

Interactive Art and Cultural Change

Stephen Wilson

THE CULTURAL IMPORTANCE OF INTERACTIVE ART

For the last 10 years I have been creating interactive artworks [1-3]. I call these works interactive because they require the audience to act as cocreators: the audience's choices shape the flow of events. Moreover, many of the works can be called interactive because they require viewers to interact with each other in making these decisions. Computers are essential in orchestrating this critically needed exploration of interactivity.

We are at a cultural crossroads in the evolution of technology. Computers promise great opportunity and great danger. They could usher in a dark age of increasing passivity and centralization and a decay into faceless mass society; or they could bring about a great flowering of individual choice, expression and access to information and communication. Like most technology, computers are intrinsically neither evil nor benign. They will be what we make of them.

Artists could be critical in helping to direct this technological evolution. They can create works that explore the unique choice-expanding features of computer technology. They can uncover and investigate new capabilities of the computer that are unlikely to be developed by manufacturers, given the current dominance of commercial interests. To do so, however, artists must create works that intrinsically make use of interactive capabilities. To use the

technology to create images and sound compositions that require the traditional kinds of passive spectator appreciation does not advance the culture's grasp of the new capabilities. Indeed, creating works that astound audiences and seem producible only by technological specialists merely reinforces the tendencies of this technology to produce centralization and discourage individual creativity.

My works use simple personal computers to generate graphics and sound. Equally important, they use the unique capabilities of the technology to give the audience a chance to make decisions. The decision-making process itself should provoke audiences to think about the opportunities and dangers of our technological era. My stress on this process is consistent with the belief held by many artists that contemporary art must focus more on the process and tools of art making and less on the particular products [4]. The following sections describe some of my recent works that explore interactivity.

ABSTRACT

Our culture would benefit if artists became more deeply involved with interactive computer technology, because artists are essential to the exploration of its possibilities. The author describes his own computer-mediated interactive art events that explore artificial intelligence, videotext information networks, synthesized speech, robotics and computer-environment linkages. The audience takes on the significant role of cocreator by making decisions that affect the flow of events.

Fig. 1. *Parade of Shame*, computer and telephone art, 1985. Cable viewers in San Francisco, California, influenced an ongoing cablecast computer animation event focusing on the vanishing of species. Viewers indicated choices by telephoning the station and pressing Touch-Tone combinations. A phone was set up in the midst of the 1985 SIGGRAPH art show to allow show visitors to participate with the rest of the city.



TIME ENTITY

Time Entity was an interactive computer-graphic animation and sound installation that modeled an artificial creature. It was part of the 1983 CADRE computer art festival in San Jose, California, and was later also presented in the gallery of the Art Department at San Francisco State University. Altogether it ran for a month. California artists Matthew Kane, David Lawrence and Eric Cleveland collaborated with me in its creation.

The possibilities and challenges of Artificial Intelligence (AI) called out for artistic attention. I had been studying AI for several years and was convinced that there was an unacknowledged aesthetic component in the creation of AI programs. The writers of these programs needed to make decisions about knowledge representation structures, search patterns, salience attributions, and so on, that affected the ways in which their programs processed information. These decisions were not purely technical; rather

Stephen Wilson (artist, educator), Conceptual Design and Computer Art, Art Department, San Francisco State University, San Francisco, CA 94132, U.S.A.

Received 19 January 1988.

they constituted the creation of a kind of fiction or characterization. The research of Kenneth Colby on modeling obsessional behavior [5] and of Rodger Schank and Robert Ableson on modeling reasoning from belief [6] hints at the possibilities of programs that manifest 'character'.

Attention to these issues will become more important as AI capabilities grow. With years of experience in the development of artificial characters and settings, artists will become essential to the further progress of AI research if AI is to generate programs that are believable and welcomed by humans. In parallel fashion, AI will be essential to the visual and dramatic arts as a natural extension of their historical concern with simulating human forms and behavior. AI will allow artists to create fictions that can dynamically interact with their audiences.

This research led me to *Time Entity*. I realized that we were not limited to simulating human intelligence. Artists could create fictional intelligent species. I studied research on interspecies communication and on the search for extraterrestrial intelligence. I began to search for models of nonhuman intelligence. Simultaneously I had been ex-

perimenting with the clock/calendar technology that had become available for microcomputers. I was fascinated by this hardware capability that allowed the design of programs that always knew the exact time and date much more precisely than we could.

I decided to create a computer-simulated creature that was obsessed with time. It would 'know' how long it had been alive and be obsessed with its future and its 'mortality'. It would have intrinsic genetic predispositions to change as it grew older. Like biological organisms it would have monthly, diurnal and heartbeat-length rhythms. It would interact with human visitors concerning the issue of time.

Our design team spent months debating the nature of the creature. We surveyed the biology of time as manifested by real plants and animals, and we played with open-ended fantasies of how organisms might relate to time. We probed the capabilities of the clock/calendar technology we were using. Some of the questions facing us were: Should the creature sleep? Should it dream? Should it develop gradually or in discrete stages? Should its pace get more excited or more calm as it interacted with humans? Should there be

events that occurred at the millisecond level that were beyond the perceptive capabilities of the human visitors?

Physically, the entity, as we called it, was a computer graphic animation that moved on a video projection screen accompanied by computer-synthesized sound. It also had a tactile and kinaesthetic life. Humans interacted with it by touching specially constructed pleasant-feeling touch pads. It lived in a forest of upside-down pine trees, the fragrance of which was overwhelming—many visitors remarked that it was the first good-smelling computer art they had ever encountered. Its appearance and behavior changed as it aged and according to the time of day and the time of the month. It had a regular heartbeat that was visible and audible. Although the smell was not controlled by the computer, it also got stronger with age because of the trees enclosed in the space.

Visitors could observe it move and grow and could actively affect it by touching the pads. For example, they could speed up or slow down its pace or choose to make part of it grow or die. They could choose to make the action happen immediately or at a specific time in its future. At any given moment, its visual appearance and the sounds it made were the result of its intrinsic growth tendencies and all the interactions up to that point.

