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Computer Animation and New Ideas
Reviews by Myer in the Dark

FEATURE ARTICLE

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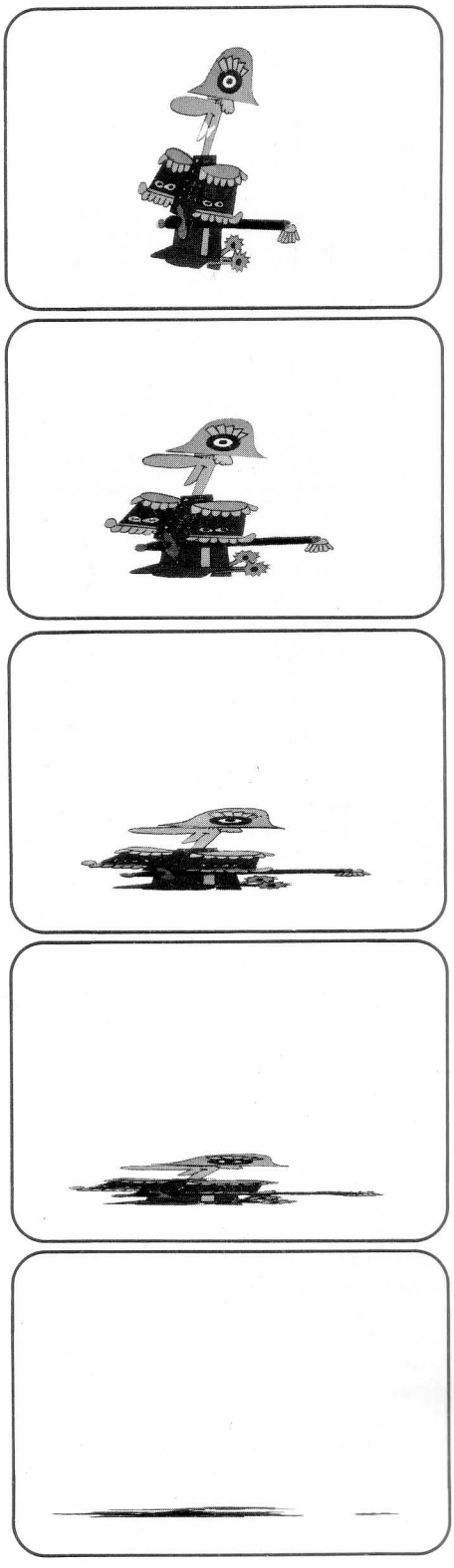
COMPUTERISING MOVING PICTURES FOR ANIMATION AND OTHER TRICKS

Animator, scriptwriter, cartoonist and computer animation expert extraordinary, the author uses all his skills in this introduction for the uninitiated



ONCE upon a time . . . films were silent and monochrome. One day, as a film-maker was pondering on this a good fairy appeared and said 'I will grant you three wishes'. The film-maker said 'I would like my films to have Sound . . . Colour . . . and . . er . . um' and for the life of him, couldn't think of anything else that would significantly add to the medium. 'Think about it' said the good fairly, and promptly disappeared in a cloud of airbrush smoke.

The film-maker thought about it. He thought of bigger, better, multi and 3D screens. He thought of stereo, quadro, and quintaphonic sound. He thought of video discs, holograms, and thermoplastic recording . . . but none of the goodies spun-off by technology's Gee-whizardry put a gleam in his eye. 'Perhaps we've done it all' he thought. 'Perhaps people only want sex, violence, and a family show at Xmas' he meditated. 'Perhaps . . . We're thinking of film in a too limited way. There must be *something* that will give the screen new impact'. So he took his last wish and said 'I wish to discover the way to give the screen new impact', and immediately there was a flash as he tripped over the aerial and hit his head on the TV set. He was buried the following Thursday.

His third wish might have been 'Computer Animation', for it contains the seeds for *all* future developments in film-making.

