Ball Recovery in the Handball Tournament of the 2008 Beijing Olympic Games: Sequential Analysis of Positional Play as Used by the Spanish Team's Defence

António Lopes
Faculdade de Educação Física e Desporto,
Universidade Lusófona, Portugal
antonio.m.lopes@gmail.com

Oleguer Camerino
Human Motricity laboratory,
INEFC-University of Lleida, Spain
ocamerino@inefc.es

Mª Teresa Anguera
Department of Behavioural Sciences Methodology,
University of Barcelona, Barcelona, Spain
mtanguera@gmail.com

Gudberg K. Jonsson
Human Behaviour Laboratory,
University of Iceland, Reykjavik, Iceland
gjonsson@hi.is

ABSTRACT
In sport there is a great need to obtain as much information as possible about the factors which affect the dynamics of play. This study uses sequential analysis and temporal patterns (T-patterns) to examine the evolution of defence (against an equal number of attackers) as used by the Spanish handball team at the Beijing 2008 Olympic Games. The aim is to help handball coaches (during their training and gathering of professional experience) to understand the importance of the structure of defensive systems. This can be achieved through observational processes that reveal the evolution and adaptation of these defensive systems according to different variables: the match score, the response of the opposing team and progress through the tournament.

Author Keywords
Team sport observation, T-patterns, observation, handball

INTRODUCTION
Recently there has been an increase in the number of studies applying observational methodology [1] to handball, both in theoretical terms (the conceptual development of models) and in the applied sense (recording and analysis of data derived from tactical and technical aspects). The form of positional play most widely used by teams is that based on attack, which raises the question as to whether this is the most characteristic method of handball play as regards ball recovery. At all events, studies that regard the attacking process as a key moment in team preparation are more common than are those which stress the importance of defence [2]. However, the choice of defence as a form of positional play is justified. Indeed, some authors have considered it to be the most important aspect and it has been widely used in handball as a phase of increased player activity, this being something which characterises and distinguishes handball play from other strategies [3].

The present paper aims mainly to describe and characterise the defensive behaviour of one handball team with respect to the attacking strategy of another (in the context of equal numbers of defenders and attackers). This is done by analysing the games played by the Spanish handball team during the 2008 Beijing Olympic Games. Traditional methods for quantifying performance in sport are limited in their ability to describe the complexity which emerges during the game. Due to the multiple dimensions and unpredictability that characterise play in handball, there is a need for studies that consider the sequential interaction between variables pertaining to both defensive and attacking play, and which do so from a multidimensional perspective and with a methodology that is consistent with the process of player opposition/cooperation.

METHOD
An appropriate research strategy in this regard is observational methodology. This approach enables the observation of individual behaviours in the real world by means of an *ad hoc* observation instrument that combines field formats and category systems. Furthermore, this instrument offers the quality and flexibility required to record the constant and random changes in player behaviour, enabling the detection of different relationships.

Participants
The match material was obtained by recording the games broadcast on television. Spain was the team observed in each case.

Design
The observational design [4] was ideographic (one team as the unit), longitudinal (several matches played by the same team at different stages) and multidimensional (the dimensions correspond to the criteria established for the observation instrument). The use of this design determines a set of decisions with respect to participation, tools (adaptation and validation of a new instrument) and procedures.

Observation Instrument
The observation instrument chosen for this study was the (SODMO), which combines field formats with category systems. This observation instrument was developed on the basis of two sources of information: first, previously published studies on defensive play, and second, the inductive construction of categories by experts (high-performance coaches specialising in handball). After constructing the observation instrument (SODMO) a team of observers was then trained in how to use it. The instrument was accepted as reliable when the value of Cohen's kappa was greater than 0.8.

Recording Instrument
The recording instrument used was the *Match Vision Studio* software [5] (see Figure 1). This is a highly-flexible software package into which the user first introduces all the codes corresponding to each one of the changing criteria of the SODMO observation instrument. All the co-occurrences of codes are then recorded, each of which occurs in a frame (the time unit used), and this produces a recording formed by the successive co-occurrences; the duration in frames of each one is recorded.