It had additional time-related features. Visitors could see snapshots from its past, because it saved a record of its current state every hour it was 'alive'. They could also choose to send messages with it into the future. By using the touch pads, they could spell out a simple sentence and tell the entity to present it at a specific moment in the future. For example, the current visitor could ask it to carry a message forward to 4:33 P.M. on the next Friday, and it would deliver it in text on the screen.

The intelligence of the program was rudimentary, although it did point toward interesting directions for future research. Visitors reported that they indeed felt that they had had an encounter with an unusual creature. This focus on the audience's experience of interaction with the computer made our work as artists discontinuous with the prevalent artistic traditions. The integration of concepts from other disciplines and the probing of the technology were at least as important as the sensory qualities of the final products. We were constantly forced to invent new extensions of the technology and

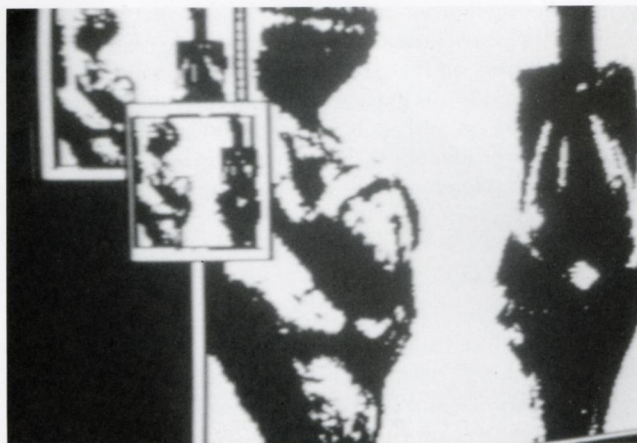


Fig. 2. *Parade of Shame*. In the *Man/Woman* animation, callers could make choices about ways to integrate male and female heritages (shown here: female, represented by digitized image of the *Venus of Willendorf*).

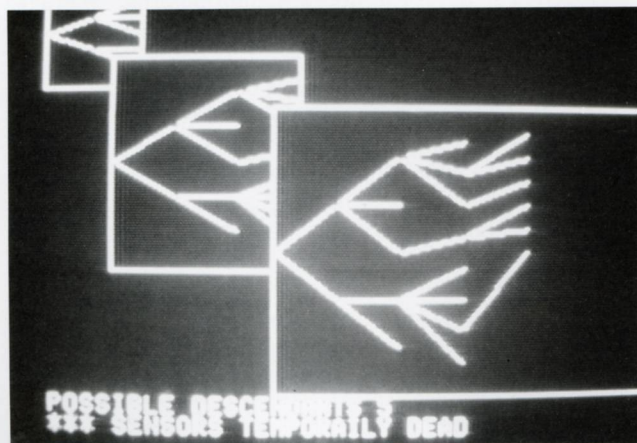


Fig. 3. *Parade of Shame*. In the *Evolution Pathways* animation, callers determined a simulated evolutionary path, and they risked becoming 'extinct' (being disconnected) if they made bad choices.

ended up discovering capabilities in the computer of which even the manufacturer was unaware. We were working simultaneously as artists, programmers, engineers, biologists, psychologists and AI researchers. Inevitably, artists working with technology in a new context will have no choice but to combine different roles.

PARADE OF SHAME

Parade of Shame was an interactive videotext event that ran on Cable Channel 35 in San Francisco in 1985. Viewers could call from their homes to make choices that affected the computer graphic animations that were being cablecast. This week-long event was part of the 1985 SIGGRAPH art show in San Francisco, California.

Videotext (and its relative, teletext) is a technology that combines video, telephones and computers to provide a new kind of information service. Typically, subscribers use special decoders to request categories of information from those provided on a central computer. The information is then sent via telephone or cable lines and appears as text and simple graphics on the home video monitor. Common kinds of information include news, weather, business news, shopping and entertainment opportunities, travel services, banking services and health information. These services are quite popular in Europe but are still in the testing stages in the United States. Prognosticators predict that videotext will eventually grow to be an enormous industry and will become the major medium for providing information to the home [7].

These developments will create significant opportunities and challenges for artists. They will be able to deliver their work directly to people's homes if they can find an appropriate way to work within the social, economic and sensory context of this delivery medium.

In 1982 Harold Layer, director of San Francisco State University's cable television station, developed an experimental approach to videotext that is still in use. Videotext is provided free to every subscriber to the Viacom San Francisco cable franchise as part of the basic package. No special decoder boxes are necessary; viewers can use the Touch-Tones on their telephone to indicate the desired information category. The computers at the station answer the telephone, interpret the

Touch-Tones, and retrieve the sequence of video pages that constitute that category. Because of its configuration, the system functions as a 'bulletin board'; that is, everyone sees the pages of information being received by the requester. Other requests are queued by the computer to be answered in the order received.

I approached Layer with the idea of including art events as one of the sets of categories. As a result, the Electric Conceptual Gallery was born. Faculty, students and outside artists were invited to create works for display on the system that home viewers could request by Touch-Tone in the same way that they requested other kinds of information.

After some experience with the system, I recognized several important limitations. The graphics were limited to the character set of the host system. Animation effects could be created only by flipping through pages. The system disconnected after the caller had used the Touch-Tone to request a category number and the request had been added to the queue.

I realized that I could use developing microcomputer technology to create a system that could demonstrate improved capabilities and allow sophisticated new kinds of art events. I discovered an inexpensive telephone response card for the Apple II that could answer the telephone, interpret the Touch-Tones and make the information available to a program. Layer supported my idea. Apple Computer's community affairs foundation responded favorably to a grant request for equipment to test the idea for a limited time.

I configured the system and wrote software that provided the improved interactive and animation capabilities. Using only \$5000 worth of equipment, I was able to create a system that exceeded the capabilities of systems costing hundreds of thousands of dollars. More importantly, I was able to develop a new context for artists to create events with which people could interact in their homes.

I was fascinated with the notion of an art event that moved out of traditional art settings into the places of everyday life. I was also intrigued by the way people could watch others making decisions on this system. I decided to create a piece that uniquely explored this decision-making/watching process.