Providing the computer input

In principle, computer animation is simple; requiring only four stages of operation: Input, Store, Process, Display. Input covers any method of getting a drawing into the computer, which in practice means converting a drawing to numbers as XY co-ordinates. There are four common ways of doing this.

Teletype Keyboard: where the actual numbers, or a formula for generating the numbers, is typed-in directly. This is suitable for shapes and movements that can be easily described mathematically, such as geometrical figures.

Digitiser: This is an electronic tracing device that will automatically convert drawings into co-ordinates as the lines are traced over. Some digitisers have a set of command buttons to allow direct control of the computer as the user is tracing.

Datapad: various versions, principles, and names, but all allow the user to draw directly with a normal pencil or a pencil-like device that the artist finds easy to handle. It is a variant of the digitiser.

Optical Digitiser: the latest goody to arrive on the market scans a drawing with a type of TV camera. It can differentiate between grey scales and boundary lines automatically. Theoretically it could digitise photos as easily as drawings, allowing the designer an unlimited range of artwork to use.

Storing and processing the drawings

The *Store* covers any method of retaining the drawings once they have been put into the computer. The Store is usually a magnetic disc, drum, or tape, but there are so many variants around that it is sufficient to say that a disc the size of an LP record can store several thousand drawings; and other methods are comparable in their capacity.

The *Processor* is the actual guts (brain?) of the computer that does all the busy stuff in whatever way it will. Not all computers are suitable for animation, as the actual way the computer

handles information varies considerably from one to another. Computers designed for scientific work (number crunchers) are more suitable than those designed for commercial work (word crunchers).

There is a new breed of computers emerging that are specially built for graphics. These put a lot more importance on the peripherals of the computer. A noticeable feature is that animation programmes can be hard-wired (in the same way as functions are built into a pocket calculator) which significantly reduces the software needed and speeds up the processing considerably.

Displaying the graphics

The term *Display* covers all the units that are suitable for displaying the processed graphics. They vary in the resolution of the image, the range of grey scales available, the speed with which they draw, and how much graphic hardware is actually built into the display unit. But for animation purposes the choice comes down to two basic types: a storage cathode ray tube, which will store the drawing on the tube for as long as required until erased; and a refresh tube, which continually refreshes the image so that in a changing sequence there appears to be continual movement in real time.

The storage tube has the advantage that it allows control over single frame shooting. The intensity level can be changed and images can be superimposed on the screen to build up complex patterns. The refresh tube is ideal for real time viewing as it allows the user to actually see the animation as it will be shot; but real time shooting direct from a display has lighting problems.

New displays coming on the market have a range of colours, and there are also microfilm plotters being developed that incorporate colour filters to allow colour film to be shot. The ultimate display – being worked on by various companies – is the digital TV system. This would allow any images on the TV screen to be transformed by a computer, and recorded on to videotape.

Transferring drawings by hand

As an extension of the display, the *Plotter* has been developed for animation work. With this, anything that can be drawn via the display can be quickly drawn on paper or animation cel (clear acetate sheet). Plotters vary in size, speed, and versatility, but for animation the ideal is a flatbed plotter that can take standard drawing pens using a range of nib sizes and ink colours.

Once the required image changes and animation sequences have been displayed and stored, they may then be plotted out as a sequence of drawings to be hand painted and shot under a rostrum camera, as in normal animation work. The savings in time and effort are considerable because each drawing includes the camera movement and editing that would otherwise be done during or after the film is shot. The final 'artwork' from the computer is all on one field size, and usually all on one level, making even the most complex images and movements easy to shoot.

Digitiser used in computer animation. Tracings made over outline drawings, using the device on the flexible lead, automatically convert the drawing into digital information that can be processed and manipulated by the computer. (Facing page: Series of drawings from The Mathematician, *a BFI Production Board film for which computer animation was used for 'in-betweening' the outlines in the total movement sequence.)*

Why use a computer?

