

# EXPERIMENTAL TELEVISION CENTER LTD.

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As video image generating, processing and synthesizing systems become increasingly sophisticated, the problem of achieving maximum control over these systems must be addressed. This is particularly relevant to situations in which videomakers work independently and frequently as individuals in the creation of their works. Many video systems provide such a large number of image making variables that manual adjustments within the parameters of each control necessary to obtain desired structures and sequences is not always possible. The artist must then compromise the image to the system. Video synthesizer systems offer an enormous potential for intricate image constructions, but without appropriate control systems the individual artist may not be able to take full advantage of the system to achieve with accuracy the structures desired. Microprocessor systems, it was believed, could provide the necessary control for precision of image structuring if these computer systems could be completely dedicated to the processes of visual art making and be made usable by artists in direct ways.

The primary aim of the Computer-Based Video Synthesizer project was the research and development of such systems with capacity for direct use by artists in the production of independent works. A major design consideration in both hardware and software development concerned the establishment of a holistic system directly related to the requirements of individuals working in the electronic arts and usable by them in their personal work. It was considered important to reduce, as much as possible, the reliance by artists on outside technical support in the production processes because of the difficulties of communication and interpretation and the intimacy of the creative situation. The initial planning for this project began in 1975 with conferences at the Experimental Television Center involving Mr. Ralph Hocking, Mr. Walter Wright, Dr. Donald McArthur and Mr. Richard Brewster of Binghamton, New York and Steina and Woody Vasulka of Buffalo, New York. With support from the National Endowment for the Arts and the New York State Council on the Arts, the project was completed in the Fall of 1977; the resulting system is now operational at the Experimental Television Center and is available for use by artists through the production program at the Center.

An important philosophical consideration throughout the project concerned a humanistic approach to the design and utilization of computer and video systems technologies; one of the initial stages of this project involved the development of methodologies which would guide the construction of complex tools and systems dedicated to the needs of visual artists. To achieve this end, it was essential that artists, programmers and engineers work together in all aspects of the project, each group communicating from its own unique perspective. Artists helped to articulate and define the types of controls which they felt were important in image making. Engineers and programmers frequently introduced image making devices and control methods which had not previously been available; the structural and compositional potentials of these components were completely unexplored. In the design and construction of the hardware there were a number of specific objectives. A flexible and versatile system was important in order

to provide artists with as many options as possible for image generation, processing and control. The present system is modular in design and permits the inclusion or exclusion of discrete components in the assembly of a system specifically tailored to meet the individual requirements of a particular artist or project. Modular and standardized design also allows for the future research and development of new components and the modification of existing hardware and software all of which can be incorporated into the present system with a minimum of effort. The system is capable of interfacing with many video and computer components an increasing number of which are owned by or accessible to individual artists and small arts organizations. For example, the system at the Center is compatible with the system of Steina and Woody Vasulka, and exchanges of software and hardware are possible between Buffalo and Binghamton. Video production requires a fairly powerful microprocessor system which is capable of efficiently handling the large amount of information necessary in the generation and control of image structures. The needs for a powerful system, also low in cost, had to be weighed against the factor of complexity since the system was to be used by individual artists the majority of whom had little or no prior experience with computer hardware or software. The 16 bit system as it was designed and constructed met the criteria of low cost, high power and ease of operation. The hardware made use of commercially available components as much as possible in the interests of efficiency of operation and construction and ease of duplication of the system by artists and arts groups. Many specific components and interfaces, however, had to be designed and constructed specifically for this project since they were either not available commercially or were too costly; many of the commercial components which were available did not meet the specific requirements determined by the nature of the application of the system.

The software development for this project also emphasized a humanistic approach to the use of microprocessor and video systems by artists. The goal of the software research was the development of an interactive language usable by artists. This language had to be understandable to artists so that they could address the computer directly, using language and concepts derived from the visual arts, without the necessity of translation into high level computer languages. The language had to be responsive to the needs of artists, enabling them to manipulate discrete elements of design and compositional structures. Further, it had to allow the artist to intervene at any point in the construction of the composition so details of compositional configurations as well as whole sequences could be easily altered. Precision was felt to be critical; the artist had to be able to develop and score the composition, store, run and edit it in a manner which insured its accuracy and repeatability. It was felt that the language should also provide for the option of programmed randomness and operate in either structured or random modes or a predetermined combination of both modes.