The SIGGRAPH art show accepted my proposal to have a piece that would exist simultaneously as an exhibit in the

art show and as an event accessible to any of the 110,000 subscribers to San Francisco cable TV. A telephone and a cable-TV-connected monitor would be set up in the art show area (Fig. 1). Visitors to the art show could call in, in the same way that people at home could. Anyone at the show or at home had an equal chance to participate.

I had long been concerned about ecological issues. I was troubled by the implications of the 'tragedy of the commons', a theory that uses the metaphor of the overgrazed commons to illustrate the consequences that occur when most members of a community make short-term, locally advantageous choices. The theory suggests that eventually such decision making results in the long-term destruction of common resources. I was concerned that our world was taking only a few years to eradicate species that had taken millions of years to evolve. Ever since I was a child, I had loved the magnificence and strangeness of elephants; I wondered if they would survive long enough for my children to see them. The march of the endangered animals was a 'parade of shame' for us.

I resolved to create an art event that focused on this issue. The technological structure of videotext meshed ideally with my conceptual goals. Only one viewer at a time could be in control via telephone; the others would have to watch helplessly as the consequences of the caller's choices were revealed. This technological situation seems a powerful metaphor for the interdependence of the contemporary world in which we all must share the consequences of others' choices.

Parade of Shame was a series of eight computer graphic animations relating to issues of evolution and ecology. For example, in the *Vanishing Species Shooting Gallery* animation, an image appeared resembling a carnival sideshow shooting gallery. Images of endangered species popped up. The caller could shoot the currently displayed animal by pushing any Touch-Tone. I hoped viewers would experience a dilemma. The temptation to affect the graphics was seductive, but the act requested was abhorrent. I wanted the viewer to think, "What will happen if I let this opportunity go by? Will my connection be canceled?" In the *Man/Woman* animation, callers got to choose how to integrate male and female heritages (Fig. 2)

In another animation, the viewer was invited to make choices about the process of evolution. How fast should it go?

Should it proceed at a constant rate or sometimes faster and sometimes slower? Was it best characterized as progress, cycle or meander? A series of animations then proceeded based on these choices. For example, the *Evolution Pathways* animation presented a series of visually intriguing images that resembled evolutionary tree diagrams (Fig. 3). If the path generated by the viewer's choices happened to end in extinction, the program cancelled the viewer's connection, hung up and took the next caller. Following a similar progression, the *Accident of Life* animation showed molecule-like icons on the screen. If two of the right kind came into contact, the event could proceed; otherwise the program cancelled the current caller's event. Few callers made it through all the sequences. The computer reported at each step how many of the total number of previous callers had been able to proceed.

I felt that the choices would be more interesting if viewers knew something about the caller who was in control. Therefore, as soon as the telephone connection was made, the caller was asked to indicate something about himself or herself. Displaying a map of San Francisco with numbered regions, the screen instructed the caller to indicate by Touch-Tone the area from which he or she was calling. That area then filled with color, letting other viewers know the caller's general location.

The next screen asked whether the caller would like to leave a mark on a map of San Francisco. Examples of the choices for the type of mark a caller could leave included the most beautiful—or ugliest—spot in the city, the spiritual center, and the place of a first sexual encounter. A blank map of the city then appeared. A box moved across the screen and the caller hit the Touch-Tone when the box was over the spot chosen. Thus other viewers got a sense of who the caller was by the kind of mark and the location chosen. The computer graphically emphasized the choice, put the caller's sequential number (for example, 50 if the person was the fiftieth caller) in that location, and then filled in with caller numbers all the locations chosen by the previous callers who had decided to leave that same kind of mark.

Over the week more than 1700 viewers called the station from home and from the art show. The event ran automatically 24 hours per day. The event explored new potentials in com-



Fig. 4. *Synthetic Speech Theatre*, computer art, 1985. Computer-generated characters debated topics of love, war and peace, and yesterday/tomorrow. The viewer was able to affect the flow of the debates by speaking particular words into the microphone. Digitized images represented each of the computer-generated characters, which 'resided' in the four corners of the room.

munication technology, and it dramatized ideas about the community's mutual interdependence on issues of ecology. It opened a new context for artwork.

SYNTHETIC SPEECH THEATRE

Synthetic Speech Theatre was installed as part of the 1985 CADRE show in San Jose, California. Viewers were asked to participate in a debate with four computer-programmed characters. The characters spoke with synthesized speech and 'understood' the audience members via voice recognition.

Visitors entered a small room that had one monitor and audio speaker in each of its corners. Large 3-x-4-ft digitized images hung over each monitor. On a pedestal in the center was a microphone (Fig. 4). The text on the monitors asked the visitor to speak his or her name into the microphone. The characters' computerized voices started a spoken debate in response.

The characters asked viewers to choose a topic in which to participate. They could pick from 'Love', 'War and Peace', and 'Yesterday/Tomorrow'. Each debate was represented by animations of digitized images of masks. Viewers indicated their choices by speaking words into the microphone in response to the questions the voices asked.

As the computer characters debated an issue, the computer turned speakers

on and off so that a particular character became identified with the audio-speaker in a particular location. The viewer was surrounded by this strange debate between computer characters.

Periodically, the characters would stop to request the viewer's opinion. The viewer could indicate a point of view by speaking into the microphone one of several words indicated on the monitors. The computer characters then proceeded with the debate in response to what the viewer had chosen. The installation played with spatial rhythms by moving the speech among the audiospeakers. For example, sometimes the debate moved sequentially around the room and at other times it went diagonally from corner to corner.

Synthetic Speech Theatre had to contend with certain technical limitations. Speech recognition for personal computers is still in its infancy. Usually these systems can only understand a limited number of words on which they have been previously trained; that is, the person who will ultimately use the system speaks target words into the system, which stores templates of these words. The system recognizes words spoken later by that person by comparing them against the target-word templates originally stored. A match is identified as the best fit among the stored templates. At this time, only advanced, expensive systems in research laboratories are capable of understanding free-flowing speech from previously unencountered

persons who have not already trained the system by storing target words.