There are three important reasons for using the computer in animation: cost, convenience, creativity. It is cheaper to do animation by computer if the subject matter is consistent with the way the computer best operates.

A good example is typography; once a typeface has been digitised, it is stored in a library and is always available. It is easy to change its size, shape, and movement when retrieved. In this way, a small library of typefaces can be used over and over again without ever being repetitive.

It is convenient to use the computer if a job has to be done very fast, or if it is work that would tie up key animators who might be doing more specialised work. An example might be diagrammatic work: animators generally dislike this job and will happily let the machine do it while they get on with more personalised work, even though the cost difference may not be a benefit.

It is creative to use the computer for the sort of designs and movements that are beyond the animator. This includes 3D movements with true perspective; true interpolation between two shapes; and complex mathematical animation such as wrapping an image around a sphere, tube, disc, etc.

A spin-off for anyone doing long runs that use the same artwork is that over a period of time all the drawings stored in the computer files become a library in themselves. This is very useful for doing a quick line-test using drawings that are close enough to the required ones for the viewer to get an idea of what the film will look like, without going to the cost and effort of putting in original artwork.

Computer aids to animation

One stage away from computer animation (where the computer does the drawing), is computer aided animation; this covers any system where the computer is used significantly in the production.

More common in US, but just becoming generally available here, are computer controlled rostrum cameras. There are two types basically: the analogue and the digital version. The analogue type is easier to use, and cheaper to buy, but does not have the versatility of the digital version. A refinement on some cameras is to incorporate a TV camera so that the user may see the artwork as it is being shot, although as yet there are no single frame video rostrum cameras that will actually record directly on to videotape.

Computer controlled video systems are in a frantic state of development. The range goes from simple pattern generators at one end, through electronic games devices to the most ambitious task of getting digital TV on the air. Not all the devices can truly be called computers, but they have the common end of allowing the user to directly control the image on the screen via knobs and buttons as against software generated transformations.

Voice analysers/synthesisers

A very busy area that has yet to hit animation is computer voice analysers and synthesisers. The synthesisers can make voice-like noises, and have had some limited success in telephone answering systems. They might one day replace actors in the Daleks, but are not of much import in animation at this point in time.

Voice analyers are just about to emerge as the editors best friend, and will go well beyond animation ☛

in their application to provide an automatic breakdown of sound tracks. Briefly, they are able to take a recorded ¼in. magnetic tape and produce a breakdown into phoneme (the actual sound), the length of the sound and the strength of the sound, and print this out as a dope sheet suitable for use by the animator. At the moment there are still problems in identifying certain sounds but these are solveable.

Experiments have been done combining the track breakdown with the animation facility to produce actual lip shapes from the sound track. As an animated film may have three sound tracks of voice, music and sound effects, it becomes a mammoth job getting these broken down into corresponding frame numbers – and in most cases they are only put roughly into sync. giving us the common lip sync effect of a square mouthed goldfish.

Using a digitiser to trace a drawing at Video Animation Ltd.

Music and sound synthesisers

Not exactly computers, but falling into the same field, are music and sound synthesisers. These can by-pass the stock sound effects that an editor has to record before laying up his own tracks.

With these synthesisers, and a multi-track recorder, just about any sound imaginable can be made. These are often used in combination with the video effects systems to get visual patterns generated by sounds – heralded by some as the first significant step towards the ultimate total art form.

Cut-outs and models

Leaving drawn animation, computers can also do cut-out animation. Well, at least provide the cut-outs if not the actual animation.

The problem of cut-outs is that they have always been used as a cheap form of animation. The figures are actually animated under the camera by the animator, and so have to be simple in design and on one level. It is difficult to get the perspective, movement and shape changes normal with cel animation. But the computer exchanges the pen for a cutter, and allows shapes simulating perspective to be cut, and further enables accurate scale change to be made to a figure to simulate a zoom.

