of possible Soccer Server modifications, we suggest touchline coaching, a revised model of stamina, and the inclusion of substitutions.

1 Introduction

Formalising human expertise is a useful technique in many areas of AI. In expert systems, for example, it takes the form of *knowledge elicitation* (*e.g.*, see [1]). In automated reasoning, designers of theorem-provers attempt to capture techniques used by human mathematicians (*e.g.*, [2]). In game-playing, designers commonly incorporate features such as opening books and pattern-recognition elements into their programs, based on moves that experts would make in given positions (*e.g.*, see [3]).

For the designers of teams in RoboCup, formalisations of expert knowledge should also be a useful tool when designing teams of players. However sources of such information are not immediately obvious: access to football professionals is limited, and books by experts rarely concentrate on the high-level, declarative descriptions of the game that would be most useful to RoboCup designers. There are many actual football games shown on TV, but although some national teams are rumoured to record games using pitch diagrams, the lack of a generally accepted transcription language means that most records remain largely visual.

In this paper, we generate our own declarative information on football by drawing on a novel source of information: newspaper match reports and features. Such articles have only become accessible to the public in a convenient form recently, with the growth of on-line newspapers. As our particular source, we chose the Internet pages of the Times newspaper, from which we downloaded and analysed the entire collection of football articles.

Our basic supposition is that any factor that is important for the success of a footballing team should be mentioned at some time by football reporters. We carry out a basic statistical analysis of the Times database in a way that we hope will:

1. Identify the important features of the game,
2. Help give more detailed objectives than 'scoring goals' to the designers of teams in RoboCup.
3. Maybe suggest directions in which the RoboCup regulations could develop. (For example, the feature of rear motion detectors was incorporated into the Soccer Server as a direct result of one of the quotes uncovered from the Times archive.)

In §2 we give an overview of the database itself, and use this to motivate the selection of a limited number of primary features of the game of football. §3 then discusses each of these features in turn, illustrating the discussion with example passages taken from the database of articles. Finally, §4 discusses the concept of *beauty* within the game of football, before we conclude in §5.

2 Database Overview

The total database contains 2402 football articles downloaded from the WWW site of the Times Newspapers Ltd, at `http://www.the-times.co.uk/`. These articles cover the 1996-1997 football season from before its start (7 August 1996) until the date that this paper was first drafted (25 Feb 1997). This represents 174 days of newspaper coverage, since the Times itself does not have a Sunday edition. In their raw format, the files containing the articles occupy 21.6 Mbytes of disk space, but after deleting the HTML headers and footers this reduces to 9.8 Mbytes.

Table 1 shows the most commonly occuring words in the database, after the removal of words with no obvious relation to football (*e.g.*, purely grammatical words), and also proper names such as those of players or clubs. We have arbitrarily chosen 400 occurrences as the cut-off point for inclusion in this table. It is a sign of the times that *million* (828) occurs so often in the database, as well as variations such as *millions* (31), *millionaire* (15), and even *multimillionaire* (13).

Some of the words in this table appear simply because they are the names of things commonly associated with the sport (*e.g.*, *league* (2454), *game* (2298), *cup* (2150), *club* (1979), *football* (1965), *division* (1880), *etc.*). Other words, however, can more easily be seen to correspond to a particular feature of the game itself. For example, the words *manager* (2435), *players* (1980), *team* (1772) and *coach* (445) all suggest the notion of 'teamwork'. Similarly, *free* (765) (from 'free kick') and *penalty* (606) suggest the importance of 'set pieces' in football.

In total we identified eight basic features corresponding to the words in Table 1. These features appear next to the relevant words in the table and, in order of first appearance, are: teamwork, basic skills, playing conditions, objectives, attack, set pieces, midfield, and defence. The remainder of this paper will be devoted to examining each of these features in more detail.