I faced a problem. I wanted the characters to understand viewers whom they had not heard before, but the system was not capable of this. Through experimentation, however, I discovered I could have it distinguish between different words as spoken by different viewers if I picked words that were dissimilar enough in sound to render variations of pronunciation unimportant. Viewers were thus asked to indicate their choices by speaking one of two alternative words offered. This restriction often created a kind of poetry because their words were metaphorically related to the debates. For example, repetitions of the words 'grow' and 'destroy' influenced the war and peace debate.

The limitations of synthesized speech also caused problems. Currently there are two major approaches to computer speech available with low-cost systems. One builds words out of synthetic phonemes; the other speaks words based on digitized recordings of human voices. The phoneme synthesizer is very flexible because theoretically any word can be pronounced by algorithmically transforming regular text. Unfortunately, this form of speech sounds robotic and often is difficult to understand.

The digitized recording approach produces speech that is more interesting and understandable because it preserves the inflection and sound qualities of the original voice. Unfortunately, it takes much computer memory to store words, even when the data is compressed, and these systems are not as flexible because their stored words must be preselected.

For *Synthetic Speech Theatre* I wanted high-quality, understandable speech. I consequently was forced to use one of the digitized approaches. Given the memory limitations of that era's computers, I used a speech board that had only 200 words available. Moreover, this selection of words was optimized for business. These were the 200 words that were most necessary for business. I thus had to program the characters' speeches about love, war and peace, and yesterday/tomorrow out of this strange vocabulary.

I found this a refreshing challenge. I was forced to choose interesting metaphors in order to stretch this word selection to fill my needs. For example, in the debate about love, each character took a different position about a

breakup: one dwelled on the pain and the feeling of being hurt, another focused on the possibility of getting together again, another urged that one should concentrate on the future and get on with life, and the last exhorted Zenlike detachment.

How did I achieve this discussion using business words? The first character said things like, "She hurt the morning and hurt the promise". The next one lamented, "Maybe one could repair the morning". The third one urged, "Open the new morning".

Computer speech offers great opportunities for artists. Speech has always been identified as one of the most distinguishing characteristics of what it is to be human. We will need to make some kind of cultural sense out of machines that talk and understand.

HI STRANGER, WELCOME TO CITY HALL

Hi Stranger, Welcome to City Hall was an interactive sculptural installation placed in San Francisco's City Hall lobby in August 1986. It was part of the San Francisco Arts Commission Sculpture Festival. A sculpture consisting of two robots symbolizing city workers reacted with synthesized speech and video in response to visitors' shaking any of their multiple hands. Milton Komisar and Donald Day collaborated with me in its creation.

Traditionally, sculptures in the festival were placed outside on a plaza where they could be viewed in the time-honored way. We wanted to explore a more vital kind of public art that required active audience participation and addressed audiences that were not self-selected art goers. We wanted to place our installation somewhere inside City Hall where people would encounter it as they went about their daily business. We wanted it to comment dynamically on the nature of City Hall.

We studied the activities of City Hall and considered possible pieces. Intrigued by the marriage licence bureau, we thought about an installation that would broadcast video back and forth between there and the divorce courts upstairs. A huge empty office gave rise to the idea of creating a totally fictitious office with all the apparatus of bureaucracy. We would move in people, furniture, file cabinets and paper. Everyone would be very busy filling out forms, filing and so on. They would respond to visitors like real city workers, only

nothing concrete would be done or produced.

Ultimately, however, we decided to concentrate on one of the two security checkpoint areas in the main lobbies. Everyone entering City Hall passed through these areas and had to have their parcels checked. It was the hub of City Hall. We studied the area like anthropologists to understand its essence. Many of the people passing by were talking about their experiences with the bureaucracy. We decided to create an installation centered on that bureaucracy and on the obsession with security in urban life. Because art was not customarily allowed in these locations, we had to get permission from the city supervisors.

We built two computer-controlled robots that symbolized city workers. Built out of PVC (polyvinyl chloride) plastic pipe, they were quite abstract and geometrical in form (Figs 5, 6). One was friendly and helpful, while the other was mean and obstructive. The mean one was tall and thin, measuring 10 x 4 x 4 ft, and glowered over viewers; the friendly one was short and squat, measuring 4 x 3 x 7 ft. Both used computer-synthesized speech to talk about issues in city government such as responsiveness and competence. The helpful one said things like "I'm sorry this is taking so long", "We can solve this problem" or "I'll find someone to help you". The obstructive one said things such as "Come back tomorrow" or "Take this form down the hall".

Viewers activated the speech by shaking one of the four hands extending from each robot. Each hand had a speaker and sensor. Computers picked the spoken phrases based on the pressure with which each hand was squeezed.

Five video monitors and five cameras also were used in each robot. The images on the monitors were mixtures of computer graphics related to city government (e.g. organizational charts, police at work) and live images of the viewers presently standing near the robots. A computer coordinated the image sequences with the speech, again in response to the viewer's squeezing of the hands. For example, squeezing a hand could bring on a live image of the squeezer, depending on the pattern of hand squeezes at any given time.

We wanted viewers to feel that they had had contact with artificial characterizations of city workers. We wanted them to reflect on what city government was like and what it could be like.



Fig. 5. Stephen Wilson, Milton Komisar and Donald Day, *Hi Stranger, Welcome to City Hall*, computer art, 1986. Computer-controlled voice and video robots simulated friendly and obstructive city bureaucrats in the security area of San Francisco's City Hall. A viewer activates the tall, mean robot by squeezing its hand.



Fig. 6. *Hi Stranger, Welcome to City Hall*. The short, friendly robot waits for a viewer to activate it by squeezing its hand.

We wanted them to appreciate city workers who did not act like robots.

