SIGGRAPH '83

Exhibition of Computer Art

acm

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These selections represent a concern that an artist's work should transcend technique, realize the full potential of the chosen medium, and reflect a consistency in their overall body of work.

Detroit, Michigan/July 25-29, 1983/Cobo Hall

Artists and Technologists: The Computer As An Imaging Tool

Lucinda Furlong

Despite the fact that the computer is a relatively recent invention, the debate over whether or not computer-generated art works can truly be called "art" has roots in a much older argument about technology. The usual objection to "computer art" is based on the fear that somehow the computer — like Hal in the film 2001 — will take control, eliminating the role of the artist. A less paranoid but equally misplaced response construes the absence of handwork to represent easy art, requiring less skill than more traditional forms. Similar objections were raised when photography was discovered. In 1859, Charles Baudelaire considered photography as nothing less than a major threat to the entire fine art tradition. He wrote:

> It is nonetheless obvious that this industry [photography], by invading the territories of art, has become art's most mortal enemy, and that the confusion of their several functions prevents any of them from being properly fulfilled .... If photography is allowed to supplement art in some of its functions, it will soon have supplanted or corrupted it altogether...[1]

As photography critic and theorist David Jacobs has pointed out, this rejection of photography stemmed from a worldview —prevalent since the Industrial Revolution — which opposed "man" to machine. Accordingly, certain values were attributed to each: "Man was construed in Romantic terms, with emphasis placed upon inspiration and the God-like qualities of creativity. Cameras were mechanistic, without feeling or bias. Depending on how one looked at it, and the photography-as-art question opposed subjectivity to objectivity, art to science, humanism to technology, or God to Satan."[2]

Vestiges of this debate are still prevalent today in the form of would-be doomsayers and visionaries who expound on the pros and cons of life in the computer age. Anyone who has worked with computers is familiar with this set of dichotomies: rather than the camera, it is the computer that has come to represent the mechanistic, objective, scientific sphere. It is incapable of producing art, so the argument goes, because it is a machine, contradicting the myth of the artist who stands poised with paintbrush in hand. The flip side of this belief is the assertion that computers bring out the artist in everyone. The error in both these attitudes is the underlying assumption that technology is a force unto itself rather than a set of inventions by humans who are responsible for their use and abuse. Since technology does not function autonomously, it is as illogical to say that the computer threatens the creative process as it is to embrace the opposite extreme.

Acknowledging that the computer is merely a tool, how can we look at the work in the SIGGRAPH '83 Exhibition of Computer Art? This exhibition is unusual because it brings together work by two disparate and usually segregated groups of people — artists and technologists. These two groups bring very different sensibilities and priorities to their work. For some, computer imaging is a problem-solving exercise: once a particular technique is mastered, the programmer tackles another one. Others are interested in how those techniques might be used to implement an idea or generate meaning that lies beyond the technical problem at hand.

For the observer, the most obvious way to engage a work is from a technological standpoint: one usually wants to know how a particular work was produced, and what it represents in terms of the hardware and software used. Examples of state-of-the-art virtuosity abound in this show, and are significant for their technological achievement. However, this aspect of a work becomes secondary when one attempts to place it in the context of a broader visual history. For as John Berger has pointed out, "when an image is presented as a work of art, the way people look at it is affected by a whole series of learnt assumptions about art."[3]

These learnt assumptions — culturally-determined ideas about what constitutes an interesting and meaningful art work — are held not only by the observer, but by the maker, and are rooted in one's background. Thus, what an artist sees as interesting may be utterly simplistic technologically; conversely, what is impressive technologically may not be so impressive in relation to contemporary art. This is not intended as a value judgment, but to point out that different criteria are used in different contexts. However, since this is an art show — and not merely a display of the latest in technology — it is important to examine the work in the context of the conventions of art.

It would be futile to try to rigidly categorize a group of works whose only common thread is the fact that they were produced with the aid of a computer. However, there are some generalizations that can be made about what traditions these works — consciously or unconsciously — are drawing on. What is unique about the computer is its capacity to generate and process information that may be transformed and displayed in any number of ways — whether it be videotape, plotter print, photograph, or Scanamural. Theoretically, this flexibility presents the artist with a choice as to what format is best suited to his or her idea. In practice, though, the final product often has more to do with the tools at one's disposal.