Word	Feature	Word	Feature
said (3743)	Teamwork	*played* (731)	
league (2454)		*midfield* (700)	Midfield
manager (2435)	Teamwork	*scored* (697)	Attack
game (2298)		*forward* (686)	Attack
cup (2150)		*long* (682)	Basic Skills
players (1980)	Teamwork	*playing* (676)	
club (1979)		*won* (622)	
football (1965)		*think* (618)	
division (1880)		*penalty* (606)	Set Pieces
ball (1829)	Basic Skills	*goalkeeper* (597)	Defence
goal (1798)		*defence* (591)	Defence
season (1784)		*people* (586)	
team (1772)	Teamwork	*supporters* (583)	Playing Conditions
time (1671)		*matches* (570)	
back (1609)		*lost* (519)	
minutes (1446)		*chance* (470)	Basic Skills
match (1414)		*run* (470)	Basic Skills
off (1302)		*move* (455)	Basic Skills
play (1213)		*coach* (445)	Teamwork
side (1112)		*teams* (440)	Teamwork
away (1110)	Playing Conditions	*defeat* (437)	
player (1109)	Teamwork	*cross* (436)	Attack
win (1099)	Objectives	*say* (421)	Teamwork
referee (952)		*post* (419)	
goals (939)		*injury* (416)	
million (828)		*points* (412)	Objectives
shot (826)	Attack	*squad* (408)	Teamwork
games (814)		*later* (408)	
man (767)	Basic Skills	*thought* (405)	
free (765)	Set Pieces	*early* (401)	Basic Skills
minute (736)		*draw* (400)	Objectives

Table 1. Most commonly occuring words in Times football articles

3 Game Features

Each of the following subsections examines one of the features of football identified in the previous section (with some of the features being broken down into further sub-categories). More examples of word frequencies from the database of news articles are given, and illustrative quotes are also selected and discussed. Possible lessons for the Soccer Server are emphasised by highlighting game features that cannot be modelled (or can only be modelled with difficulty) within the framework of the current implementation.

3.1 Teamwork

Database examples: *manager* (2435), *players* (1980), *team* (1772), *coach* (445), *squad* (408), *captain* (281).

The overall notion of teamwork is well described by the following quotes:

> 'People work in teams because together they have the potential to create something they cannot create alone. By maximizing the quality of the relationship between team members, teams maximise their performance.' The words of John Syer, a psychologist who works in sport and business, in his latest book, *How Teamwork Works.* [4]

> ...you can never expect that any single player will go out and win the game by himself. Each individual needs collective support. [5]

In this paper 'maximising the quality of the relationship between the team members' will be interpreted as optimising the way that a team, as a whole, deals with each of the game features discussed in the following subsections. Note, though, that whilst the maxim that 'no player functions alone' generally holds true, it does just occasionally get disproven:

> In the 87th minute of the match between AC Milan and Verona, George Oppong Weah transcended any solo goal in the imagination. He defended a Verona corner, he ran 85 metres, he outpaced, out-thought, outclassed seven gentlemen of Verona, and within 14 seconds, 30 strides and 14 touches of the ball, he scored. [6]

A goal such as this would be highly unlikely under the current implementation of the Soccer Server, since the model of stamina makes it difficult for one player to outrun other players for an extended period. We will return to this issue in the section on 'Basic Skills'.

Communication. A natural sub-topic of 'teamwork' is 'communication'. Already, a number of designers of teams participating in the Pre-RoboCup simulator league have reported using the `say` and `hear` protocols of the Soccer Server to increase each player's information about the state of the game. For example, a player in a good position to receive a pass can broadcast this information to a team-mate that has the ball. Also, players that are not directly involved in the play can keep team-mates up to date with information such as the positions of opponents who may be approaching them from behind.

In addition to spreading information about the environment, communication also offers an avenue for feedback and learning during the course of a game. For example, when a player chooses one action from between two or more alternatives, it may actually be one of his team-mates that is in the best position to judge whether the outcome has actually improved the position of their team. Also, decision-making can be improved during a game by using communication to express *displeasure* at the actions of team-mates:

> I tell you, Paddington Bear could learn something from the Ravanelli hard stare. A couple of times, when a colleague failed yet again to understand his elevated conception of football, he dealt a look that almost sliced his head off. [7]

It should further be noted that managers as well have a role in communicating feedback and advice to players:

> [United's manager] came down to the bench and, after much encroachment to the touchline, United's tactics evolved so that *they* put the emphasis on attack.... [8]

> Francis appeared to have hot cinders in his training shoes at this point, hopping around excitedly a metre or so from the dugout as he waved players forward. [9]

Currently, the rules of the simulator league allow programmers to modify their software at half-time. This encourages the design of software that utilises concepts high-level enough to be tinkered with during such a small time-span. However, the above quotes show that real football managers can also have an effect on their team's performance *during* the play itself. This suggests an increased role for the current 'coaching mode' of Soccer Server.

