



## Digital Video Analysis Using QuickTime

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### ABSTRACT

Video has been used as an analysis tool in a wide range of research settings and paradigms. This paper describes a computer program developed for the purpose of coding QuickTime movies on a computer desktop. Events in these movies can then be coded for analysis by means of user-defined categories. Each event that is coded in a category is called an instance. Text can be attached to each instance and this text can be searched. Instances identified as a result of this search can then be used to create new movies. Movies can be created from all instances within each category.

### Introduction

Video has been used in many types of research. In biomechanics and ergonomics it has been used to study human and animal joint movement (*Takarada, Hirano, Ishige and Ishii, 1997*) and the mobility skills of children with cerebral palsy (*Hainsworth, Harrison, Sheldon and Roussounis, 1997*).

In medical research, video analysis is frequently used, particularly in the systematic study of cellular activity (*Smith and Chapin, 1996; Geisler, Weiss and Lindl, 1995*). Video analysis has been used to monitor airways management (*Mackenzie, Jefferies, Hunter, Bernhard and Xiao, 1996*) and to categorise many types of animal and insect behaviour including reproductive (*Zeh, 1997*) and feeding behaviour patterns (*Doyle, Berridge and Gosnell, 1993*).

Video analysis is used by sports researchers to analyse racquet preparation variables (*Wollstein and Neal, 1993*). In the social sciences, video analysis is used as a qualitative research tool. It has been used to study the language development of children (*Kot and Law, 1995*), arousal in infants (*Bigsby, Coster, Lester, and Peucker, 1996*) and the performance of trainees in simulators (*Tattersall and Hockey, 1995*).

One advantage of video analysis is that specific events can be reviewed repeatedly in circumstances similar to their original context. Most video analysis is conducted using conventional

videotape technology. One limitation of this technology is that isolating, identifying and reviewing events of interest can be time consuming, especially when these events are separated by more than a few minutes. This disadvantage can be overcome by using digital video and recent price/performance improvements in digital video technology have made desktop digital video analysis a viable research option.

This paper reports on the development and use of a digital video analysis computer program called VideoSearch (Knibb, 1997). A demonstration version of this software can be obtained from [http://malt.ed.ac.cowan.edu.au/VS/VS\\_DOWNLOAD/VS\\_demo/](http://malt.ed.ac.cowan.edu.au/VS/VS_DOWNLOAD/VS_demo/). To operate effectively, VideoSearch requires a Power Macintosh with 64 Mb of RAM, a video digitising card (eg. miroMotion DC30) and two or more gigabytes of free hard disk space. The memory partition for VideoSearch should be between 24 Mb and 32 Mb for a 64 Mb machine.

### Digitising movies

The first step in using VideoSearch is to store a video sequence on a computer hard disk as a digitised movie. VideoSearch is able to use all free space on a hard disk in a single digitising session if required. There is no two Gb limit to the size of the movie file recorded.

In trials, more than three hours of continuous video has been recorded. Approximately one gigabyte of free hard disk space is required to store 15-20 minutes of digital video suitable for most research purposes, but the storage rate varies considerably depending on the quality and size of the recorded images.

The first step in digitising a movie is to open the movie preview window by selecting Make > Open movie preview window.



Figure 1. Movie preview window

To initiate recording from the VCR or camera so that the movie can be stored on the computer's hard disk, click the Record

button in the movie preview window, set the recording location using the dialog box and click the Start recording button. During the recording process, the amount of free disk space is shown at the bottom left of the movie preview window. If the computer runs out of disk space during recording, the process will halt and the movie will be automatically saved. Recording can be halted by clicking the Stop button.

## Coding movies

As recording is halted, VideoSearch creates a movie window (Figure 2) at the top of the screen and a code window (Figure 3) underneath linked to this movie window.



Figure 2 Movie window attached to Document 1

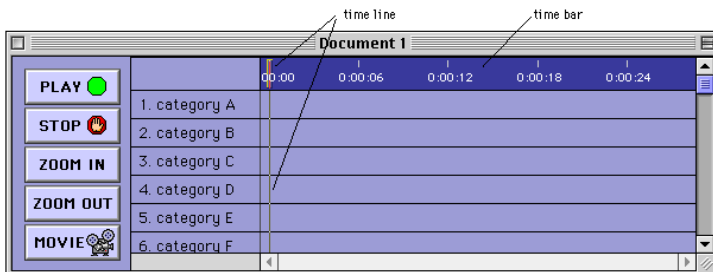


Figure 3 Code window

The time line in Figure 3 shows the time of the current view of the movie in the movie window. Click anywhere in the time bar to move to that time in the movie. Because the movie is stored on a hard disk, access to any point in the movie is almost instantaneous. In Figure 3, the times that can be viewed range from 0 seconds to just over 24 seconds. Double click on the time bar to start the movie playing from that point.

The movie window contains the movie and the code window contains observation categories and representations of instances of these categories in the movie. The movie files and code files are stored separately. This allows movie files to be archived to CDs for cheap storage. If the code file is on the hard disk, the codes can still be modified.