The computer-based video synthesizer system which is now operational at the Center consists of two sub-systems, the microprocessor and the video system and their interface. The computer section consists of a 16 bit DEC LSI-11 microprocessor, teletype and printer, dual floppy disk and 20K of memory. Components designed and constructed specifically for this project include the parallel interface, buffer memory, module to element bus, element bus, digital to analog

converters, analog to digital converters and real time input. The video system includes a four channel analog colorizer with keyers, a 50 point switching matrix, spatial and intensity digitizer and a voltage control bank. The video system is modular in design; each of these components was researched, designed and constructed over a period of four years under the research and development program at the Center. Each of the video components may be combined with any other to form a system tailored to individual requirements; the video system may be operated manually or placed under computer control. This design consideration allows a maximum flexibility with a limited amount of equipment, permitting the same components to serve a variety of artists with different systems needs and experiences. Hardware design also permits manual interruption of computer processes at any point through the use of analog to digital converters and real time input. This feature allows the artist more complete control over all elements of the image and its temporal structures. Changes in composition may occur by software reprogramming or direct manual interactions by the artist or a combination of these techniques.

A more detailed description of the hardware aspect of this project is presented in the papers by Dr. Donald McArthur. Section I A provides an orientation to the system architecture. Section I B is a paper written from a transcript of a presentation by McArthur in Buffalo, New York in March 1977 for the 'Design/Electronic Arts' conference supported by the National Endowment for the Arts and the New York State Council on the Arts and sponsored by Media Study/Buffalo and the Center for Media Study, State University of New York at Buffalo. This presentation by McArthur was based directly on the research McArthur had done for the Computer-Based Video Synthesizer project.

The aim of the software aspect of the project was the development of an interactive language which uses concepts and vocabulary derived from the visual arts. It was anticipated that this approach would make the computer based video system accessible to a much larger number of artists than would a system which depends on the presence of a programmer to interpret the ideas and images of an artist into a computer language. Before any except the most rudimentary of programming could be developed, analysis of the fundamental elements in the composition of single images as well as their temporal structures had to be conducted. Identification and definition of these elements and the parameters of change within each variable were the initial steps. Within single images, discounting the time function, elements which were chosen included color field variables such as hue, saturation, chroma and intensity, form and shape variables including type of shape, position and frequency, texture and density. Each element has parameters of change which involve the temporal aspects of video. The methods of change involve problems of duration and sequencing with references to rhythmic structures.

As is noted in the papers by Wright, the software research is still in its initial stages and further explorations are necessary before the interactive language is fully functional. Several programs have been developed, one of which is analyzed in Wright's paper, section II A, which represents an incomplete stage of the

language. Section II B is a transcript of a presentation by Wright at the 'Design/Electronic Arts' conference in Buffalo in 1977; these materials are based directly on the research Wright had done for this project.

The computer based video synthesizer system is now operational at the Experimental Television Center in Binghamton, New York and is available to artists under the production program. As a greater number of artists utilize this system, each artist will be encouraged to articulate ways in which the system can be made more responsive. The results of this project have already indicated several important avenues for continued research, among them further and continued software development and the publication and dissemination of the results of the research to date. The computer based video system can serve as a model system; publication of research results will allow the duplication and modification of the system by other individual artists and arts organizations. Although the research to date has been specific to video, microprocessor systems are useful tools in many of the visual and performing arts, and a publication of this nature would assist many individuals from a variety of fields. A complete set of documentation has already been prepared; the next phase of this project, for which the Center is seeking support, includes the publication of these materials, including detailed schematic documentation. This publication will also include more theoretical papers, approaching the system and its applications from the points of view of aesthetics, physics, electronics and video and microprocessor technology. The aim of this publication is to provide specific and detailed information to permit duplication of the system and also introduce conceptual frameworks from which to view the electronic arts.