Stage	***Teams involved***	***1st half***	***2nd half***	***Final score / overall result***	
Preliminary round	Croatia-Spain	16-11	15-18	31-29	Lost
	China-Spain	12-16	10-20	22-36	Won
	France-Spain	16-10	12-11	28-21	Lost
	Brazil-Spain	20-17	16-18	35-36	Won
Quarter-finals	Korea-Spain	13-14	11-15	24-29	Won
Semi-finals	Iceland-Spain	17-15	19-15	36-30	Lost
3rd place play-off	Croatia-Spain	14-12	15-23	29-35	Won

Table 1. List of games observed.

Figure 1. Screen capture from the Match Vision Studio software.

Procedure
In order to study the defensive behaviour of the Spanish handball team in the Beijing Olympic Games we conducted a sequential analysis so as to obtain temporal patterns (T-patterns) [6,7,8] for each game and game half. This was done using the Theme software, which produces dendograms based on event configurations that correspond to the behaviours recorded, showing the temporal distance between occurrences [9].

The total number of configurations/game-events recorded using the Match Vision Studio software (for all seven matches and based on the changing criteria of the SODMO) was 3511. These files were then transformed into the format required by the Theme analytic software, i.e. a table with temporal information for the successive co-occurrences of codes recorded. The codes of the SODMO observation instrument were then imported into the Theme software [6,7,8].

The data were then imported into the Theme software with the aim of detecting temporal patterns. In this context, T-patterns can help to reveal hidden structures and non-observable aspects of sporting techniques. Here, these T-patterns were obtained using the algorithm that is incorporated within the software package Theme v.5 [7].

RESULTS
The result of all seven matches was analysed by grouping them as follows: each game individually and then grouped according to games won and games lost. Due to the large amount of data generated by the seven matches observed, we only present the results of matches won and lost in the group stage of the Olympic tournament. Therefore, the analysis concerns four games distributed in two groups: games won (Brazil-Spain and China-Spain) and games lost (Croatia-Spain- and France-Spain) (see Table 1).

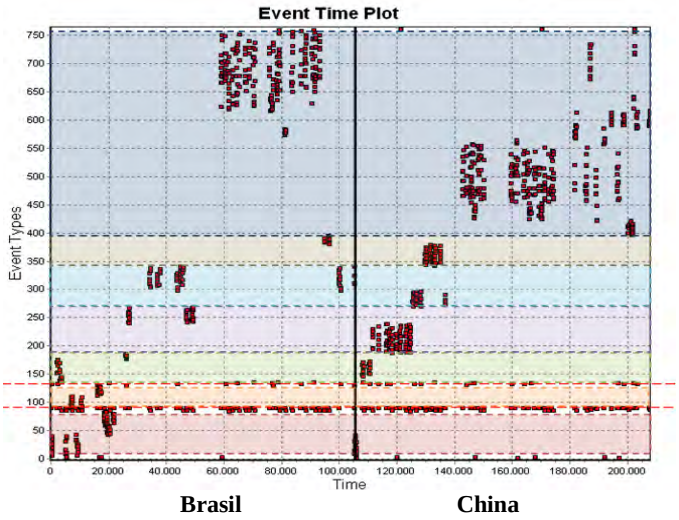

Figure 2. Event time plotter of all lost matches in the group stage.

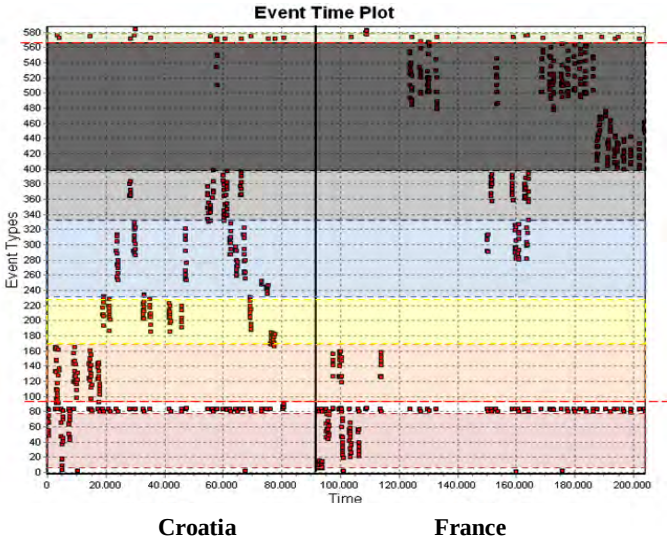

Figure 3. Event time plotter of games won in the group stage.