Specifically, teams could be allowed to use the 'coach' to monitor play in real time and shout advice to players. Since the coach has a global view, it should be easier to determine something about the play from this perspective, compared to the restricted vision of the individual players. Of course, to prevent the coach actually directing the players during play itself, coaching advice should only be allowed during breaks (*e.g.*, between the scoring of a goal and the next kickoff or at throw-ins).

Increasing the role of the coaching mode would facilitate research on one of the more difficult (and interesting) areas of RoboCup: enabling a team of clients to monitor — and meaningfully react to — the strategy and tactics of another team. Although a number of researchers are already using machine learning techniques to develop client programs strong enough to play in RoboCup, there seem to be very few (if any) teams that include a component that makes a serious attempt to learn *during* a match. It could be that tackling the 'easier' problem of using the coach to analyse the play will encourage people down the harder road of getting the actual players to do the same task for themselves.

Note that one further part of the manager's role that does not feature in the current implementation of the Soccer Server is squad selection and substitution. In real life, this plays an important part in determining the outcome of a game (*e.g.*, *substitute* (195), *substitutes* (59), *substituted* (26), *substitution* (11)). We will return to this issue when we discuss the issue of stamina in the following subsection.

3.2 Basic Skills

Database examples: *kick* (384), *work* (350), *turned* (330), *pass* (307), *position* (300), *training* (296). *control* (192) *touch* (174)

Touch. Ball control and touch is a recurring theme when talking about the skills of players:

> You could see the way Cantona touches the ball what a great player he could be [10]

Despite being talked about frequently, however, 'touch' is not an easy concept to define. Perhaps in the context of RoboCup it relates to the fine control of the ball necessary to carry out more complicated actions such as passing (or intercepting, dribbling, turning, shooting *etc.*).

Passing. As for passing itself, it is often not just important to get the ball to another team-mate, but to do so in a way that actually advances the position of the team.

> His first touch is sure, his passing elegant, and he has the courage to eschew the obvious for the enterprising. [11]

Position. Actually getting players into a good position to receive passes (and to intercept the opponents' passes) therefore becomes a key to successful interplay:

> There is no footballing equivalent of 'street-smart', but there should be. Wright is supremely 'pitch-smart', or 'ball-smart'. [4]

A lack of 'running off the ball' was one of the most striking features of many of the teams participating in the Pre-RoboCup tournament. This area is particularly ripe for progress since it also offers the benefits of increasing the freedom of the players who actually do have the ball:

> Roger Hunt was darting about in a series of decoy runs, 'diving in different directions and their defenders were being pulled and all the time I was allowed to go further and further. I thought, if they let me go another half a dozen yards I'm going to have a dip.' [12]

Improving the use of space and the passing of RoboCup teams should see the demise of the 'rugby effect': the result of a strategy that sees teams constantly send four or five players after the ball, resembling a pack of rugby forwards. A good passing side should easily be able to outmanoeuvre teams that concentrate their players in this way.

Possession. The combination of touch, passing and positioning allows a team to control possession:

> One-touch or two-touch, short-range or long-range, they appear to know instinctively where their best-placed team-mate is positioned. Possession is treasured, not to be discarded lightly. [13]

Although not mentioned particularly frequently in the database (*possession* (95)), possession is one of the key aims during many stages of football play:

> 'If you give the ball away at this level, you cut your throat.' (Alex Ferguson, quoted in [14])

Turns. Once in possession, one of the ways (other than passing) of keeping possession when challenged by an opponent is to get past the opponent:

> ....[Okocha] teased with his silky control, he drew Gary Neville close to him. Tighter, tighter, the African seemed to invite the England right back; and then, with remarkable balance, Okocha turned full circle, swept the ball with a delicate little chip out of the reach of the now bemused Neville, and skipped past. [15]

Within the RoboCup environment, deciding when to pass and when to try to turn an opponent may be a critical element of a player's abilities: a team that never takes on the opponents may never make any real forward progress, but a team that tries to run at the opponents too often may give away too much possession.

