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CALENDAR

Television Listings

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Part VI

Computer-Generated Images—The Revolution That We See Every Day

Computer graphics—the most significant technological advance in the visual arts since the invention of film—is playing an increasingly important role in commercials, research, educational materials and films. Calendar begins a four-part series on developments. Today: an overview.

By CHARLES SOLOMON

Station break: The NBC *N*, apparently carved out of a block of colored Lucite, whirls through space, spotlights reflecting off its gleaming sides.

A teen-ager gapes as the Genesis bomb turns a barren planet into an Earth-like paradise in "Star Trek II: The Wrath of Khan."

A student in an astronomy class watches a space probe fly by Saturn, the vehicle's antennae and cameras turning as they record data about the planet's shimmering rings.

All three images are examples of the increasing number of computer-generated graphics Americans see daily, usually without realizing that those images exist only on film and in the memory banks of a machine.

"We're rapidly approaching the point where computer-generated imagery will be indistinguishable from reality," states Harry Marks of Marks & Marks, a computer-animation studio whose work includes the new animation of the "Entertainment Tonight" logo.

"Except," he went on, "a computer has virtually no visual limitations, so we can take you where it's physically impossible to go. If you want to see what it would look like to sail the Queen Mary through the eye of a needle, we can show you—in perfect detail."

Computer imagery has so thoroughly revolutionized the look of television commercials and logos that animators emulate that flashy look with conventional techniques. Architects and designers are beginning to use computer-animated films instead of still drawings to present their ideas to clients. Jet pilots and tugboat captains are trained with computer simulations. Computer animation offers the first real innovation in special-effects technology in 50 years. The Disney movie "Tron" demonstrated how computer-generated imagery could even provide an environment for live actors.

Computer graphics were originally devised for scientific and technical research. Computer models could be used to demonstrate how a structure would react under stress or visualize the configuration of complex organic molecules. The basis of the imagery is the computer's ability to assign values for brightness and color (a percentage of red, blue and green) to an individual point, or pixel, on a video screen. The pictures are composed of thousands of pixels. Sequential images can be filmed to create an illusion of motion.

Creating these visuals requires some of the most sophisticated technology available.

At Digital Productions in Culver City, designers and technicians are using a $6.5-million, 5.5-ton Cray 1S/1000 computer to create special effects for Dino De Laurentiis' feature film "Dune" and for Lorimar's "Starfighter," a movie for TV. One of the new generation of supercomputers, the Cray can perform as many as 100 million calculations per second, yet it has to run day and night to process all the data needed to generate those effects.

At present, television provides the most widely seen application of this technology. Glittering chrome-and-neon letters and shapes advertise everything from

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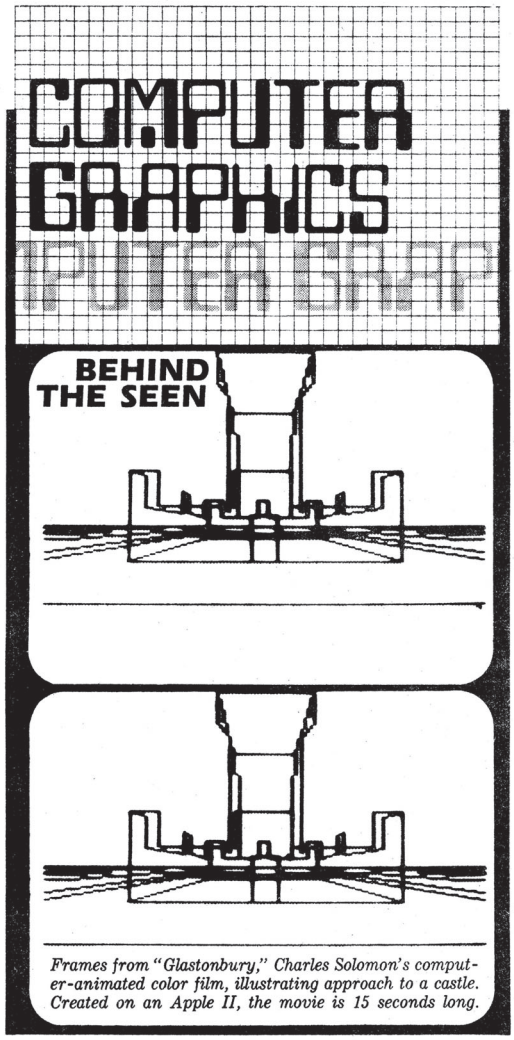

