

A VIDEO PROCESSING FACILITY FOR ARTISTIC USE: Design Philosophy
and a Description of Components

In the organization of a standard television facility, a switcher functions roughly like the system's brain. It receives information in the form of incoming electronic signals, processes them, then sends them out again to monitors, videotape recorders, or to a transmitter for broadcast over the air. The evolution of television technology has produced a common two bus switcher which enables an operator to fade between two signals. It is used conventionally for making transitions between various picture sources, and is limited to two signals at any one time.

Artists at the National Center are pressing out upon the parameters of broadcast technology. Images traditionally considered aberrative are used as aesthetic components. The receiving monitor has become a canvas for subtly layered images mixed simultaneously from many sources. For these artists and their work, the conventional system's brain seemed to restrain, rather than coordinate and liberate. As a result, Lawrence W. Templeton, when he began design and construction of a switcher for the Center, found he must create an instrument which had no precedent in video, one which required a new design philosophy as well as new circuitry, one which could not properly be called a "switcher" at all.

DESIGN PHILOSOPHY

At the outset, the artists' work obviated purchasing a standard two bus-plus preview switcher. This instrument is designed to fade between two signals simultaneously; the Center artists wished to fade and mix among at least eight. An eight input/eight output switcher is not manufactured commercially; it could be custom-built, at great cost, but it would be basically an inflexible instrument, particularly for an experimental operation. This is due to the design philosophy of the broadcast switcher itself, which reflects wholly different production needs: there are certain situations in broadcasting which are normals; they are repeatable day after day in a television studio; there are normal paths for certain kinds of flow -- three cameras into a switcher, that switcher into a master control switcher and to videotape recorders -- and it is nearly impossible to reverse this flow, recombine signals, or loop them back through the switching apparatus. The working mode of Center artists seemed much more analogous to an audio mixing situation than to this conventional video scheme. The standard switching design, therefore, was rejected, and a highly flexible arrangement of patch cords and experimental plug-in modules instituted.

As the Center "Mixer" evolved, its pliability became apparent. Its six distribution amplifiers -- only one of many types of modules in the Mixer -- with four inputs and three out-

puts each, permit simultaneous mixing of nineteen signals to become one new, complex image. Rather than using the lighted pushbuttons of the broadcast instrument, signals are connected among modules with patch cords. An artist makes these connections directly, by plugging and unplugging cords of various colors, and, as his work becomes complex, can see clearly all the elements of his signal flow. The Mixer's normal mode is open-ended and disconnected, with compatibility both-endwise on each module. This means that instead of a "male" plug coming in and a "female" going out, anything can be plugged into anything. Outputs can even be patched to outputs by mistake, without damage. The artist can connect pieces of equipment together in strings, parallels or multiples -- in any configuration he wishes -- to the point of controlling what are normally considered technical aberrations and utilizing them aesthetically.

Design of the Mixer took three areas into account: the generation of signals, their processing and their control. Presently, signals are generated at the Center by two Sony DXC-2000A black and white cameras, a Sony DXC-5000 color camera, or they can be originated by the Beck Direct Video Synthesizer. In this report, it is the processing and control of signals which is emphasized; a description of the Beck Synthesizer appears as another paper in this bundle.

All inputs, levels and outputs in the Center Mixer are standard. Any external video signal can be patched in, processed in a number of ways, and then become a standard output signal.

The signals within the processing system are non-composite -- sync and color burst are stripped off the signal before it enters the processing module so that the signal can be easily transformed, and they are added again as the video leaves the Mixer for external destinations such as monitors and videotape recorders.

The processing modules -- keyers, colorizers, color modulator, edge generator, feedback delay lines and multi-keyer -- were designed as experimental plug-in modules. As they were used and refined, they became regular tools built into fixed panels on the Mixer. Liberal space was provided, moreover, for the continued addition of experimental modules to give the Mixer new functions and the artist new capabilities.