One step further than cut-outs is model animation. At its simplest it makes up most of the animation seen on television before the six o'clock news, and would bore an intelligent three year old. At its best it goes a stage further than King Kong to produce arthritic monsters from other worlds.

The problems of making models move naturally is that normal movements change speed as they start and stop. In conventional animation this is called a fairing – and the cameraman puts this on to camera moves for most drawings, but it is very difficult to do this with a hand-moved model. Further to this is the problem of strobing that occurs when there is no speed slurr to soften the edges.

Both these problems can to some extent be overcome by using the computer to operate the models. This area has not been developed very far, but some attempts have been made using an actor in a harness hooked up to a computer to record his movements, which are then fed to a model. Other methods use a model which is moved by hand and the movements recorded; these are later played back at various speeds.

The mind-boggling future

A fantastic amount of time, money and effort is being put into computer simulation – most of it involving graphics and animation. Every leading computer manufacturer now has a graphics system; and many specialist computer peripheral makes are turning to the graphics and animation output for speed and convenience. The main areas of interest are displays, lasers, plotters, and digitisers.

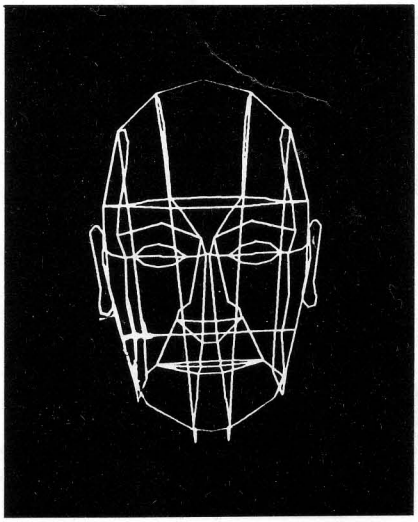
Displays are developing in various directions. Apart from getting larger, smaller, thinner and with better resolution, they are becoming available in liquid crystal, L.E.D, plasma, electroluminescent, and other exotic methods that are consistent with computer interfaces. Three-dimensional radar in colour, pocket calculators, cockpit displays, are typical development areas.

Plotters are notoriously slow computer output devices. The new matrix plotters have several hundred nibs on them and can print half-tone pictures at about one every three seconds. Ones being developed include those that spray ink on specially treated paper, and produce almost instant drawings.

Digitisers are going from 2D to 3D so that solid shapes may be 'traced' over as easily as drawings, or a drawing given three dimensions at the drawing stage rather than the processing one. There are also acoustic digitisers available that allow you to draw with your finger on a plain sheet of glass – the co-ordinate being picked up by an echo of where your finger is. This would allow back projection tracing, as in the common animation technique of Rotoscoping.

Slightly off the track is the possibility of using ballet notation as a method of typing in the movements of an animated character. Quite a bit of work has been done in this field, and 'ballets' have been created on the computer display by this method; in fact NASA used a ballet notation to record the positions of weightless spacemen.

Puppets can be automatically shaped by a machine – using numerical control as found in factories but programmed from digitised drawings. Multiscreen projectors can be operated by programmed computers and cameras are becoming increasingly automatic to the sort of effect and transitions that broadly would otherwise be done as an animation technique.



Three-dimensional reconstruction of a man's head which, by computer animation, can be easily changed in perspective. From Personality and Learning, *an Open University film.*

Markets

The recent conference on animation held in UK by the Scientific Film Association indicated the new areas of development in computer animation. Originally the techniques were developed for scientists to model mathematical concepts in space and time, and have always had obvious applications in teaching – but have until recently been far too expensive for most work.

Tony Diment (Video Animation) demonstrated at this conference a showreel of computer animation that covered the spectrum of markets, from TV commercials and BBC logos, through teaching and scientific simulation, to 'moving blueprints' for engineers and architects. The costs have been brought down considerably by working in close liaison with animation studios and only providing the artwork or line test that the animation studio could not do themselves. This allows the computer to do what it does best yet still allows the animator to give it the personal touch. ■