Work, Training & Stamina. The following quote describes a player called Lucas Neill:

> Speed, stamina and skill are his assets, he says, and one can believe him; though he is hard on himself when he says that his touch needs to improve. [16]

We have already discussed touch, but not speed, stamina or skill. Of these three, skill is the easiest to deal with, as it has been covered to a certain extent by our discussion of ball control and touch, and is in any case a general concept applying to many aspects of the game (*skill* (89), *skills* (87), *skilful* (18), *skilled* (8), *skilfully* (4)). Skill is also used to describe types of ball control that are not reproducible within the Soccer Server environment:

> ...he made a football, of all the unwieldy objects, behave as a stump-shattering late in-ducker. He seemed to possess an almost painterly talent, his brush the swerve-inducing, ecstatically-sponsored Predator boots.[17]

Speed and stamina, however, both feature as parameters within the Soccer Server. They are also an integral part of the modern game, and they form the backbone of the style of play that has become traditional in England:

> 'Look at the World Cup final video of 1970 between Brazil and Italy,' Olsen said, 'and you see it was almost a walking game [even allowing for the heat and altitude]. The game has advanced so much in speed and fitness.' [18]
>
> Ask any foreign player to draw an identikit picture of the typical English footballer and the image would be readily identifiable. Pearce is easy to caricature and easy to despise, too, the ultimate product of a system that reveres physique over technique, stamina over skill. [19]

In the current Soccer Server, each player has a maximum stamina (the default is 200 units) which decreases by the `dash` power whenever a player runs (the `dash` power may be up to 100). On each simulation cycle, stamina is recovered by a preset amount (the default is 20 units). This clearly models *short-term* exhaustion very effectively, but we suggest here that it may also be beneficial to incorporate a slightly more sophisticated *long-term* model of stamina into the environment.

The modelling of long-term stamina within the Soccer Server would greatly broaden the scope of the tactical and resource management issues in the simulation. For example, envisage the situation where each player starts the game with a finite pool of *reserves* that decreases in proportion to their movements (like the current stamina), but never gets replenished during the game. As a player's reserves becomes more and more depleted, his overall performance would start to be affected. To play effectively under this system, every player would clearly have to ration their efforts throughout the entire game — a longer-term notion of resource management than the current implementation of stamina requires, and also one which does not inherently bias against the kind of solo goal described in §3.1.

At any one time in the game, each of the players would generally have used a different amount of their reserves. This difference between players (where currently there is essentially none) expands greatly the opportunities for tactical reasoning. For example, players could be tactically re-shuffled, to concentrate the players with most reserves in the areas where they are most needed. Also, examining the opposing players for signs of weakness would become more profitable. Further, a meaningful use of substitution suggests itself: the coach client could be allowed to swap players who are running low on their reserves for a fresh player with full reserves. Choosing whether to station these fresh players in defence, midfield or attack would depend on the current game situation.

Vision. Finally in this section on basic skills, we give two quotes that illustrate the importance of being able to 'read the game'; the ability to predict future events and, ultimately, to dictate them.

> Leboeuf has a fine touch and excellent distribution, but best of all is the way he sees things about ten minutes before they actually happen. He is an education. [20]

> Injuries and his own immaturity have tarnished Gascoigne's career, but a trace of greatness is still visible. His superiority to the men around him is not just a matter of technique, of weight of pass and refinement of touch. It is intentions as much as skills that separate such a figure from the array of competent professionals. [21]

3.3 Playing Conditions

Database examples: *away* (1110), *supporters* (583), *stadium* (338), *pitch* (335), *crowd* (301), *fans* (217), *atmosphere* (50), *weather* (39), *rain* (36), *wind* (32), *rained* (12), *snow* (21).

These statistics from the database seem to indicate that the main external conditions that affect the outcome of a game are the supporters, and the atmosphere they create, rather than other factors such as the weather or the state of the pitch. Indeed one British club (Wimbledon) went as far as to hold a seminar about its atmosphere:

> So concerned is the club at keeping the pot boiling, it is even staging a 'crowd atmosphere' seminar on December 2, at which the gathering will discuss ways of transforming Selhurst Park into a seething cauldron. [22]

Of course, crowd atmosphere is unlikely to ever have a formal role within RoboCup. In any case, it is often debated whether a crowd's efforts can actually sway the results of a game in a particular direction or whether they simply encourage *all* the players to raise their performance. As the Liverpool and England player Steve McManaman says about a trip to rivals Newcastle:

> Personally, even though it can be quite intimidating there, I enjoy it immensely. At this level, few players freeze in such an atmosphere, and so it tends to give both sides a lift. There is nothing like playing in front of a passionate crowd, because you can't fail to be anything but inspired. [23]

3.4 Objectives

Database examples: *win* (1099), *points* (412), *draw* (400), *lead* (376), *beat* (372), *hope* (301), *injured* (186).

