

EDITING COMPUTER ANIMATION BY COMPUTER

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The use of a computer for the production of film animation seems to be gaining popularity. A computer system for editing this film material would appear to be a logical next step. This paper will describe the approach taken by the author to develop such a system at the University of Toronto. The facilities of the system include the ability to cut and splice, make timing and intensity adjustments, add fades and dissolves, and make corrections to badly plotted frames. There are three modes of operation, two controlling the manner of plotting the film data, while the third, an interactive mode allows the special facility of creating new material while doing part of the editing step.

RESUMÉ

Il semble que l'utilisation d'un ordinateur pour la production de films animés devienne plus courante. Il paraît logique que la réalisation d'un système pour bien finir ces films soit la prochaine étape. Dans cette communication, on décrit la méthode utilisée à l'université de Toronto pour développer un système qui peut à la fois couper et réparer, régler la vitesse et l'intensité, commencer ou finir en fondu, enchaîner et corriger les images mal dessinées. Il y a trois modes d'opération dont deux sont des modes de contrôle de la méthode de représentation des images afin de les filmer et la troisième est un mode interactif donnant la possibilité de dessiner de nouvelles images pendant le processus de correction des autres.

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While working with Professor Les Mezei at the University of Toronto (May 1971 to June 1972), I was involved in the making of several computer-oriented films along with several artists. Two of these were fairly long, and were done in short segments. The system we used involved writing the film information onto magnetic tape, then plotting onto film via a Colcomp 835 microfilm plotter as a separate step.

For several reasons, I began to think that an intellegent plotting system would be a very desirable aid to film making. Initially I though only of being able to 'splice' segments and parts of segments together (the existing plotting software, although it allowed this, left at least one blank frame between plotted segments, causing an undesireable blink). A short time later, a situation arose where we needed some apparently simple optical work done. Looking into this turned up a much higher cost than anticipated. This led to the thinking of adding optical effects capabilities to the plotting system.

This scheme for using the computer to do some or all of the editing work of film-making appears to be

potentially quite useful. It by passes the need to do the messy, mechanical work of cutting and splicing, putting together A and B rolls etc. In many situations sufficient money exists to pay for computer time, but not for optical work. It also makes it possible to produce complete (except for sound) films, ready for showing, direct from the in-house plotting system.

### Background

The animation system in use at the University of Toronto is based primarily on ARTA, a picture-manipulating system developed by Les Mezei and Art Zivian, that has both interactive, and batch versions. The film-production is done on a Calcomp 835 Microfilm plotter fitted for 16mm film on-line to an IBM 360/44, through a special interface unit. The only useful editing features the plotter provides are controlled frame advance, and a set of about 8 or 10 useful grey levels.

In producing animated films, ARTA writes vector information about each frame onto magnetic tape which is expanded to incremental form when being plotted (an on-line operation). This vector information is reasonably compact, is complete, frame by frame, and thus can be thought of as film frames. The frames are separated by easily-recognized film advance information, and thus can be referred to separately, regardless of content.

The existing plotting software provides for the plotting of film information, either complete, partially in sequences (such as the first fifty frames), and/or in series (eg: every nth frame, or, every nth frame between frames m and ml). The software also provides for preview of film information on an IBM 2250 display unit on a one-frame-at-a-time basis.

Although this software works quite well, it has the annoying property mentioned of leaving, at a minimum one blank frame between segments of plotted film, and it is partly to solve this problem that the editing system is being written.

### Objectives

The objectives of the editing system are many, but basically they are quite simple: to provide a means of electronically editing computer animated films before/ during plotting, and to use the capabilities of the computing and plotting hardware to provide some "special effects" features.

Editing is simply the process of cutting out unwanted pieces in a desired order, not necessarily in the same order as when produced, yielding smooth, unbroken resultant film. This is usually a long, painstaking, and messy job. Using the computer for this purpose doesn't really make it much shorter, or less painstaking -- you still have to decide what to cut out, in what order to put what's left, and be able to describe it all frame by frame, but it does cut out the 'messy' part (our plotter can only handle 100 ft. rolls of film, thus a longer film must have 100 ft. sections glued together conventionally).

The system's real advantages are realized in its special effects' capabilities. By 'special effects' is meant such optical capabilities as fades, dissolves (a cross-fade between two film segments), superimposition of single and sequences of frames, timing adjustments (lengthening or shortening film sequences), reversing (printing sequences in reverse sequence) and image intensity adjustments. As well there are the additional capabilities of making corrections to individual frames, and of adding new material while editing.

Although it is possible to achieve most of these effects while initially producing the film, and is certainly more efficient to do so, it is often desirable to save the editing for a separate step. Many times when making a film you're not sure exactly what you are trying to achieve until you've seen the film footage. In our case at the University of Toronto, while making the film, we can't see what we're producing in real time (i.e. 24 fps) from the computer, and have to wait for the film. In these types of cases, after-the-fact editing gives you more flexibility, and better capability for producing good films.

### Approach

There are three approaches taken to achieve these goals. They all yield much the same results in final film output, but they do it in different ways that provide different types of usefulness.

One mode involves modifying the plotting system in such a way that all the editing steps are carried out yielding only a piece of film containing the edited information. This mode is particularly suited to producing a quick run to see how a particular editing scheme would work on film. It can be used to put together the final film if only one or two copies are wanted.

A second mode involves producing a new data-set containing the edited film information that can be plotted by

a simple plotting program. This mode's advantages include simpler plotting, especially when several copies are wanted, and a certain amount of data reduction by retaining only the needed information.

These two modes are somewhat similar, differing only in the form of the output. They operate in a batch mode, being directed by control cards in a manner similar to utility programs. All of the effects mentioned: cutting, and splicing, fades, dissolves, superimposition, timing and intensity adjustments are well handled by these programs.

The third mode is the interactive mode. It operates quite differently from the other two, and is primarily intended to provide a facility for making corrections to individual frames, and for the insertion of new material during part of the editing process. It is written as an additional command for the interactive version of ARTA, and relies on ARTA or provide the real power.

This mode of operation is intended to produce a new data-set containing edited film information. To this end, the addition to ARTA provides for the calling of any data-set, in any order desired; the transfer of specified frames from an input data-set to the output one; the skipping of un-wanted frames; and the transformation of plot information back to ARTA picture format for display. The user can use this system to view single or sequences of frames. Corrections can be made to any frame, or sequence of frames on a frame-by-frame basis, and new material can be created and inserted at any time.

### Conclusion

The system I've described isn't a particularly sophisticated one, nor is it very transportable in that it has been designed with the University of Toronto's system in mind. However, it would be useful to anyone making use of ARTA, and I hope the ideas involved may be useful to others. Since the use of computers for film animation appears to be growing, an editing system such as the one described would appear to be a useful tool. I've tried to show my approach to this.