While most of the works in the SIGGRAPH '83 Exhibition of Computer Art are photographs and plotter prints, a number of pieces expand our understanding of the term "hardcopy." They include: Margot Lovejoy's fold-out, a hand-colored Cloud Book; Luciano Franchi de Alfaro III's The Band, a hand-colored digitized image on handmade paper; Darcy Gerbarg's ceramic tiles entitled Auroale; David di Francesco's stone lithograph; Deborah Gorchos's Eyed 28, a digitized image transferred to fabric; and Sheila Pinkel's woven plotter print. Dan Sandin's holograms and David Morris's computer-aided sculpture further stretch the boundaries.

A number of people have begun using the computer as an extension of their work in photography and electronic imaging. Among them are Sonia Landy Sheridan and Ron MacNeil, a faculty member at M.I.T.'s Visible Language Workshop. MacNeil's 12 x 12-ft. air brush plotter print, Dog Rock, raises the issue of scale: like large-scale paintings and photographs, one must view the image from close-up and distant vantage points. Sheridan — a pioneer in xerography as an artist's medium, and theorist of what she calls "generative systems" — exploits the computer's serial possibilities in the print, Stretching Jim in Time. The distorted portrait lies somewhere between the still and moving image, becoming an artifact of the passage of time. Works by Grant Johnson, Copper Giloth, and Phil Morton demonstrate a similar concern, underscoring the idea that the serial image is perhaps more reflective of the computer's potential than the singular image.

The computer's flexibility as an imaging tool also means that the final product can take on the characteristics of other media. Thus, much of the work in the exhibition draws on the visual conventions of more traditional forms. Ralph Hocking's plotter print of a semi-abstract nude resembles an etching; Nancy Gardner's Polaroid print, June Blues, mimicks watercolor with its horizontal "washes" of pastel colors; Monique Nahas's and Herve Huitric's Souvenir de Vacances looks much like a pointilist landscape; and a good number of people — Frank Dietrich, Eleanor Kent, Eudice Feder, Michael O'Rourke, and Alice Kaprow, to name a few — have produced works that rely on the same formal ideas as modern abstract painting. This fact has been a source of criticism: if it is merely mimicking other forms, why bother to use the computer? People forget, however, that whenever artists work in a new medium, they initially draw on their visual antecendents. Early photography was discussed in terms of 19th-century painting, and early abstract videotapes of the late 1960s and early '70s were compared disparagingly to modern formalist painting. What's most important is for artists to acknowledge this visual history as such, and use it as a point of departure.

Not all the work in the exhibition specifically reflect conventions of fine art. Probably the most common use of the computer is for commercial graphic design and illustration. There are a number of examples of fine graphic work, among them Collette Gaiter-Smith's Showers, and untitled works by Jean Tracy, Laurence Gartel, and Mike Newman. Contemporary illustration is represented by Marilyn Abers's untitled Cibachrome print, Joe Pasquale's Hello Plugs, and Ned Greene's Mondo Condo.

The 20 videotapes included represent a number of different approaches to the medium. Probably the most traditional — if that word can describe such a young art form — is the integration of electronically synthesized images and music. Guenther Tetz's V and Dots, Stan VanderBeek's Spectrum Six, Dean Winkler's and John Sanborn's Act III, and Calypso Cameo, a collaborative work by Winkler, Vibeke Sorenson, and Tom Dewitt, all explore variations on graphic and aural themes.

Other tapes are more akin to the "concept videos" of Music Television, in which a popular song is illustrated. These include JoAnn Gillerman's Clone Baby, and Big Electric Cat, by Sanborn, Winkler, and Kit Fitzgerald. Still another genre is the dance tape. Both Oua Oua and Digital Dancer by Ed Tannenbaum, and Moving Along with X, Y Axis, by Roberta Hayes and Robert Coggeshall provide fine examples of how digital effects can transform and accentuate — rather than merely record — a dancer's movements.

Some tapes don't fit neatly into any category. Jane Veeder's Floater addresses one aspect of the phenomenology of seeing — how our eyes perceive movement — by using real-time animated graphics as retinal stimuli. Barbara Buckner's Greece to Jupiter: It's a Matter of Energy is a series of graphic depictions of how energy changes in space and time. In Bob Snyder's Trim Subdivisions, images of tract houses are manipulated in such a way that the tape becomes a play between two-dimensional flatness and three dimensionality. In Yoichiro Kawaguchi's Three Pieces, geometric forms come to life as clay-like fantasy characters that perform a series of sophisticated movements.