We also had another goal. Generally the two robots, which were located 50 yards apart on opposite sides of the lobby, did not interact. If a particular viewer squeezed one of the hands too long or too hard, however, they acted

differently. The robot whose hand was squeezed warned the viewer to back off. If the viewer persisted, both robots went into a 'security alert'. The speech synthesizers started playing specially composed tunes that resembled sirens. All the monitors on both robots locked into one freeze-frame image of the per-

son who had squeezed too long or too hard. None of the hands was responsive during the alert. The short, squat sculpture talked about the dangers of being overconcerned with security (for example, "What do we give up?"), while the tall, thin sculpture talked about the need for the concern (for example, "We must have total security").

We wanted to comment on our society's unfortunate need to be so concerned with security, brought about because of terrorism. The security guards at these checkpoints were genuinely needed, but we should accept this fact only while reflecting on the possibilities of more gentle kinds of public life that would not require such wariness. We thought that the City Hall of San Francisco was an appropriate place for this comment, since in recent history the city's mayor and a city supervisor had been shot in their offices.

DEMON SEED

Demon Seed was an interactive installation shown in the 1987 SIGGRAPH Art Show in Anaheim, California. Viewers controlled four computer-choreographed robot arms that moved and talked. Each motorized robot arm moved on one of four platforms in front of galleries of digitized images of demons from various world cultures (Fig. 7).

The installation reflected on the perennial tendency of humans to project images of demons onto things that they do not understand. There are signs that robots may be the next recipients of our demon-projecting fears. Moreover, because of the shrinking of the world through communication, several different world cultures may share the same robot-demon imagery instead of having different images as before.

Demon Seed asked the audience to experience this combined fear and fascination with robots. Its robots were simultaneously ominous and endearing. Each platform featured a particular culture with a demon tradition (American Indian, Japanese, Spanish Catholic, African), and the robots moved in front of a gallery of repeated digitized images of spirit masks from the target culture. Each robot was dressed in materials from that culture. For example, an American Indian robot was outfitted with feathers and a small straw weaving. The robots seemed like mechanized priests or shamans (see Color Plate B No. 1).

The computer moved the robots through a series of ritualistic motions. Sometimes all four moved in unison; sometimes they moved in counterpoint. Sometimes the robot dance rippled downward, starting with the top robot arm and then repeated in turn by each of the robot arms underneath.

The installation did not ask the audience to observe the robots passively. Commenting on our ability to exercise some control, *Demon Seed* periodically gave viewers a chance to influence the robots' actions. In keeping with the demon theme, the time of potential control was only partially predictable. I constructed special squeeze rods that could read viewers' squeezes. I covered these rods with a lush red and black velvet such as is often used in religious and royal ritual (see Fig. 7). I felt that the usual interfaces with computers, such as buttons, mice and keyboards, connoted a certain distance and coldness that is not always appropriate. Because of its subject matter, I wanted *Demon Seed* to convey an impression of intimacy, tactility and warmth that is not usually associated with computers and robots. I see exploration of this area as important for artists.

Finally, a viewer could influence the robots through speech. Periodically, the robot that a viewer was controlling would 'listen' into a microphone placed near the squeeze rods. It would pick up the viewer's voice and then speak with processed digitized recordings of the viewer's words. In an eerie linkage, the robot spoke with a demonized version of the viewer's voice. I hoped this sonic link would lead the audience to think about the role of projection in the human creation of demons.

OCEAN MERGE

Ocean Merge (Figs 8, 9) was performed in the summer of 1987 on the beach at Morro Bay, California. It was part of the California State University's summer arts festival. California artist Joel Slayton created an innovative arts education setting in which artists were invited to create installations while students served as apprentices.

Computer art is usually presented in high-tech, modern urban environments. It is a common belief that computer art cannot approach the kinds of close relationships to nature achieved by traditional art forms such as painting. I refuse to accept this assessment.

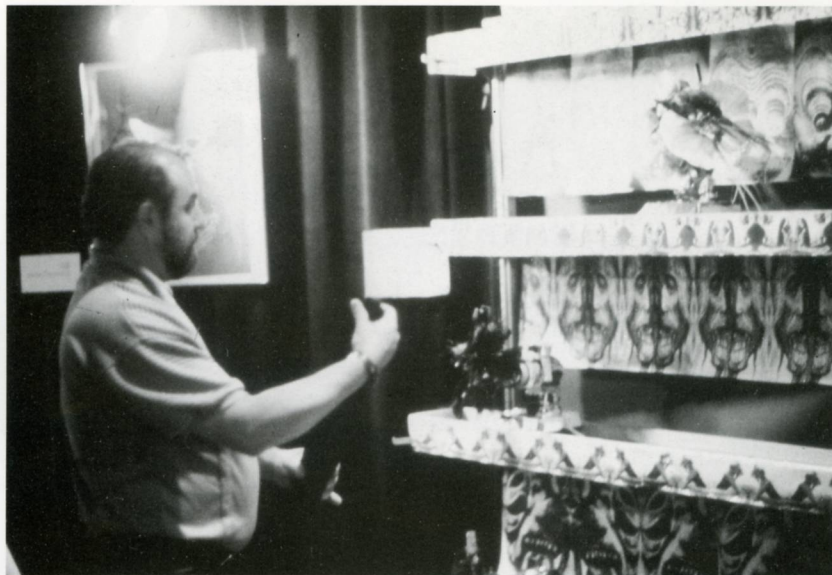


Fig. 7. *Demon Seed*, computer art, 1987. Audience members could sometimes control the moving robot arms by squeezing velvet-covered rods.

Indeed, I believe artists can do much to explore alternative visions of how computers can connect to nature.

California is blessed with some of the most beautiful beaches in the world. I wanted to create an artwork that used computers to focus an audience's attention on this beauty. Having always been fascinated by the mystery and power of ocean waves—often I sit and watch them—I decided to arrange for my computer to orchestrate an event based on wave motion. I placed a series of five metal rods in the sand in a line that stretched from the dry sand through the water line out into the ocean. The number of rods covered by water changed with the strength and penetration of each wave.