Frames from "Glastonbury," Charles Solomon's computer-animated color film, illustrating approach to a castle. Created on an Apple II, the movie is 15 seconds long.

Using a Computer to Make an Animated Film Presents a Number of Problems

By CHARLES SOLOMON

A few months ago, with great trepidation and numerous protests, I made my first computer-animated film, "Glastonbury," in a class at UCLA, using an Apple II equipped with Sub-Logic's A2-3D2 graphics package, and a good deal of instructor Don Miskowich's patience. All of my previous films had been done in conventional, drawn animation, and my hands-on experience with computers had been restricted to word processors.

The A2-3D2 software gives the user a cube of space inside the computer that is 64,000 units on a side. Any point in that space can be located with three numbers on an axis system similar to the X, Y and Z's we used to graph equations in high school algebra. The *draw* mode enables the user to connect points with lines drawn on a monitor in one of six colors. This produces the sort of outline figures that professionals call "wire-frame" animation, a far cry from the glittering chrome objects in TV commercials, but computer-generated nonetheless.

The first thing I learned was that the monitor could produce only rudimentary images. Anything I tried to draw would have to be very simple and composed of straight lines. The system couldn't handle curves any better than an Etch-A-Sketch could. I worked out a design for a castle by drawing its front, side and top views on graph paper. I recorded the locations of each corner: The numbers filled nine pages of a legal tablet.

When I entered the coordinates in the computer, I realized I hadn't really been thinking in three dimensions. Some of the numbers were wrong. Back to the graph paper and try again. Two days later, I was able to build the castle, one side at a time. That job took an entire day. Later, I added a landscape around it.

I planned the film around a relatively simple movement: The viewer's eye would begin at the edge of the landscape, high above the castle, and spiral in and down, ending up at the front gate. To create this move, I had to tell the computer what the viewpoint would be at various times in the film. A program had been written for us that would calculate the differences between those points.

Switching to the *eye* mode, I began looking for the vantage points I wanted. This process turned out to be fun: Each time I typed in a three-number location, I was rewarded with a different view of my castle, always in perfect perspective. I also learned how easy it is to get lost in a cube measuring 64,000 units per side. The computer knew where we were, but I didn't.

Once I finally found the points or *key frames* I wanted, I entered them in the computer and waited 40 minutes or so for it to do the necessary calculations. After four tries, I could sit back and the computer would show me 360 sequential views of the castle (15 seconds at 24 images per second). It looked better than I dared expect.

While I could never render an object in perspective as accurately as the computer could, making a film on the Apple II was no less work than drawing one would have been. It was just different work.

Some computer-graphics specialists claim their machines are going to streamline animation and remove the drudgery. Often, their "improvements" seem to give you a choice between spending the day drawing or spending it typing numbers into a terminal. I suspect most animators—myself included—would rather draw.

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major corporations like TRW to the nightly news.

"One factor limiting the amount of computer-generated imagery on the air is the cost of the hardware," says Bill Kovacs, vice president of research and development at Robert Abel & Associates. "That cost is being cut in half about every five years, but computer graphics are still expensive. The demand exceeds the supply because very few professional companies produce them.

"I think the growing use of digital sound-recording equipment—both Paramount and Lucasfilm have digital sound facilities—is a precursor of the increasing digitalization of visual imagery," he continues. "The control, the cleanness and the precision of the technique are so appealing. It's another aspect of the way digital technology is being applied to everything, including automobile dashboards and microwave-oven control panels."