Sequential Analysis

The plotter graphics were analysed by describing the events during the match and observing the sequences and ball recovery methods according to the match score at a given point (see Figures 2 and 3).

Into the results obtained related to the games won we can see that the game between China and Spain was the third match in the handball tournament, and ended with the score at 22-36. The game between Brazil and Spain was the fifth and final game in the group stage (preliminary round) and ended 35-36. Over these two games Spain scored 72 goals and conceded 57.

Seven different types of sequences (shown in the figure by colour bars) can be identified from among the 97 that make up the game as a whole. They have the following event frequencies and intervals according to the match score for the Spanish team at a given point in time. This enables us to observe the different dynamics of defensive sequences at the end of each match.

Into the results obtained related to the two parties lost in the preliminary phase, we can see that the first match lost by the Spanish team was that against Croatia, which ended with the score at 31-29. The match between France and Spain was the fourth game in the group stage (preliminary round) and ended 28-21 (see Table 1). Over these two games Spain scored 50 goals and conceded 59.

The analysis of the defensive systems used in these two defeats reveals seven different types of sequence (shown by the colour bars in Figure 3) from among the 97 that make up the game as a whole. They have the following event frequencies and intervals according to the match score for the Spanish team at a given point in time. Here we can see greater variability among systems of play, which shift between 5x1 and 6x6 in an attempt to overcome the rival.

After analysing the transition between defensive configurations using the plotter graphics we then selected the most significant T-patterns by means of the dendograms produced by the Theme software. All criteria were used to analyse the interaction between defence and attack.

By way of an example we show here an interpretation of dendograms for the match between Croatia and Spain (see Figure 4). The Spanish team were behind for most of the game and resorted to a 6:0 (zonal) defensive system, which was modified mid-way through the second half to 3:2:1 (nine), when the match scoreboard showed a three-goal disadvantage (p3). They then switched to 5+1 (six) when they were only one goal behind (p1) and level (e), returning then to the initial 6:0 (zonal) system.

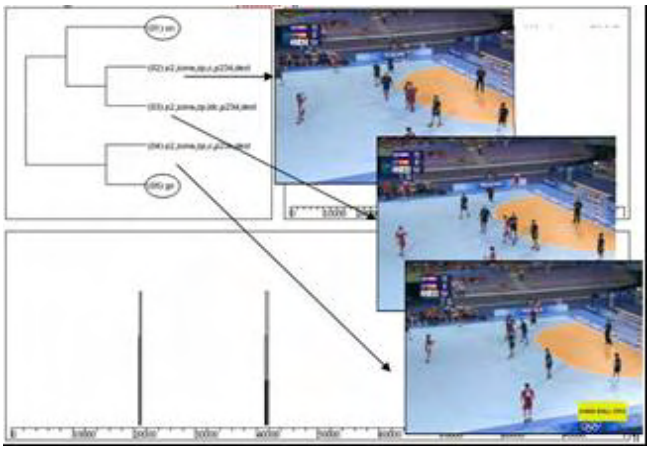

Figure 4. Dendogram of the match between Croatia and Spain.

CONCLUSION

It was possible to verify the existence of T-patterns in which a defensive system was more associated with the type of ball recovery (conceding or without conceding a goal). There were more event configurations in dendograms when the Spanish team used the 6:0 defensive system. The change of defensive system varied depending on both the score at any given time and the 'quality' of the opponent. Defensive systems with more defensive lines were used in unbalanced matches in which the observed team was losing, as well as against better opponents.

The application of this software has proved to be extremely effective for studying different aspects of the dynamics of play in various contexts of interaction between opposing teams. As stated above, the present study focuses on the dynamics of defensive play in the handball tournament of the 2008 Beijing Olympic Games.

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