Citing photography's recent mainstreaming, some artists who work with computers feel it is only a matter of time before their work is also accepted, and to some extent, this is true. However, it should be kept in mind that "acceptable" is usually synonymous with marketability. For example, all talk of whether photography was "art" or not subsided when that medium was assimilated into the art print market around 1978.[4] Similarly, it is the reality of the marketplace that will play a bigger role in the computer's acceptance — not rhetorical debates over its merits and deficiencies as an artist's tool.

Notes

1. In "The Salon of 1859: The Modern Public and Photography," reprinted in Modern Art and Modernism, edited by Francis Frascina and Charles Harrison (New York: Harper and Row, 1982), p. 20.

2. In "Of Cretans and Critics: In Search of Photographic Theory," Afterimage, Vol. 10, No. 7 (February 1983), p. 9.

3. In Ways of Seeing (New York: Penguin Books, 1972), p.11.

4. See Jacobs, ibid.

Lucinda Furlong is a critic, and a frequent contributor to Afterimage, a journal of photography, video, independent film, and artists' books. She is currently working on a history of the "image processing" genre of video art, through a grant from the New York State Council on the Arts.

A Medium Matures: The Myth Of Computer Art

Gene Youngblood

We embark upon SIGGRAPH's second decade with a growing conviction that the leading edge of culture is no longer defined by the fine arts community — by what's being shown in galleries, purchased by museums, published in art magazines or talked about in SoHo lofts. The excitement and power and significance today seems to lie in electronic technology, especially the computer, which we are convinced will reveal the way to unlimited new aesthetic horizons and produce wholly new art forms. And yet the idea of computer art — of an art unique to the computer — remains after twenty years an unrealized myth; its horizons barely in view, its forms still to be manifest. For, ironically, most of what is understood as computer art today represents the computer in the service of those very same visual art traditions which the rhetoric of new technology holds to be obsolete.

For this reason, one might well take the view — only partially as Devil's Advocate — that there is in fact no such thing as computer art. In the first place, art is always independent of the medium through which it is practiced: the domain in which something is deemed to be art has nothing to do with how it was produced. Art is a process of exploration and inquiry. Its subject is human potential for aesthetic perception. It asks, how can we be different? What is other? It is a mode of consciousness, a way of being in the world. This requires a medium, of course, but the properties of that medium, the techniques that define it, do not constitute the exploration they facilitate. It is not paint that makes a painting art — even if the subject of the painting is painting itself.

In the second place, the boundaries of computer art as we know it today are circumscribed by a much larger history — that of the fine arts tradition — which contains all visual art and defines its possibilities. The use of the computer in the production of drawings, prints, textiles, ceramics and sculptures does not suddenly transform these ancient traditions into "computer art" — they remain painting, drawing and sculpture and their status as art will always be determined by art-historical concerns, not by any consideration of the computer's role in producing them. The myth of computer art is that it is visual art.

This is not to imply that computers do not give us new visual experiences. Three-dimensional animation, for example, is not only unprecedented in a visual sense but may well qualify as a truly new art form. Combining the objectivity of the photograph, the interpretive subjectivity of the painting and the gravity-free motion of hand-drawn animation, "digital scene simulation" is by far the most awesome and profound development in the history of symbolic discourse. It is possible to view the entire career not only of the visual arts but of human communication itself as leading to this Promethean instrument of representation. Its aesthetic and philosophical implications are staggering, and they are ultimately of profound political consequence. But the question whether a particular work of 3-D animation is Art will be addressed in a historical context that need not — and should not — take into account the medium through which it was produced, no matter how dependent on that medium it may be.

Art and Ontology

This seems sufficient cause to question the whole premise of Art and Technology. On one level this movement has simply been the art world's way of acknowledging that new technologies have a lot of cultural significance, and Art is a status-conferring label that means "this is culturally significant." But this validation is frequently bestowed on technologies whose actual significance may have nothing to do with what has traditionally been understood as art. Perhaps the "and" in Art and Technology should be changed to "or," for so many of our entrenched assumptions about art are inappropriate to new technologies and actually prevent us from realizing their unique potential.
The true aesthetic significance of the computer will be revealed only when we begin to explore that which is unique to it regardless of whether the results are art-like or not, or whether the art world acknowledges it. Whatever the case, I suspect it will not have much to do with producing anything at all — for what is most unique about the computer is precisely its intelligence, that is, its interactivity. In other words, the great value of the computer is ontological rather than phenomenological — it has more to do with processes of being in the world (ontology) than with the consequences of our being here (aesthetics, phenomenology). This is repeatedly confirmed by computer artists themselves, whose testimonies are almost always ontological, seldom phenomenological — always about the processes of producing the art through in-

teraction with the intelligent machine rather than about the art itself. This is what Dan Sandin means when he says that one cannot understand computer art by looking at it. And it is why Jane Veeder's interactive paint program/arcade game Warpitout was the outstanding work of computer art at SIGGRAPH '82.