Computer animation appears least effective when it is used to depict human and animal bodies in motion.

No one knows what effects this technology will have on conventional animation. Computers will almost certainly assume the function of coloring the animators' drawings, currently the most labor-intensive and therefore most expensive area of the medium. But animators generally regard the idea of using computers in their work with a mixture of curiosity and suspicion.

To date, computer animation has proved most effective in areas where drawn animation has been weakest: simulating elaborate camera moves in perspective and rendering metallic or intricately detailed objects. The gleaming logos that zoom in and out of infinity would be nearly impossible to draw. By accurately reproducing the way light would reflect off a surface, computers can achieve an almost photographic illusion of reality.

Conversely, computer animation appears least effective when it is used to depict human and animal bodies in motion, which drawn animation captures very well. The subtly interrelated curves of organic forms do not lend themselves to mechanical simulation.

Computer-generated people and animals tend to look like badly sculpted automatons. Computers offer little help to character animators, except as a guide for keeping things in perspective. The movements of living things—even a seemingly simple walk—are the result of complex interplays of muscle and bone against gravity. So much information is needed to describe these motions that it cannot be programmed effectively.

While some of these problems might be overcome with advanced hardware and/or software, others would remain. A human animator understands the feelings that make a brash character like Bugs Bunny walk differently from a timid one, like Elmer Fudd, and puts that understanding into his drawings. A computer cannot.

"I have mixed feelings about using computers to do conventional, drawn animation," observes Robert Abel of Robert Abel & Associates, who has produced such famous computer-animated spots as the "Walking the Dog" commercial for Levi's. "Sometimes we try to make a machine do something that is better done by other means. Straight, drawn animation may be a better way of communicating some things, especially emotions."

"I feel the real future of the computer in animation lies in a mixture of techniques," adds Bob Kurtz of Kurtz and Friends, one of the most respected commercial animators in the country, whose work includes the Chevron dinosaur spots. "When the sort of intimate personality animation Disney used to do is combined with computer-controlled light sources and camera moves, the effect is going to be tremendous—and contemporary. I think this would represent the best of both worlds, and audiences would eat it up."

Some observers believe that the real potential of the computer lies in the vast possibilities offered by abstract form and motion. Only a handful of artists have practiced abstract animation with any degree of success. The difficulty of drawing the movements of abstract and semiabstract forms has discouraged most animators before they begin. No artist could possibly draw the thousands of points of colored light that form the exquisite patterns in John Whitney's film "Arabesque" or Larry Cuba's "Two Space," but computers can generate them quickly.

People involved with computer graphics are producing more and more abstract and semiabstract films and videotapes. Many of these works juxtapose technical perfection with an artistic void. The audience becomes so aware of the technique that it loses sight of whatever aesthetic statement—if any—is being made.

The work of Oskar Fischinger (1900-1967) offers the best artistic models for abstract computer animators. In films like "Composition in Blue" (1935), "Allegretto" (1936) and "An Optical Poem" (1937), Fischinger—who had extensive technical training—demonstrated that abstract animation could make powerful artistic statements, comparable to the paintings of Kandinsky and Klee. Using the graphic capabilities of computers, artists could weave form, color, texture, motion and light into vast, abstract harmonies.

But exciting as these prospects are, many animators stress that the computer represents an adjunct to the tools that the frame-by-frame film maker has at his disposal, not a replacement.

"Powerful statements will not be limited to any single medium," Abel cautions. "Picasso might use a simple pencil line to render a portrait, while Rembrandt would use a whole spectrum of oil colors, but they both made profound statements. We'll never replace the kind of expression found in the drawn animation of Bugs Bunny or Donald Duck. We may be able to add to it or expand it, but I think the idea of trying to find a substitute for it is a rather abysmal approach to life and the responsibility of the artist."

Next: A profile of animator Robert Abel, whose computer-generated visuals helped revolutionize the look of television commercials.

Solomon writes frequently for The Times on animation and entertainment technology.