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# VIDEO ANALYSIS IN SPORTS: VIDEOCOACH<sup>®</sup>

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## Abstract

The traditional way of analysing soccer matches by coaches or whoever is interested in getting statistics about them, is to take notes on a piece of paper or to make remarks about what happens while watching the game.

This paper proposes a different approach to match analysis, utilising computers and the appropriate software tools. VideoCoach<sup>®</sup> allows the user to annotate the match through easy-to-use interfaces. The annotations are saved in a database. Match analysis and statistics are automatically retrieved from the annotation database, video compilations can be made and analysis can be done. This kind of analysis is not strictly bound to soccer, but the examples will be from this sport.

## 1 Introduction

The Canadian researcher Ian Franks proved that coaches only remember 30% of the game content correctly. Even after going through a special training they do not do any better than 50%. As a consequence, a trainer often misjudges certain situations. A quantitative and objective analysis of soccer games, with the aid of computers, could therefore be a priceless advantage.

VideoCoach<sup>®</sup> is a tool we specially developed to assist coaches. Starting from a video of the game and the software package VideoCoach<sup>®</sup>, an annotation of the game can be done after some initialisation. From the annotation, statistics can be derived, compilations can be made and video analysis can be done. The flow chart of the entire process is shown in Figure 1.

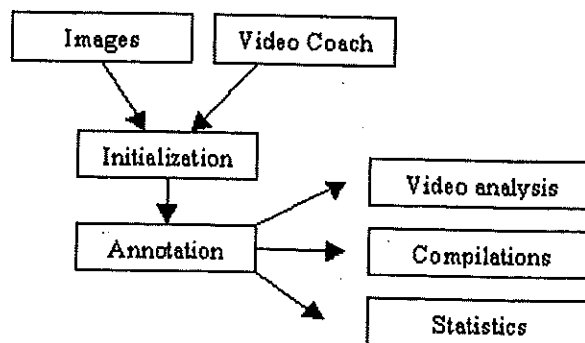


Figure 1: Flow chart of VideoCoach<sup>®</sup> process.





## 2 Images

The images of the game can be recorded with an ordinary camera or directly taped from television. They have to be digitised. We use Dazzle MovieStar [1] to deal with this problem. It can digitise input from a VCR, directly from a camera or even from television. It writes the input to mpeg format (real time) and the user can specify the bit rate. A quality of 12MB/minute is ideal because this is high enough and one half of the play can be burned onto one CD-ROM for distribution. We tape 55 minutes for each half to deal with extra time and camera set-up.

## 3 Initialisation

Before the annotation can start in VideoCoach® there is an initialisation phase. The purpose is that the coach has to decide what he or she wants to annotate (which actions, players, etc.) and how to annotate (with the keyboard interface or the touch screen interface). An absolute advantage of VideoCoach® is that the labels can be chosen freely by the user, that is, the labels are not predefined by the program.

The first step is to define the teams. Therefore a team database is set-up and saved on the hard disk. The team information can contain only the name of the team or can be more detailed including the names of the players, the shirt numbers and the labels attached to the players.

What are those labels and why are they needed? As stated above, the purpose of VideoCoach® is to help the trainer to remember the critical situations and to make it easy to reconstruct the situations when analysing the match with the players. Using this tool, a coach can mark each situation that is worth remembering. This marking is done by pressing a key (keyboard interface) or touching a button on the screen (touch screen interface). The label behind the key or button is attached to the phase. This can be "free kick", "goal", "fault", "corner", "throw in" or any other label that was defined by the user. These labels thus define actions and are called action labels. There are also quotation labels (to give a quantitative appreciation to an action), time labels (to identify the moment at which the action occurred, these are automatically filled in by the program) and player labels (usually the player's name, to indicate which player did the action).

A coach can define different label sets. Standard label sets for each kind of annotation (e.g. team or player) will be available for download in the near future. When the coach wants to analyse an individual player he or she will need other action labels than when wanting to analyse a whole team at once. The coach can combine the labels in any fashion, but before starting the annotation will need to select at most one action label set and one quotation label set.

After defining the label sets, matches can be created. Just the two teams that are playing against each other can be defined as a match, but we may also define the number of spectators, team line-up, date and hour, as well as a whole collection of notes that are important to remember for later use.

## 4 The annotation

Once a game is created, it is possible to annotate it. This can be done while watching the game in real time (the video is then linked afterwards) or otherwise. A label is attached to every interesting phase, using a touch screen or the keyboard.

The use of the touch screen is developed for a quick and user-friendly annotation. Figure 2 shows the interface. The yellow buttons are the labels. The label is written to the annotation list at the time the button is pressed and a new line is started (one click thus results in one label). On the left there is the video that is annotated and there are buttons to navigate through the video, start the first half, second half, extra time and penalties. In the left corner the annotation list is shown.