I connected each of the rods to the gameport connector of an Apple II computer. These gameports usually work by reading the changing electrical resistance of devices connected through the port—for example, game controllers or joysticks. Since seawater conducts electricity, I knew I could have the computer read the different resistances at the rods at various times. This pattern of resistances would reveal the changing position of the waves, because the rods in contact with the water would have lower resistance than the others. Because the beach I used was somewhat isolated, I needed to use a portable generator to power the computer. Amazingly, the computer could handle the less than perfectly stable power supply.

I concentrated on the waves' eternal cycling and their periodic variations in energy. Computer-programmed sound

and graphics would respond to waves and serve as a gateway for audience attention. I placed audiospeakers up and down the beach, spreading them out from the audience's location. I built a controller using relays and connected the annunciator outputs of the Apple gameport so that I could switch the loudspeakers on and off. The audience sat on the beach watching the waves and a graphics display facing back to them. As the waves came in, the sounds moved from the more distant loudspeakers on both sides of the audience to the closer ones. The graphics and sound quality also changed in resonance with the waves. The movement of the sound thus followed the movement of the waves.

The computer was also programmed to allow an audience member to speak into a microphone. The computer then processed the sound of the person's voice and moved it from loudspeaker to loudspeaker. Ultimately, in future work, I plan to combine digitally the voices of the audience with the songs of whales. There are great opportunities for artists to integrate computer-based art into nature if they are willing to experiment with working in nontraditional settings.

AUDIENCES AS COCREATORS

We can no longer afford art that sits quietly on walls in special art appreciation places. Acceptance of the role of passive spectator by art audiences takes on new danger in the contemporary



Fig. 8. *Ocean Merge*, computer art, 1987. The computer read the moving waves and generated computer graphics and moving sound in response.



Fig. 9. *Ocean Merge*. Steel rods in the surf read the conductivity of seawater as a way of monitoring wave motion.

era. The combination of the mass media and the centralization possibilities of computerization poses an unprecedented threat to the human spirit. Already a huge proportion of the population is having its consciousness shaped in uniform ways by exposure to common media experiences. Diversity of perspective and individual activity and initiative, which historically have been some of the key resources of the human community, are currently at risk.

Art has historically served as a countercurrent. Artists have been beacons to illuminate present dangers and point toward possibly better futures. The arts now need to serve that purpose more than ever.

Merely adjusting the content of art to address the dangers will not suffice. The times call for structural change. Art presented in the traditional way to an

audience of passive spectators reinforces the dangerous idea that people should accept what is offered. Ironically, the new media are potentially even more mesmerizing than traditional forms.

The interactive capabilities of computers offer a unique possibility. Artists can create works that require audiences to act as cocreators. Any work is incomplete without the viewers' taking action. The exploration of this structure in art should point the way to similar structures in other realms of public life such as politics, commerce, education and entertainment. My works are merely first steps in the direction of interactive art. Furthermore, my work as an educator tries to prepare future generations to further develop these interactive forms [8,9]

References

1. Stephen Wilson, "Environment-Sensing Artworks and Interactive Events: Exploring Implications of Microcomputer Developments", *Leonardo* 16, No. 4, 288-292 (1983).
2. Stephen Wilson, "Computer Art: Artificial Intelligence and the Arts", *Leonardo* 16, No. 1, 15-20 (1983).
3. Stephen Wilson, *Using Computers to Create Art* (Englewood Cliffs, NJ: Prentice-Hall, 1986).
4. Sonia Landy Sheridan, "Generative Systems Versus Copy Art: A Clarification of Terms and Ideas", *Leonardo* 16, No. 2, 103-108 (1983).
5. Rodger Schank and Kenneth Colby, *Computer Models of Thought and Language* (San Francisco: Freeman, 1973).
6. Rodger Schank, *Cognitive Computer* (Reading, MA: Addison-Wesley, 1984).
7. J. Tyderman, H. Lipinski, R. Adler, M. Nyham and L. Zwimpfer, *Teletext and Videotext in the United States* (New York: McGraw-Hill, 1984).
8. Stephen Wilson, "Artists as Explorers of the Technological Frontier", *Academic Computing* 2, No. 1, 32-34 (1987).
9. Stephen Wilson, *Introduction to Multimedia Design* (Englewood Cliffs, NJ: Prentice-Hall, 1990).

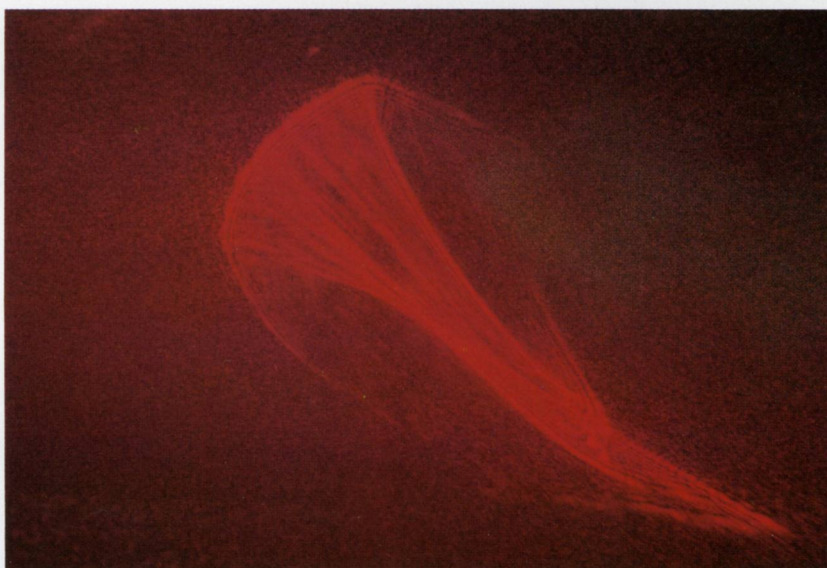


COLOR PLATE A

No. 1. Top. Dave Sturmoski, *Intrigue*, 8-x-10-in Cibachrome, 1989. (See article by Doug Czor.) This work is an abstract photograph of a semi-circle prism illuminated with a helium-neon laser and a black light. The camera was equipped with a 35-70 mm macro lens, a star filter and a prism filter.