Interactivity

We have identified two domains in which the computer offers truly unique contributions to the theory of art — three-dimensional simulation and interactivity. Many people believe the ultimate computer art form will be a synthesis of the two. Let us first consider interactivity. In interactive art the concepts "artist" and "audience" become the roles of "author" and "participant." The author creates not a particular image, object, event or space but rather specifies the laws of an environment that contains many possible images, objects, events or spaces that can be realized by the participant as he or she interacts with that environment according to its laws. But a truly interactive environment becomes conversational — its laws change as a result of its interactions. The computer "senses" the participant's state of being (for example, through a menu of questions, or through kinetic or physiological sensors) and changes some aspect of the environment (such as images or sounds) accordingly. This is the ultimate case of Marcel Duchamp's dictum that the artist begins the artwork and the witness completes it — for the more interactive a system is the more transparent it becomes: its own systematic characteristics are less evident as it becomes what you want to be seeing, what you want to be doing, what you want to be experiencing.

The first interactive art form likely to be addressed by artists is the interactive movie, based on computer-controlled optical videodisc systems. The user essentially creates his or her own personalized movie as they branch through a relatively open-ended cinematic space in ways made possible, but not directly determined, by the author of that space. The first so-called interactive discs (discs aren't interactive; only computers are), primarily educational in nature, have appeared only in the last few years. The most elaborate have been produced by the Architecture Machine Group at MIT, whose best known is the Aspen Movie Map which allows the viewer, among other things, to travel down any street and into buildings to examine their contents.

As impressive as they may be, such projects are fairly straight-forward compared to more abstract, poetic, conceptual or perceptual experiments that artists might pursue. For example, the video artist Bill Viola, recently awarded a major grant to produce an interactive videodisc, compares the open-ended nature of the medium to the "infinite resolvability" of reality. As a metaphor, he recalls a sequence of satellite photos showing first the east coast, then the New York metropolitan area, then just Manhattan, then just lower Manhattan, finally isolating individual buildings. "What fascinated me," he said, "was that the progression was not a zoom or a blowup. It's not as though they used four different lenses and made four different pictures. All the buildings in the closeup existed already in the global view because it's actually a computer data base and they're in the information. So the image doesn't lose detail or become grainy when it's enlarged because it's computer-enhanced. That's not like zooming. You determine the scale of what you're seeing by processing information that's already there. That's how eagles see. They see a field mouse from 500 feet. They're not zooming their eyes. It's like the World Trade Center being in the satellite photo from 200 miles out. That's where media's going in general — the idea that recording becomes mapping. Everything is recorded. Everything is encoded into the system and as a viewer or producer you just determine what part you're revealing."

