Noldus
Information Technology

How to use Theme in sport research

# Soccer analysis

Would the outcome of the World Soccer Championship 2002 have been different if the coaches had used T-pattern analysis to study performance? Andrew Borrie and his colleagues do not answer this question in their paper on T-pattern analysis in soccer matches. However, the investigators of the Research Institute for Sport and Exercise Sciences in Liverpool did highlight the potential of this kind of analysis as a tool to support soccer coaches.

The researchers analyzed thirteen soccer matches, four club and nine international matches. They observed the matches in digital video file format and coded the behavior. Coding included information on player, pitch position and match events (pass, tackle, header, run, dribble, clearance, shot, cross, set-play, lost control and foul). The pitch was divided in 18 zones (see Figure 3 on the next page).

## Pattern analysis by Theme

The observational data were analyzed using the software package Theme (Magnusson, 2000). Theme is a professional system for detecting hidden patterns in behavioral records, so-called T-patterns.

Theme detected many temporal patterns in the soccer matches analyzed. Figure 1 shows a typical within-team pattern of events. The pattern occurred three times during the first half of a European Championship qualifying match in 1998 and describes how player A moves the ball towards the opponent's goal by receiving the ball in, and then passing it out of, pitch zones 8, 11 and 14 consecutively. Player A then completes the sequence by passing it to player B who receives it in zone 15. The movement from zone 11 to 14 also occurred on another five occasions during the first half, suggesting that player A was working effectively through the middle of the pitch, an attacking movement which the opponent may wish to prevent. Standard frequency analyses of passing would have identified the ball reception and subsequent pass from each zone as discrete events, but are far less likely to have linked the consecutive actions in the four zones.

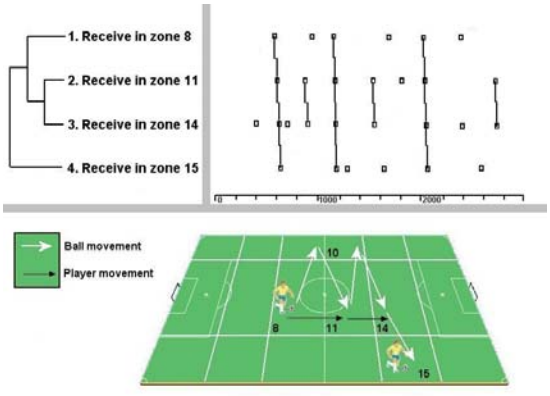


**Figure 2.** *A temporal pattern of attacking movement through the center of the pitch. Bottom box: schematic representation of the pattern. Upper left and right box: data output from Theme showing the temporal and hierarchical representation of the pattern. The movement of the ball from zone 11 to 14 also occurred on three other occasions in the observation period. Therefore, events 2 and 3 are closely related.*

## Comparison between matches

Striking differences were found when club matches and international matches were compared. The total number of pattern occurrences and the number of different T-patterns detected was greater in international matches than in club matches, whereas the number of events coded was similar. This suggests that within the international matches a) more consistency exists and b) individual events are

more often part of larger temporal patterns. This could mean that on an international level players make a better team.

## Conclusion

The results show that T-pattern analysis by Theme creates the possibility to move beyond the constraints of traditional frequency-based analyses of performance, which makes this method an effective research and support tool in performance analysis.

## Reference

Borrie A, Jonsson GK, Magnusson MS (2002), Temporal pattern analysis and its applicability in sport: an explanation and exemplar data. *J. Sports Sciences* **20**, 845- 852.

## Theme: a unique tool!

The present example is one of numerous possible applications of Theme in behavioral research. The study highlights Theme as a unique tool to detect and analyze 'hidden' patterns. Patterns of this kind are hard or impossible to detect using other methods.

**How does Theme work?**

Theme uses a unique algorithm that searches for relationships between events by taking into account both the order and relative timing of these events, and their hierarchical structure. Statistics such as the number of different patterns detected in a behavioral record, their length, abundance and number of actors involved can be used as objective measures of the level of organization or complexity of the behavior.

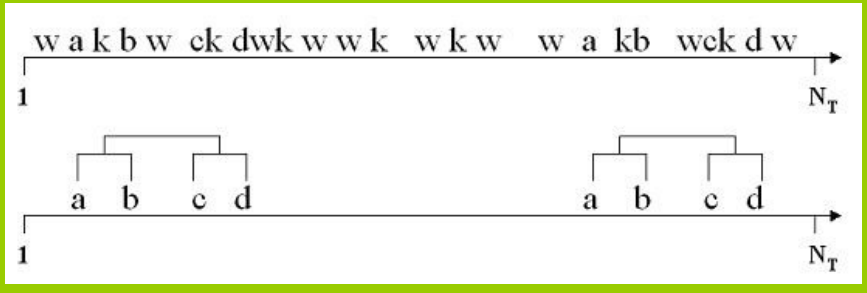


**Figure 3**. *Upper part: A record containing six types of events (a, b, c, d, k and w). Lower part: The same record after removing all occurrences of k and w. Two simple pattern (ab) and (cd) appear that were difficult to find when the other events were present. The patterns (ab) and (cd) are part of a larger pattern ((ab)(cd)) which may then become part of an even more complex pattern.*

**Reference**

Magnusson MS (2000), Discovering hidden time patterns in behavior: T-patterns and their detection. *Behavior, Research Methods, Instruments & Computers* **32**, 93-110.