Another advantage of having separate movie and code files is that the same movie can be linked to many code windows. In this way, more than one researcher can code the same movie. This could be useful for the purposes of evaluating the reliability or consistency of judgements. A rating consistency index procedure is provided under the Output menu. Only one movie can be linked to a single code window at a time.

The buttons at the left of the code window provide control over the attached movie. PLAY and STOP start and stop the movie attached to the code window. ZOOM IN zooms in on the code window for detailed coding. This reduces the range of times displayed in the code window at any given time. The MOVIE button creates a movie of the instances in the selected row.

Each row in the code window can be thought of as a category, usually a category of behaviour. The names of the rows can be edited by double clicking on the name. Instances of categories can be inserted into each row to represent the presence of that event category in the movie for a given period of time. Figure 4 shows one instance of Teacher question and two instances of Student answer.

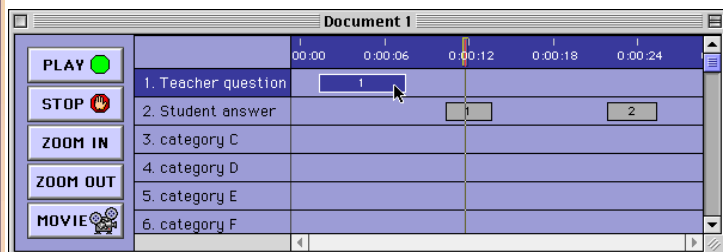


Figure 4 Instances in a Code window

Instances of observation categories in the attached movie can be inserted by; clicking once on the row that contains the observation category, clicking in the time bar and dragging the time line to the start of the instance, holding down the command key and dragging the time line to the end of the instance; and releasing the command key. To delete an instance, click on it once, then press the delete key. Select Undo from the Edit menu to restore the deleted instance.

Double click on an instance to play the movie for that instance. The movie for the instance selected will be played in a separate movie window. This movie can be saved if required. To create a movie that is a combination of all instances in a row in the code window, first click on a category name to select it. Next, click on the MOVIE button.

### Attaching text to an instance

Text can be added to instances and this text can be searched. To add text to an instance select Edit instance window... from the Windows menu title. A small text editing window will appear. Click on the code window to select this window. Click once on an instance in the code window to select that instance. This instance is now linked to the text edit window. The title bar of the text edit window indicates which instance it is linked to. Click on the text edit window to bring it to the front. Type the text to be attached to the instance.



Figure 5 Text Edit window

If there is space available in the code window, the text can be seen in both the text edit window and the instance at the same time.

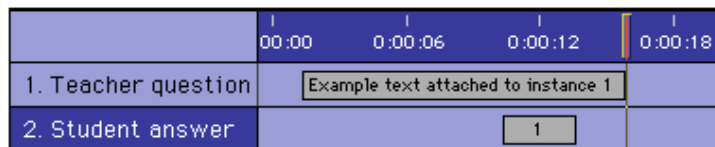


Figure 6 Text in an instance

There is a limit of 32 000 characters or about 5000 words for each instance.

## Creating movies from text descriptions

To create movies from text attached to instances first choose Edit > Find and highlight. This menu selection produces the Find dialog box.

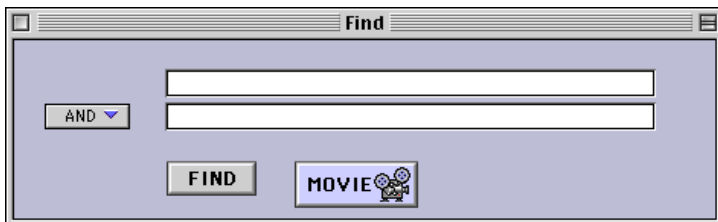


Figure 7 Find dialog

This dialog box can be used to search and highlight instances containing specified combinations of text. There are two dialog items in which text can be typed for subsequent searching. If a dialog item does not have any text inserted, then this dialog item is ignored during the search. The operations in the pop-up menus at the left ( AND, OR, NOT ) provide various search options.

For example, to search for and highlight instances containing "Teacher" and "speaking", type "Teaching" into the first dialog item and "speaking" into the second dialog item, select AND from the popup menu, then click the Find button (Figure 7). The search operations are progressive. This means each new operation (i.e. AND, OR, NOT) as it is encountered, is applied to the state of the search at that point.

## Output

VideoSearch contains a limited number of statistical analyses procedures. The results of these analyses appear in an output window. Output > Frequency produces a display showing basic frequency statistics of the instances in the code window. This output can be copied and pasted into other applications that can display graphics.

## Applying VideoSearch

VideoSearch has been used to code and analyse videos aimed at determining how small groups of students used an interactive multimedia program based upon a framework of situated learning (*Herrington and Knibb, (in press)*). The purpose of the study was to determine whether students spent the major part of their time attending to the program - as some studies suggest this is common in tertiary education settings - or whether they actively participated in the learning process. The findings of the study suggested that an interactive multimedia program based on a situated learning model is conducive to promoting important student activities such as articulation and reflection.

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