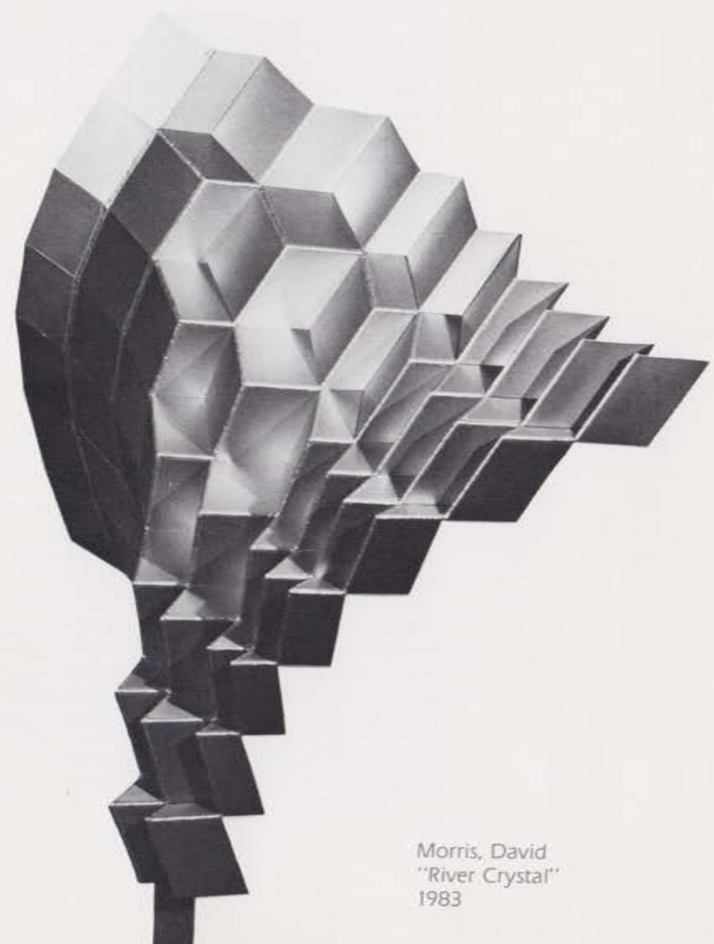
Simulation

The fundamental premise of the interactive movie — the global recording of a scene or event from, as it were, a "spherical" point of view which allows the user to select a particular pathway through the material — is an idea ahead of its time, one which will be served only partially by conventional photography and the videodisc. It begs for three-dimensional scene simulation. For whereas the photographic disc is limited in the number of decision-nodes or branching points its method of production can accommodate, simulation can offer a decision thirty times a second: every frame becomes a branching point, every shot can pose the question what to do next? This is well understood by designers of video and arcade games who see these rudimentary toys as forerunners of the cinema of the future. And it is understood by pioneers of digital scene simulation like John Whitney, Jr. and Gary Demos at Digital Productions in Los Angeles, who are developing the "algorithmic database" software which they believe will make remote interactive scene simulation over cable TV channels a commercial possibility within this decade.

"The real-time simulation channel would be a direct feed from a supercomputer like the Cray-1," Demos explained, "running 24 hours a day and available on a subscription basis. So you just tune in and connect your home computer to the central computer by phone modem and you become a part of the movie. The Image Utility presents the generic possibilities and you make variations based on your own personality and abilities. You control things, create a custom movie that will never be seen by anyone else. The entertainment value of interactive characters more beautiful than those in Disney animation, all customed to your commands, would be incredible! There would be some restrictions on scene complexity if you wanted real-time interaction; but the ability of the viewer to introduce flies and birds and wind and weather into the simulated environment would be overwhelming. Look at the popularity of video games today with their low level of visual sophistication and interactivity. It seems to me that the applications for real-time custom simulation are infinite and the demand will be enormous. Custom news, for example, or just your general interests. Maybe a doctor needs a readout on a patient so we simulate his heart from the doctor's input. Geologists, architects, they all need images — not just line graphics but three-dimensional shaded motion images. It seems to me that everyone could easily consume a couple of hours of television today. The AT&T of the future is the company that sells custom visual simulation. I am certain it will be common in ten to fifteen years."

In Search of Computer Art

The full aesthetic potential of these forms will be realized only when computer artists come to the instrument from art rather than computer science. This will require a new generation of ultra-powerful personal computers at prices affordable by artists, as well as a new generation of artists with the desire to afford them and the skills to use them. Computer art will not mature overnight. The kind of interactive simulation envisioned here requires today a $10 million Cray-1 supercomputer and software that does not yet exist; but the manufacturers of the Cray-1 believe that by the early 1990s computers with three-fourths of its power — quite sufficient for computing real-time interactive simulations at video resolution — will sell for approximately $20,000. Such a device would have an enormous market potential, and it is certain that the simulation software would be available with it. Thus finally accessible to autonomous individuals, the full aesthetic potential of interactive visual simulation will be revealed, and the future of cinematic language — hence the social construction of reality — will be rescued from the tyranny of perpetual imperialists and placed in the hands of the artists and amateurs who shall inherit the world.



Morris, David
"River Crystal"
1983

Mapping A Sensibility: Computer Imaging

Catherine Richards

"The work of art," as the surrealist André Breton said, "is valuable only so far as it is vibrated by the reflexes of the future." These "reflexes of the future" have introduced, since the early 1900s, increasingly powerful visual technologies. To rephrase André Breton — in certain critical epochs, art anticipates effects that are only fully realized by newly emerging technology and new art forms.

It is often stated that our "new information society" or "the electronic age" is now at a critical time of societal transformation. In this transformation new visualization tools are predicted to play an increasing role.

How can we gain an insight into the characteristics of the emerging visual media? According to André Breton's perspective, contemporary art concerns can anticipate those of the new visual technology. Therefore, by mapping one to the other we can locate clues pointing towards a changed visual sensibility.