No. 2. Middle. Linton Godown, dry electrostatic photogram, 11 x 14 in, 1979.

No. 3. Bottom. Krista Armstrong, *Angel Jazz*, helium-neon laser refraction on Ilford Cibachrome 1-A, 1989. (See article by Doug Czor.) The laser refraction is designed to suggest a myriad of feelings and not limit the image and imagination.

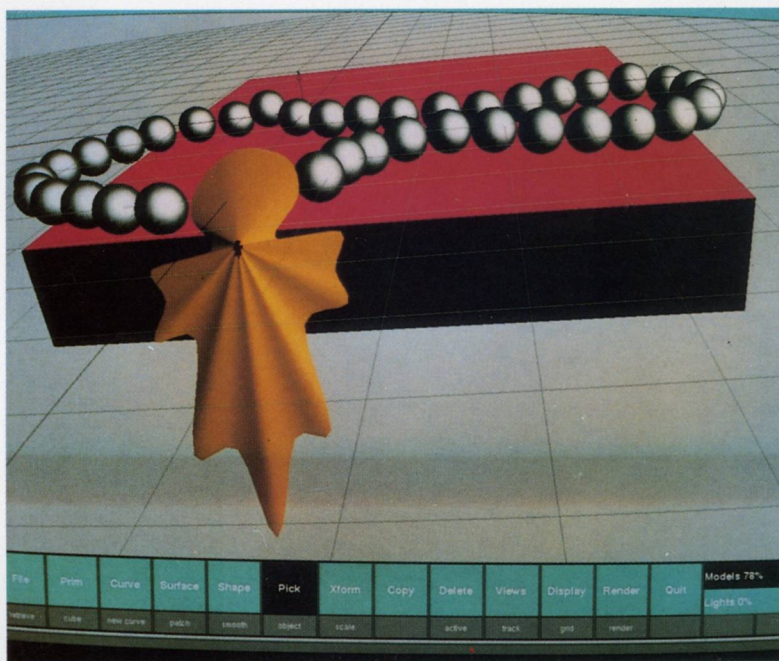




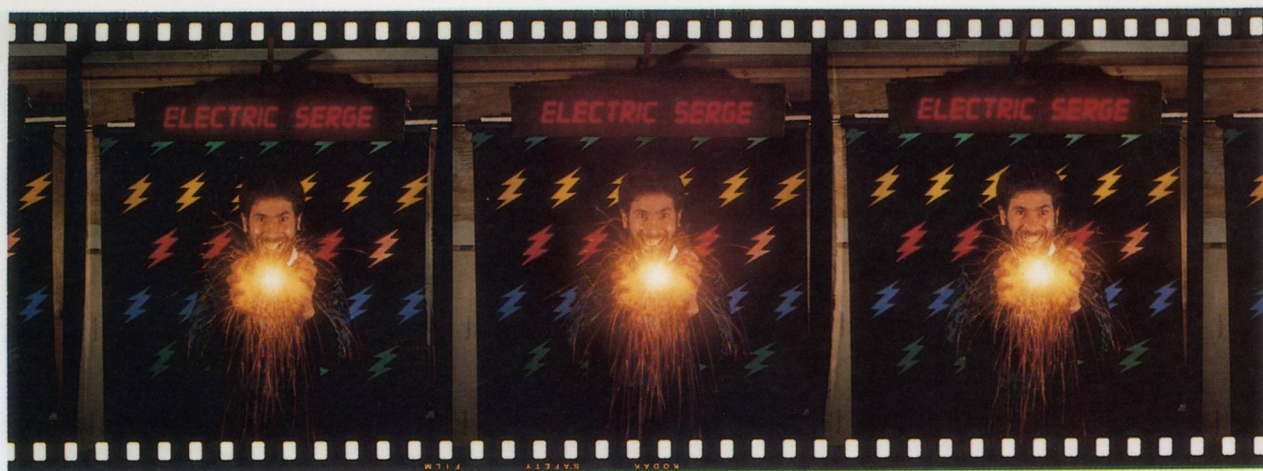
COLOR PLATE B

No. 1. Top Left. Stephen Wilson, *Demon Seed*, computer art, 1987. One of four computer-choreographed moving and talking robot arms, which could be partially controlled by audience members. Each robot arm was costumed in the garb of a particular culture and moved in front of a digitized demon masks from that culture. The illustrated robot arm wears feathers and straw to represent American Indian traditions.

No. 2. Top Right. Duane M. Palyka, *The Hell Disk*, modeling compound and paint, 15 × 17 in, 1989. This sculpture, part of a multimedia installation piece, reflects the relationship between Hell—A Computer C-itcom and the Tibetan Wheel of Life.