By using the keyboard a combination of the different label sets can be made if wanted. So one line in the annotation list can contain the time label, the player label, the actions made and the quotation. Each label has a unique key attached to it. By pressing this key, the label is displayed on the screen.



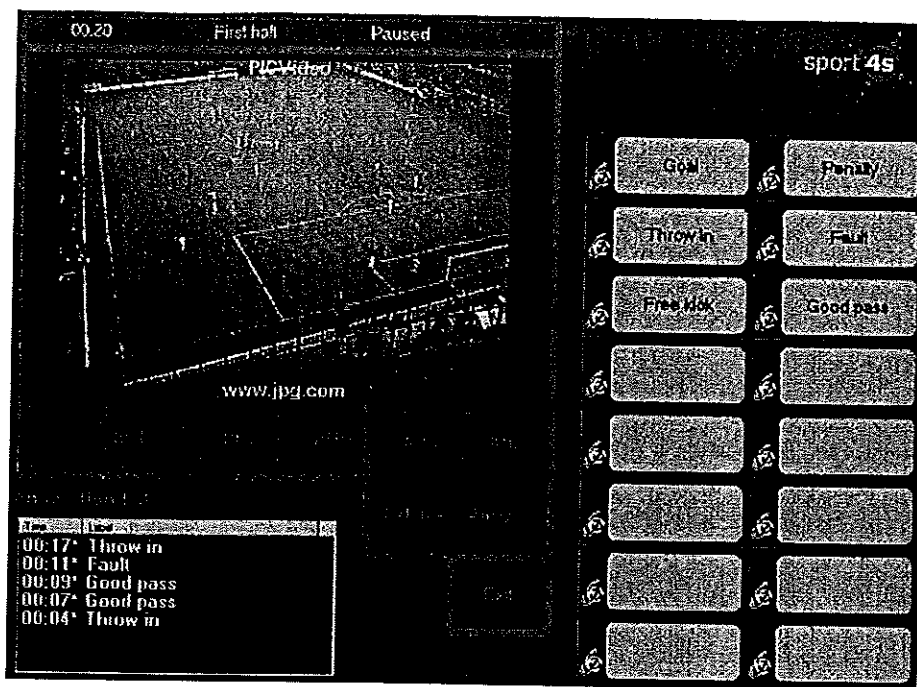


Figure 2: The touch screen interface.

The user specifies which label set defines a new line. When a label of this set is used, the annotation line is written in the database and a new line is started.

The annotation results in a list containing all the labels, as shown in Figure 3. The list can be ordered on time, action, player or quotation. The video fragment attached to every phase can be shown by double clicking on the corresponding line. A compilation can be made from this list. For example, in the screen dump all the actions of Crasson are selected. Figure 4 shows the corresponding compilation.

Belgium					
Period	Time	Action	Player	Quotation	
<input type="checkbox"/>	1 - First half	00:05	Fault	De Wilde Filip	+
<input type="checkbox"/>	1 - First half	00:13	Free kick	De Wilde Filip	+
<input checked="" type="checkbox"/>	1 - First half	00:20	Throw in	Crasson Bertrand	-
<input checked="" type="checkbox"/>	1 - First half	00:20	Fault	Crasson Bertrand	-
<input type="checkbox"/>	1 - First half	00:30	Throw in	Hosencia Emil	+
<input type="checkbox"/>	1 - First half	00:43	Fault	Valgaeren Jero	+
<input type="checkbox"/>	1 - First half	00:50	Free kick	Willaert Marc	+
<input checked="" type="checkbox"/>	1 - First half	00:56	Goal	Crasson Bertrand	+
<input type="checkbox"/>	1 - First half	01:02	Fault	De Wilde Filip	-
<input type="checkbox"/>	1 - First half	01:03	Goal	De Wilde Filip	-

Figure 3: The annotation list showing the labelled actions.

## 5 Video analysis and compilation

By just double clicking on the label in the label list, the video of the action behind each label can be shown. By selecting the desired actions a compilation can be made. This way, an individual player can get a video of his or her actions, ordered by action, time or appreciation. In Figure 3 all the actions of



Bertrand Crasson are selected. This player's actions are grouped in a compilation displayed in Figure 4. The compilation can be played, deleted or written to a new mpeg file of the same quality as the original one. The compilation can also be ordered on time, action, player or quotation. Extra information can be added manually or automatically if wanted.

Time	Period	Action	Player	Quotation	Info
00:20	1 - First half	Throw in	Crasson Bertrand		
00:26	1 - First half	Fault	Crasson Bertrand		
00:56	1 - First half	goal	Crasson Bertrand		

Figure 4: The compilation from the selection made in Figure 3.