The following text maps contemporary art concerns to computer imaging in three major aspects of image making. First, the techniques of forming an image are called, in the text, "image formulation." Second, the image's relationship with the viewer (and/or creator) is called "interaction" (after the person/machine relationship in computer science). The last aspect, the image's relationship with its subject matter, is called "Reality." It is these three sensitive areas that begin to subtly shift as new technology forces adjustment in human perception.

Image Formulation

Many computer graphics techniques are modeled from existing techniques in other visual media. Computer graphics demonstrates startling facility in perspective, texture, as well as another obsession of the arts in the fifteenth century, modeling with light. Ray tracing algorithms, for example, produce subtle displays in mirrors, lenses or glass. "Paint systems" model two dimensional painting by hand. Key frame computer animation is transposed from cel animation in film. Fades, dissolves, zooms and other grammatical transitions of film and television are also available. This brief number of examples indicates the ability of computer graphics to easily absorb many imaging techniques proven effective by earlier media. What we can now suggest are the following unexpected capabilities.

Integration Of Visual Techniques — First there are new combinations of known imaging techniques. The moving point of view is a simple example. This technique combines the advantages of three-dimensional drawing with the camera's freedom of movement. Thus, motion dynamics allow the viewer to "fly" around drawn buildings or molecules. One can expect that future developments will combine visual techniques with other disciplines such as digital sound.

New Description Systems — A second unexpected capability is the arrival of a new visual description system such as fractals. Fractals are based on a different geometry than that which underlies most three-dimensional form making. This geometry offers new ways for artists to think about forms — such as intervals of dimension, "roughness dimension" and its ability to produce infinite detail. Its power to describe detailed natural forms such as grass, plants or terrain is proving to be an image breakthrough in computer graphics.

Windows — A third unexpected capability is a change in visual format. Max Ernst described his collages in 1936 as "a meeting of two distinct realities in a plane foreign to them both." This statement describes a visual environment very different from the consistent spatial unity of a perspective image. It also describes the overlapping windows of progressive activities in the Smalltalk programming environment or spatial data management systems. Within the history of collage and multi-screen video and film, these window frames are unique. They are user directed viewports into ever-receding depths or around ever-expanding horizons of information.

Automation And Creativity — One fascinating aspect which can only be suggested here is contemporary art's exploration of levels of artistic decision-making. Both art's compositional techniques, as well as chance and random procedures are now being automated through computers. Perhaps it is for this reason we see more emphasis on the creative process itself. Ironically it may be no accident that music is a case study in artificial intelligence. Marvin Minsky said in the New York Times, "you have to make a . . . composer (program) . . . . that means your attention is drawn not so much to the rules of the surface (of the music) but to the rules of how the composer decides what to do next." Similarly, we will likely see an increased interest in the mental procedures of image-making.

Interaction

Pulling back from the image technique itself, we find a person in relation to that image — he/she interacts. In the language of film, TV, theatre or painting, this position is occupied by the viewer, the spectator, the audience. It is significant that in computer graphics, this person is always referred to as the "user." This may be obvious to the world of computer graphics but a radical change for most visual production. But again there has been anticipatory art. The 60s happenings, theatrical improvisation, the 70s performance art tried to stretch, dissolve, reform, destroy the formidable spectator-object boundary. "Guerilla" TV encouraged "talk back to your TV set" through social action video and community TV. All awkwardly anticipated the powerful and natural interactive relationship between user and machine/program. This work has put such a strain on art language that the best, but inadequate, word to describe the new role of spectator is "participant." In terms of the historical image-making world, this change demands a fundamental reorientation of subject-object relationship.

Mental Shelter — Architectural structure may present a better analogy than film, TV, painting or photography to re-think the subject-object relationship. A building creates an environment for movement. Unless it is a prison, the architecture does not attempt to precisely control persons. "Tamara," a play in Toronto, anticipated this sense of dramatic spatial design by attaching audience members to actors as they played a drama throughout a house. Similarly one plays an adventure game, flies a plane through a desert and branches through an information space. The twist to this situation occurs, for example, in teaching programs designed to track the individual weaknesses and strengths of the user and adapt its response. The mental shelter has become an adaptive organism.

Reality

At last we arrive in the trickiest terrain — so apparently innocent. The core of visual art is the ever-questioned link between the image and . . . something. Since no serious art can avoid this issue, artists generally have a healthy cynicism for visual conventions that lay sole claim to "reality." This had not always been the case. Photography introduced an indelible trauma into western art's smug acceptance of visual conventions they believed truly depicted "nature."