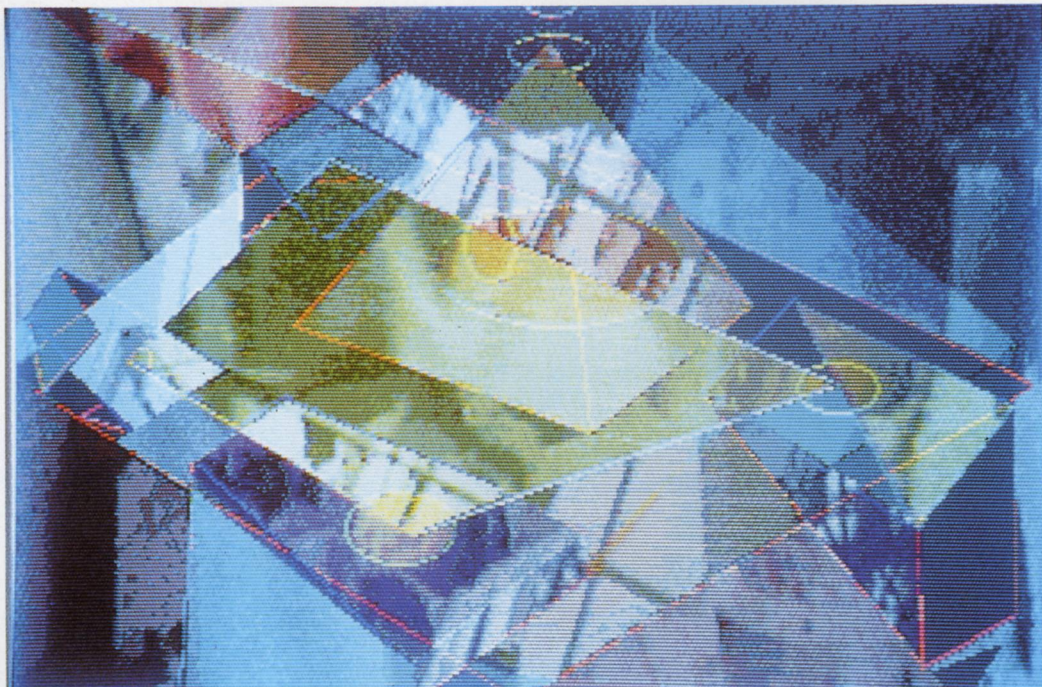
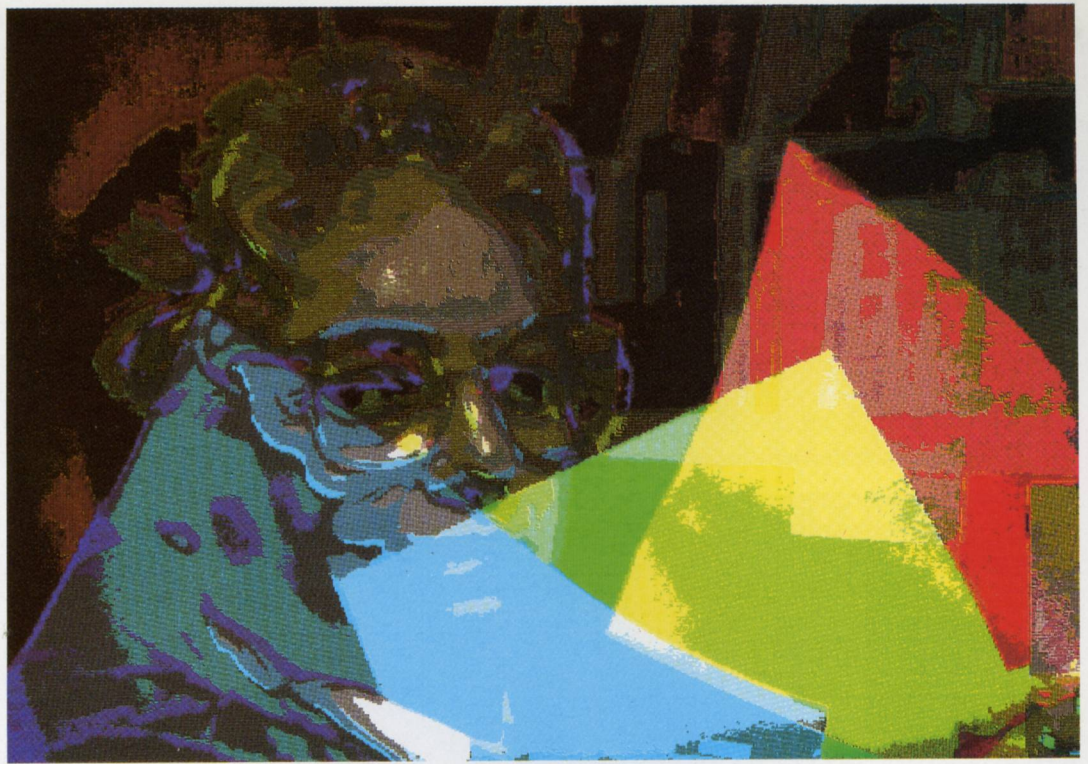
No. 3. Bottom Left. Willard Van De Bogart, *Angel's Pearls*, computer graphics, Silicon Graphics Personal Iris computer, Quick Model 3D software (Alias Research, Toronto), 1989. (Technical assistance: Thomas W. Casey, Production Masters Inc., Pittsburgh, PA. Engineer: Milton [Bud] Luce, Silicon Graphics Computer Systems, Pittsburgh, PA. Photo: Greg E. Enslin.) Moving beyond the cones and spheres created in Fig. 2 (see article), for this image the artist had to create a string of spheres, render them in white and use pink for the pearl box. The gold medallion depicts an angel.



COLOR PLATE C

No. 1. Top and center. Gregory E. Gundlach, sections from Z-TRANZ™ image sequences, photographed with the author's 19-lens camera on 70-mm EK 64 film: *Electric Serge* (top), 1989; *Cartwheel* (center), photographed in the strobe lab at M.I.T., 1986. The camera's 19 lenses, each 58 mm apart in a horizontal arc, simultaneously record separate images of the subject from their slightly different viewing angles. These are then printed in narrow strips onto one sheet of film and displayed behind a black line raster. When viewed, different strips (and, hence, different images) are visible to the left and right eyes, and the viewer experiences the three-dimensional effect of the Z-TRANZ print.

No. 2. Bottom. Marisa Gonzalez, *Contemporary Musical Graphics in Color* (detail), copier-generated art, 1 × 11 ft, 1985. A mural at the school of music "Soto Mesa" in Madrid; color painted with light.



COLOR PLATE D

No. 1. Top. Sonia Landy Sheridan, *Visualizing Time: Layering/Transparency*, Lumena 8 (Time Arts), Xerox Diablo printer, Kodak Cibachrome photograph, 30 × 40 in, 1989. (Photo: Paul Lane) As the artist sat before the video camera she moved a sheet of typing paper across her face, once for each color cycle: red, green, blue. The three sheets can be seen as transparent layers. (See "Image Generation Survey: Visualizing Time via Computers" by Sonia Landy Sheridan.)

No. 2. Bottom. Richard L. Loveless, *Energy Ingratiates Time*, computer-generated inkjet print, 28 × 36 in, 1988. One of a series of 150 images about "Timing Marks", exploring concepts of energy, life and time-travel from the caves of the Anasazi Indian to contemporary Europe and back into the soul.