TELEVISION'S CREATIVE PALETTE

by Eric Somers

Techniques used to create abstract television "art" can add appeal to local studio productions at minimum cost.

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The term "special effect" presupposes a particular role for the television medium, that of accurately reproducing images seen by the unaided eye. An image that does not correspond to a real-life visual perception, a matte effect for example, is therefore "special." Often such "special effects" are used as gimmicks to attract attention to a commercial, or to make a song or dance number look "arty."

At the Creighton University Communication Arts center we are experimenting with techniques for creating entire television "programs" from "special effects." In the context of our research we no longer consider non-representational images "special effects." We are developing a kind of television programming not committed to the traditional role of television, that of accurately reproducing images seen by the naked eye. We are creating visual structures, television "programs" or art pieces, made up of images generated by electronic and electro-optical systems.

For purposes of our research we have collected a fairly complex assemblage of equipment we call an electronic video design system. It consists primarily of commercially available electronic and optical devices (although some devices are being used for purposes other than that intended by their manufacturer), along with some equipment built by Jon Olerich, Creighton CCTV chief engineer, and me.

We have resisted calling the system a "video synthesizer." Several people have built so-called "synthesizers," but no "synthesizer" with which I am acquainted seems as versatile visually as modern music synthesizers are aurally. Our system is not a single video "machine," but is a constantly changing electronic system, as is a television studio, designed to create abstract and semi-abstract television pictures. We believe our system has greater

image generating capability than any of the so-called "synthesizers" currently in use.

Since many parts of our television system consist of devices found in most television studios, many of our image generating techniques can be duplicated by commercial broadcast and cable studios to increase their "special effect" capability. Some broadcasters may shy away from the concept of abstract images, associating such images only with "far out" art pieces rarely seen over the air (except occasionally on public stations). But the creative producer can often borrow valuable techniques from the visual artist, even though his video productions may be aimed at a general audience. The painter, Pieter Mondrian, for example, influenced commercial advertising design tremendously. And many unusual photographic techniques seen frequently on the advertising and feature pages of today's magazines were developed by photographic artists like Man Ray and "weegee."

If electronically created images are to be used often, they must have considerable variety. Computer art often fails because it seems incapable of being developed (within the present state of technology) beyond the level of geometric tricks. Every work of pictorial art contains elements of tone value (brightness) and color (even though there may be only a single color, i.e. monochrome). Ability to control the tonal value and color to a great extent will help make interesting images.

The forms, or shapes, found in pictorial art can generally be catagorized into one of three types: lines, masses, or textures (actually apparent texture since the term "texture" in its strict sense relates to the sense of touch). A producer who wishes to use abstract images effectively should know techniques

for generating images of all three types. In that way he can avoid the trap of over-repetition of the same forms.

Changes of color and tonal value in a television picture can alter the overall image immensely. Often changing these elements in the picture produced by a conventional television camera is sufficient to create a semi-abstract image of great interest. Reversing polarity or altering the balance between the outputs of the pick-up tubes in a color camera are obvious and somewhat crude methods of changing tonal value and color.

A more sophisticated technique is to use a colorizer or quantizer. A colorizer takes a monochrome video signal and inserts color information related to the brightness component (i.e. voltage) of the signal. The resulting colors, of course, bear no relationship to the colors in the scene being photographed. The results can be startling.

A video quantizer changes both the tonal values and color values. It consists of a series of gates which "slice" the gray scale (voltage range) into a number of divisions. Each division is assigned a certain tonal value (voltage) and color which need bear little relationship to these components of the original signal. The "slice" is a segment of a continuum, but the electronically generated signal which replaces a slice is of constant brightness (voltage) and color. Therefore, the result is a series of colored contours, the number determined by the number of "slices" selected, which give the impression of a picture created by overlaying colored paper cutouts.

We are always looking for effective ways of creating synthetic color at Creighton, since our best image generation techniques are capable of providing monochrome pictures only. Of all the techniques and devices we have tested

to date, the Colorado Video model 606 quantizer is the most versatile. It is capable of up to 16 "slices" and produces an R-G-B output suitable for encoding to the NTSC, or any other, system. Although its $3500 price tag may be a bit steep for very low budget operations, it is an extremely versatile production tool that should find considerable use in the hands of a creative production team. In day-to-day production not using abstract effects, the quantizer can be used to create color effects in titles and graphics that would otherwise require considerable skill and time on the part of a graphic artist.

An easy and inexpensive method of producing interesting abstract shapes is by controlled use of video feedback. We are talking about optical feedback, pointing a television camera at a monitor displaying the output of the camera. If one is totally unfamiliar with feedback images, it is perhaps best to start by placing a studio monitor directly in front of a camera and focusing the camera on the screen. The output of the camera should then be fed to the monitor and an object placed near the monitor, between the camera and the monitor. If the camera is then shaded correctly, and the monitor brightness and contrast controls set properly, a "tunnel" of image repetitions will result, similar to the effect produced when two mirrors are placed opposite each other. Instead of placing an object between the camera and monitor it is also possible to display on the monitor two images, one from the camera aimed at the monitor and one from another camera. Repetitions of the image of a person, for example, can be created this way. By mixing the images from the camera photographing the person and the camera generating feedback, an image can be put on the line which contains a well defined subject and a series of less defined "shadows."

But feedback can be used alone to create images of great complexity. Returning to our original camera-monitor set-up, but without an object placed between the camera and monitor or a secondary image displayed on the monitor, gradually rotate the monitor through at least a 180 degree arc. At various points around the arc stop and adjust camera iris and pedestal (and possibly monitor brightness controls) and various circular or polygonal shapes of varying degrees of complexity should accur. The camera may be zoomed or dollied to change the effect. When certain factors interact together images in motion may result even while there is no manipulation of camera or monitor controls. Reversing polarity will also create new images. If images from another camera are also displayed on the feedback monitor, these forms will be integrated into the abstract display. A moving point of light, such as a candle held in front of the monitor, will produce multiple spot patterns.