In the mid 1800s, for instance, picturing such things as a horse in gallop was a perplexing problem. The photographer, Muybridge, took up the challenge and produced a series of photos that contradicted all previous representations made by artists. The meaning of "true to nature" lost its force. What was true could not always be seen and what could be seen was not always true. No artists would then dare to paint a horse in the old position without risking public ridicule. Photography had won a powerful victory in its correct role as "evidence" in our culture.

Reality links — Updated computer graphics makes a direct link between changing measurements and corresponding changes in visual representation. In the past, complex charts have attempted to picture large patterns and abstract relationships. Animation has attempted to illustrate processes. But to directly and dynamically link measurable changes in the world to changes in visual representation is a dramatic step in the history of images. It appears that not since the invention of perspective (and its descendents in the optics of photography and film) or the appearance of movement in film through persistence of vision have we added such a powerful new imaging tool to our culture. Perspective offered the analysis of space, film the analysis of motion and updated dynamic images the analysis of abstract relationships.

We began by looking for signposts to a changing sensibility in our image environment. We characterized the common terrain of contemporary art concerns and computer imaging. What we found was an increasing integration of visual techniques and conventions, a close embrace of participant (user) and object, (machine/environment) and a close-knit bond between dynamic images and measurements of abstracted relationships in "reality." These are generally integrative impulses. It is likely they will be furthered by computer graphics' chameleon-like ability to simulate both mental and physical processes.

Exhibitors Hardcopy

Abers, Marilyn
"The Pool" 1983
GENIGRAPHICS
C print, 11x14
Hardware/Software: GENIGRAPHICS

Blum, Terry
"Red #5" 1983
Fashion Institute of Technology
Cibachrome, 16x20
Hardware: Cromemco
Software: John Dunn

Cavadia, Christan
Lihou, Jean-Pierre
"Bouquet Fleche" 1980
ARTA-Centre Georges Pompidou
hand colored plotter drawing, 20x24
Hardware: Tetronix 4052
Software: ARTA Interactive

Chuang, Richard
"Swirls" 1983
Pacific Data Images
Cibachrome, 16x20
Hardware: VAX 11/750
Software: P.D.I.

Coleman, Connie
Powell, Alan
"Untitled" 1983
Experimental TV Lab
Cibachrome, 18x22
Hardware: Cromemco, Jones analog colorizer
Software: Paul Davis, David Jones

Culver, Joanne
"Ascent" 1983
Northern Illinois University
C print, 16x20
Hardware: PDP 11/45, Vector General Display, Sandin image processor
Software: GRASS

de Graf, Brad
Stevens, Payson
"Entropy" 1983
Science Applications, Inc.
Cibachrome, 16x20
Hardware: DeAnza VC 5000
Software: S.A.I.

Dietrich, Frank
"Softy3" 1983
West Coast University
C print, 20x24
Hardware: VAX 750, AED 767
Software: Fortran by artist and David Coons

Di Francesco, David
"Hand" 1983
Lucasfilm
stone lithoprint, 15x20
Hardware: Litho press, DICOMED D48, DeAnza frame buffer

Feder, Eudice
"From Darkness into Light" 1983
University of California
plotter drawing, 16x20
Hardware: Calcomp plotters 410, 1051
Software: SIMPLOT by Russell Abbott

Franchi de Alfaro III, Luciano
"C.W. 2/83-2" 1983
hand colored printer drawing 18x20
Hardware/Software: Cygnus I computer and Terminex 200 printer

Gaiter-Smith, Collette
"Showers" 1983
Colgate-Palmolive Company
C print, 20x24
Hardware: Ramtek 6214 computer
Matrix 4007 camera
Software: Xybion

Gardner, Nancy
"June Blues" 1983
Visible Language Workshop, MIT
Polaroid print, 20x24
Hardware: Perkin-Elmer 3220, Grinnell frame buffer, Reticon CCD scanning camera
Software: VLW

Gartel, Laurence
"Tik Tak Toe" 1982
C print, 16x20
Hardware/Software: Ampex AVA Paint System

Giloth, Copper
"A Bird in Hand" 1983
Real Time Design, Inc.
plotter drawing, 25½x17½
Hardware: Datamax UV-1 computer, Hewlett-Packard 7580-A plotter
Software: Zgrass, UV-1 Paint System

Gorchos, Deborah M.
"Eyed 2b" 1983
heat transfer onto fabric, 12x15
Hardware/Software: Cygnus I digitizer, Terminet 200 printer