## 6 Statistics

Statistics are calculated automatically after the annotation is completed (Figure 5). The number of times that every action occurred is calculated. From these occurrences the positively and negatively evaluated ones are counted and displayed separately. The analysis can be done for every player, for the whole team or for both teams. In Figure 5, it is done for the whole team.

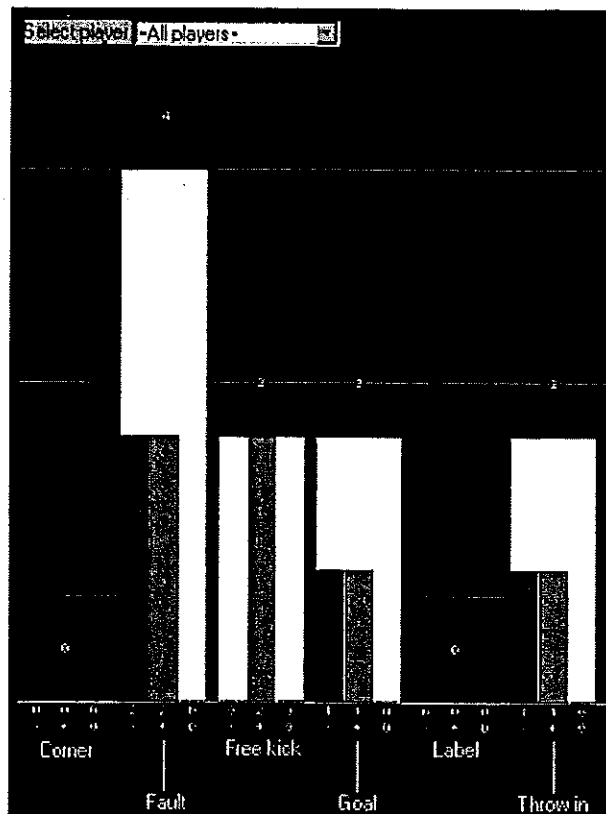


Figure 5: Statistics calculated automatically from the annotation.



Besides these statistics, sequence statistics can be calculated; for example, one can calculate how many times action x was followed by action y (Figure 6) and this for several time intervals. This can be useful, for example, to see how long the ball is kept in possession by the team after a free kick or a throw-in. Figure 6 shows how many times a throw-in was followed by a free kick.

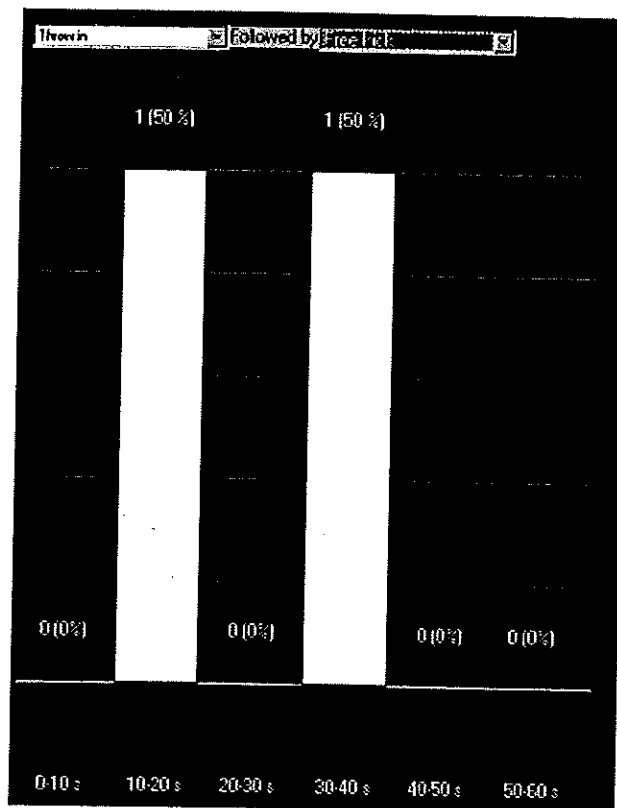


Figure 6: Sequence statistics show how many actions x are followed by actions y in different time intervals.

## 7 Future work

In the future, the statistics and data collected during several games will be used to make predictions, search for patterns and make a complete player database. Also a LUI (Language User Interface) for labelling will be developed.

A downloadable version will be available soon. The downloadable version can be obtained from [www.sport4s.com](http://www.sport4s.com) (not yet online). Those concerned can write to the authors to obtain VideoCoach<sup>®</sup>. Predefined VideoCoach<sup>®</sup> label sets for soccer and other sports and in several languages will also be downloadable from the website.

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## Reference

[1] Website: [www.dazzle.com](http://www.dazzle.com).

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