It is commonplace for real football teams to tailor their tactics and their mode of play to fit the objectives they have set for a particular game. Teams may try to slow down a game to silence the voices of a hostile away crowd, they may try to play for points, or they may need to win by a certain number of goals to secure their position in a league. Currently in RoboCup it is unlikely that teams are sophisticated enough to modify their play significantly, but given the round-robin style of the tournaments, such an ability would certainly represent an advantage. Note also that a team's objectives can change dynamically during a game:

> Rangers had enough ideas and possession to deserve at least a draw and probably would have got one had not Palace read the game so well; but Palace realised, after only 15 minutes of watching their opponents finessing the ball to no good purpose, that here was a match for the taking. [24]

One further twist is that once opposing teams start to observe each other's strategies it is possible for them to attempt to gain an advantage by misleading each other about their intentions:

> Apparently our defence was so weak because Poland had cunningly tricked us. 'No, we will not be trying to score goals,' they announced beforehand, with their crossed fingers hidden behind their backs. 'Goals are overrated, in our opinion.' And we fell for it. Good grief. [25]

3.5 Attack

Database examples: *cross* (436), *header* (372), *area* (309), *attack* (229), *opening* (186), *opportunity* (155), *wing* (119), *winger* (116), *opportunities* (66), *deflection* (35), *one-two* (7), *one-twos* (2), *goalpoacher* (1).

The basic purpose of attack is to score goals by creating openings and opportunities. As a demonstration of the possible ways of creating chances, we have the following quote from Kevin Keegan:

> Where were the crosses, where was the invention, where were the cute one-twos strikers thrive on? [26]

One aspect of real football that may not translate so well into the RoboCup domain is the use of wingers to attack down the sides of the field. In real games, such attacks often end with crosses, but in RoboCup the inability to kick the ball into the air may decrease the effectiveness of such balls.

> It took him until ludicrously late to appreciate that the best way to negotiate a packed defence is to go round the back, using the wings. [27]

> The delivery from the flanks, Hoddle acknowledges, is vital. [28]

It may be more interesting to see how the following argument carries over into RoboCup:

> The controversy surrounding the merits of the long-ball theory and the possession game, exemplified by Brazil and Liverpool, is unresolved. Olsen argues that direct play is the most effective route to goal, the majority of goals stemming from three passes or less. [18]

3.6 Set Pieces

Database examples: *penalty* (606), *corner* (369), *set* (289), *free kick* (261).

By the very nature of set pieces, teams have more freedom to organise players than under normal game situations. Many teams in the Pre-RoboCup tournament, however, made poor use of set pieces. This is in contrast to real football, where some teams try to survive almost exclusively on set pieces alone, for example as in this description of Lincoln City:

> Their only real ploy appears to be to pump the ball into intentionally soaked corners of the pitch, to win corners, free kicks and throw-ins around the penalty area. It is Pomo, the position of maximum opportunity, gone mad... [29]

3.7 Midfield

Database examples: *midfield* (700), *central* (218), *playmaker* (22)

The midfield is particularly important for the possession style of football mentioned in §3.5. Denying the opponents' possession in midfield is a question of controlling the space and of timing:

> Of Ince, the ball winner and anchor in midfield, Hoddle said: 'He's appreciated when to tackle, when to hold off. Once he stepped into a higher level in Italy [with Internazionale] he learnt the right time; otherwise players there would be around and away from you.' [30]

Midfield can also give rise to specialised positions such playmakers who instigate attacks either by directly creating opportunities or directing the play into promising patterns:

> There is therefore the renewed scope, Hoddle thinks, for the playmaker... Yet, he believes the game has moved away from the individual; that the contemporary formation of 3-5-2 — which he favours — calls for flexible midfield creativity. [31]

The following also describes another specialised role in midfield:

> You're not outstanding at anything but you're very good at everything. You can tackle, you've got skill on the ball, you're good in the air and you read the game well. I've got the perfect position for you; the holding slot in front of the back four. I want you to dictate, get the ball, play it, set everything up, keep it all ticking over, but never get in front of the ball. Wherever it is, I want you behind it.' [32]

3.8 Defence

Database examples: *defender* (371), *clear* (280), *mark* (251), *save* (244).