PROCESSING OF SIGNALS

Keyers. The Center's four keyers deviate only slightly from those standard in the broadcast industry. A keyer is basically a switch controlled by a video signal which enables an operator to switch between any other two video signals with the switching decision made by a third video signal, or one of the two he is switching between. It is used most often in broadcasting for show titles or for creating the illusion that a newscaster is sitting in the corner of his news footage. Center artists generally use keyers to remove parts of images and insert new material inside. Portions of a face, for example, will seem to disintegrate and new colors or imagery replace them. Into the

Center's keyers was built the ability to invert signals so that those reversed signals could be added together -- black as white, white as black, or colors in their negatives.

Colorizers. The four colorizers generate a color signal of arbitrary amplitude (brightness), hue and saturation, so that an artist can create any color at any brightness or intensity he wishes. The basic color signals out of which he forms the color are generated digitally and will not drift after being set. Colorizers can be used through straight addition to other video signals, either monochrome or color, or with the keyer to insert arbitrary colors into a signal. They are controlled by "joysticks," as if the color spectrum were laid out in a circle; the artist creates his color by moving and twisting the joystick: it is twistable for brightness; the saturation is deviation from center and the hue position-relative to center.

Color Modulator. With this module an artist takes a basic color signal from the color camera or from a colorizer and controls the hue and saturation of the color in that signal using another signal, either audio or video. Instead of moving his hand around with a joystick, he can electronically create or change colors of previously existing signals. Brightness is literally translated into color. In a picture of a man's face, for example, the bright spots on the face might appear to be red, the dim spots blue, green, or whatever else the artist chose to make them.

Edge Generator. The edge generator outlines solid forms, so that the human body, for example, becomes a moving line drawing. This module separates out the high frequency components of the video waveform, i.e., wherever there is a sharp transition from black to white or white to black, and puts them through a squaring circuit so that all transitions, positive or negative, come out all positive or all negative.

Delay Lines. The Center artists utilize two variable delay lines to create new images. These delay lines are used during "feedback" production, i.e., when a camera is being trained on a monitor which is displaying the signal the camera is creating. The delay lines permit the artist to vary the time required for a complete trip around the circuit -- from camera through cables to the monitor, through space, to the camera lens. This causes changes in the feedback-created patterns, with the most profound effect on colors.

Multi-Keyer. This module enables an artist to simultaneously key eight different signals -- colors or separate picture information -- into a video display. The multi-keyer switches are driven by another external video source, a ninth source, or any one of the eight that are being introduced into the switches. The decision to switch is based on the amplitude of this input control signal, i.e., if the input control signal is higher than a certain level, it opens up one switch; if it is higher than the threshold level for the second switch, it opens the second and the first one is closed. Through any

of these switch-inputs an artist can put in a colorizer, another picture, or a processed signal of any kind.

Remote Control Switcher. This is an addition to the Center Mixer designed and built by circuit engineer Richard Stephens. An adaptation of broadcast switching design, it is a hand-held unit that enables one artist on the studio floor to make an entire work without ever leaving that small area. In addition to switching between one or more cameras, the artist can switch between images combined or processed by the Mixer. The hand-held unit is an encoding box which sends control voltages to circuits built into the Mixer where the switching actually occurs.

CONTROL OF SIGNALS

In designing an experimental video facility, it is important that each piece of equipment be compatible with the others by means of standardized signals. Artists at the Center, for example, have begun modulating video in the multi-keyer via control voltages from a Buchla Electric Music Box. At present, control of signals is effected by the human being manipulating knobs, buttons and joysticks. There is no reason, however, why this cannot occur with touch-sensitive plastic "keyboards," or biological feedback devices. Experiments have begun at the Center where polygraph and skin response measurement devices have been interfaced with the Buchla synthesizer to modify video displays. Ultimately the

human being may be able to "make" video with his own, natural biological signals.

In both audio and video art, many of the electronic processing techniques are the same: the difference lies in the bandwidths involved. With commonality of control voltages, each element in an experimental system could be plugged into all the others. With audio and video processors, entire video compositions could be stored as audio control tones on an audiotape, and artists would be making audiotapes to play back on audiotape machines which control video processors.

Lawrence W. Templeton
Don Hallock
Richard Stephens
Ann Turner