Feedback images require much patience and considerable knob twisting to produce really impressive results. But careful and patient experimentation will reveal that a seemingly endless array of images can be produced. Certain camera-monitor combinations work better than others. Often low cost CCTV cameras, especially those having an RF output feeding an ordinary home receiver, produce the most complex patterns. But we have also achieved excellent results with broadcast type cameras. The lack of specialized equipment needed and the variety of shapes which can be produced have made feedback a popular technique with young people having access to portable equipment.

Feedback images are probably best generated in monochrome and colorized synthetically. But some color camera / color monitor combinations are capable of producing excellent color feedback images, especially if the output levels of

the color pickup tubes are altered as the images are being produced. We have achieved especially good results with a Norelco LDH-1 plumbicon camera and a Sony Trinitron monitor.

Line images often resembling computer generated images can be inexpensively obtained with one or more function (or audio) generators, an oscilloscope, and a television camera capable of reproducing the image from the oscilloscope screen. The technique is simple. Produce a visually interesting design (preferably one that moves) on the oscilloscope CRT and photograph it with the television camera. Synthetic colorization is almost a necessity unless your favorite color is green. Ben Laposky, an artist who began making still photographs of images produced with an oscilloscope as far back as the early 1950s, uses a white phosphor cathode ray tube (as found in flying spot scanners) and adds color with a rotating color wheel. Since the image is "drawn" on the face of the CRT over a period of time, various portions of the image take on different colors corresponding to the segment of the wheel that is in front of the moving spot at a particular time. The light output of such a setup is so low that only exotic color cameras designed for extremely low light operation could probably reproduce a complex trace (containing fine lines).

Most engineers probably know how to produce a large number of interesting shapes on an oscilloscope. Such images are frequently displayed at science fairs and are a favorite pastime with technical students. I know a PhD professor in Creighton's School of Medicine who admits to occasional electronic "doodling" with an oscilloscope and function generator used in his research. For those who may have used a scope only as a test instrument, however, some review of image producing techniques may be useful.

A signal from a function or audio generator may be used to affect the CRT display in one of four ways. It can drive the vertical axis of the scope and be displayed horizontally using a horizontal sweep signal generated by a built-in time base. (On some scopes it is possible to reverse the arrangement and feed a signal to the horizontal axis to be displayed along a vertical time base.) A signal can also be fed to either the vertical or horizontal axis of the scope and a second signal fed to the remaining axis input. By use of a simple phase shift circuit the same signal can be fed to both axes, but one out of phase with respect to the other. Finally, a signal can modulate the Z-axis (brightness) of the CRT display.

Complex signals often make the most interesting display patterns. Simple forms from several generators can be mixed. Some scopes also allow for electronic switching of two or more signals feeding the same axis. A voltage controlled amplifier (inexpensively bought or built) will allow one signal to be used to amplitude modulate another. If a function generator possessing a voltage controlled oscillator is used, frequency modulation will be possible. A little experimentation should lead to many visually pleasing line patterns and textures on the display tube. Mixing oscilloscope images and feedback techniques will allow for the creation of countless "hybrid" designs.

At Creighton we presently use a Synthi AKS analog synthesizer, designed for electronic music, as a signal source for electronic image generation. Although the device is limited to audio frequencies, it does provide a nice array of voltage controlled oscillators, voltage controlled amplifiers, filters, etc. in one package. We have added a dual channel phase shifter (two inputs, four outputs) to the unit. Since some of us who use the system are also trained in

music, the synthesizer is useful for creating music and sound effects tracks also.

But we originally began generating electronic images with a few inexpensive Eico audio generators and a voltage controlled amplifier built out of junk box parts. With a little imagination most any engineer can probably put together a useful set of components without much expense.

Better quality electronic image displays can be achieved by replacing the camera-oscilloscope combination with a scan converter of the type used for computer readout purposes. But the cost of such a system would probably exceed its usefulness to most broadcasting or cable studios.

Studios lacking colorizers or quantizers can feed three monochrome camera signals into an NTSC encoder to get three-color effects. This technique should work especially well with oscilloscope images since often they are not very dense.

The techniques described in this article should provide the creative director with many useful abstract and semi-abstract images to add color and life to television productions. In addition to the techniques described, we are experimenting at Creighton University with three other types of image generation devices and techniques; monitors modified to distort the sweeps with various control signals (cameras re-shoot the images displayed on the monitors), Z-axis modulation of the television raster (i.e. non-video signals displayed as video, a simple technique in principle but requiring complex and expensive systems of specialized generators and modulators to achieve complex images and good control — the Beck Video Synthesizer uses this principle) and diffraction and interference patterns generated with a laser and specialized optical systems which display the image on the face of a vidicon tube (an extremely useful image tool because of the textural complexity and great beauty of the moving

and still images created).

But this article has attempted to explain only those techniques which can be used by almost any broadcast or cable studio without the purchase of too much specialized equipment. A little patience and imagination, along with these techniques, will allow even the smallest operation to put out video productions of considerable aesthetic appeal.

Eric Somers is Associate Director of Communication Arts at Creighton University. An early experimenter with abstract television techniques, he taught the first university course in experimental television. He has lectured and shown his abstract tapes in most cities in the U.S. and Canada. Last summer he was Workshop Director of the First National Videotape Festival held in Minneapolis.

In addition to television production, Mr. Somers does creative work in electronic and non-electronic music and in holography.

Professor Somers also works independently as a communications software designer (film, television, holography, graphics, and sound design) and as a hardware systems designer.