One important feature of defending highlighted by our use of the Times database was the importance of being able to sense the presence of players and other objects even when they are behind you. Rear motion detection was incorporated into Soccer Server after the author posted the following quote to the RoboCup mailing list:

> One of the many alarming things that can happen on a football field is disorientation. As the ball moves about, you can lose your sense of direction and the precise understanding of where everybody else is. That is why you constantly see defenders reaching out to grope the man they are marking. You need to know where he is, and where the ball is at the same time. [33]

The ability keep other players close helps to implement the general idea of defence as the complement of attack: the closing down of attacking players in an effort to prevent them creating the chances and opportunities needed to score goals. However, in the modern game, defence has become something more important than this. The 'total football' ideology preaches that defenders should have the ability to come forward as attackers. Indeed, echoing back to our previous classification of touch, passing and vision, there are those who advocate treating defence as the beginning of attack:

> defenders are expected to be proficient in more than jumping, tackling and clearing their lines... [34]

> 'Nowadays, at the back, it's important that you've got a good touch, that you can pass the ball, read the game,' Matteo said. There lies the key to Hoddle's new road: he wants to build the game up from defence. [35]

In the final analysis, if there is one area in which an otherwise outclassed team should concentrate its attention it should be defence:

> Ever since the radical change in the offside law in 1925 — from three defenders between opponent and goal to two — tactics have continually evolved. What has latterly changed most, however, is the defensive organisation of lesser teams and their advanced physical fitness, counteracting those which once dominated by technique. [18]

4 The Beautiful Game

It was Pelé, arguably the greatest player ever, who described football as 'the beautiful game'. Looking at some word frequencies in our database, it is possible to partially support this epithet: *e.g.*, *beauty* (45), *beautiful* (42), *beautifully* (15), *beautifully-struck* (2), and *beautifully-weighted* (2). Is it too much to hope that RoboCup programs will produce 'beautiful' moments, such as the following description of a shot that

> ...followed the trajectory of a ping-ponger's forehand loop, from centre circle to goal in a gloriously walloped arcing topspin lob. Beautiful indeed. [17]

This is a difficult question to answer. It is also debatable whether the goal of beautiful play is in fact a useful one. Even the journalists themselves express doubts about this:

> Perhaps a player can only ride the wave of beauty so far. Perhaps other qualities — Linekeresque opportunism, Shearer-like aggression — are more lasting. [17]

The problems of declaratively describing football itself are even more apparent when dealing with beauty:

> You can move the salt and pepper pots how you like to show the chess-like manoeuvring that led to the great strike, but that is to miss the point. You do not stroke your chin and say: hmm, that was a *good* goal. It is a cry of wonder from deep inside your guts. [12]

Note also that the essentially 2-D nature of the RoboCup will also hinder the learning of 'beautiful' play from examples in the 3-D world of real football games.

In real life, it has to be admitted that many teams succeed without playing beautifully, and in some cases by actively aiming for the opposite. For example, the following quote describes Wimbledon — an unfashionable team ('no one likes us, we don't care') who are nevertheless enjoying great success this season, lying fourth in the English Premiership table at the time of writing.

> They don't play the beautiful game; they have perfected the hideous game, something like volleyball with a no-hands rule. [36]

In the final analysis, the old adage 'nothing succeeds like success' may well be the best guiding principle when designing RoboCup teams. Witness the following:

> And of course, when it comes to goals, they all count, there are no marks for artistic impression and football is about winning, not about aesthetics. To get seduced by beauty is one of the most dangerous traps in football... [17]

This may be the bottom line:

> ...as a golf pro once vividly explained to me, there are no pictures on a scorecard. [36]

5 Summary

This paper has used an analysis of newspaper articles on football to identify basic features of the game. These basic features were examined in a way that should give insights to the designers of RoboCup teams and also inform the future development of the Soccer Server environment itself. We ourselves plan to use the basic breakdown of game features to design an effective fitness landscape over which evolutionary computation techniques can be used to develop client programs. As concrete examples of future Soccer Server developments, we suggested touchline coaching, a revised model of stamina, and the inclusion of substitutions.

We finished by looking at the concept of 'beauty' within the game of football. Perhaps the last words on this subject, and in this paper, should go to the ex-England manager Don Revie (as quoted in [17]):

> As soon as it dawned on me that we were short of players who combined skill and commitment, I should have forgotten all about trying to play more controlled, attractive football and settled for a real bastard of a team.

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