Greene, Ned
"Mondo Condo" 1983
NYIT
Cibachrome, 16x20
Hardware: VAX 11/780, DICOMED D48
Software: Paul Heckbert, Tom Duff, Peter Oppenheimer, and Lance Williams

Haimes, Rob
"restore O" 1983
Visible Language Workshop, MIT
Polaroid print, 20x24
Hardware: Perkin-Elmer 3220 CPU, Grinnell frame buffer, Reticon CCD scanning camera
Software: VLW

Hall, Roy
"Refractions" 1983
Cornell University
C print, 8 x 10
Hardware: VAX 11/780, Grinnell frame buffer
Software: by the artist

Hall, Roy
"The Gallery" 1983
Cornell University
C print, 16x20
Hardware: VAX 11/780, Grinnell frame buffer
Software: by the artist

Hamilton, Bruce
Hamilton, Susan
"Tower" 1983
plotter drawing, 11x16
Hardware: Tektronix 4051 computer
Tektronix 4662 plotter
Software: by the artist

Helmick, Richard
"American Sunset" 1982
screenprint, 10 x 34½
Hardware: Apple II+, MX-80 printer
Software: by artist written in BASIC

Ho, Hsuen-Chung
"Untitled" 1983
Cranston/Csuri Productions, Inc.
C print, 20x24
Hardware: VAX 11/780, 480x640x32 bit frame buffer
Software: ray-tracing and sub-division algorithms

Hocking, Ralph
"Untitled" 1983
The Experimental TV Lab
printer drawing, 4x4
Hardware: Cromemco Z2, Cat 100 frame buffer, NEC PC 8023 printer
Software: David Jones

Holland, Harry
"Frame up" 1983
Carnegie-Mellon University
C print, 11x14
Hardware: LSI-11, AED 512
Software: CMU-PAINT by Warren Wake

Huitric, Herve
Nahas, Monique
"Souvenir de vacances" 1982
C print, 20x24
Hardware: VAX 11/780
Software: Production Automation, Rochester University

Hushlak, Gerald
"Depth Enigmas" 1982
University of Calgary
plotter drawing, 22x30
Hardware: Calcomp 718, PDP 11/45
Software: by Lynn Sveinson

Johnson, Grant
"Bunny's Choice" 1981
Stimulus
9 Cibachromes, 8x10 each
Hardware: Sandin image processor, Paik Abe synthesizer, Templeton Telenetics Quantizer
Software: by the artist

Kaprow, Alyce
"Untitled" 1983
Architecture Machine Group, MIT
C print, 20x24
Hardware: Perkin-Elmer 3230, Ramtek 9300, Matrix 2000 camera
Software: Walter Bender and the artist

Kaprow, Alyce
"Untitled" 1983
Architecture Machine Group, MIT
C print 20x24
Hardware: Perkin-Elmer 3230, Ramtek 9300, Matrix 2000 camera
Software: Walter Bender and the artist

Kent, Eleanor
"Video Eggs" 1983
Mark Allen's Polot Productions
Cibachrome, 11 x 14
Hardware: prototype colorizer by Jack Pines

Kerlow, Isaac Victor
"Pyramid T" 1982
Columbia University
C print, 20x24
Hardware: VAX 11/780, Grinnell frame buffer
Software: CARTOS by Irwin Sobel and Noel Kropf

Lindquist, Mark
"Porno Movie E" 1983
Digital Effects, Inc.
C print, 16x20
Hardware: IBM 4341, PDP 11/34
Software: DEI's Video Palette

Lovejoy, Margot
"Flux 1" 1982
screenprint, 20x30
Hardware: IBM 370, Amdahl line printer output

Lovejoy, Margot
"Cloud Book" 1982
color xerox, 9¼" x 9¼"
Hardware: IBM 370, Amdahl line printer output

Lovejoy, Margot
"Cosmic Code 2" 1982
Mixed Media, 14x18
Hardware: IBM 370, Amdahl line printer output

Lyon, Douglas
"Sky: Overhead Projectornoids" 1982
RPI — Image Processing Lab
C print, 16x20
Hardware: Prime 750, DeAnza Image Array Processor
Software: by the artist and Prof. H. Freeman

MacNeil, Ron
"Warpron" 1982
Visible Language workshop, MIT
Polaroid print, 20x24
Hardware: Perkin-Elmer 3220 CPU, Grinnell frame buffer, Reticon CCD scanning camera
Software: VLW

Marshall, Mike
Polito, Fred
"Target 1" 1983
Cibachrome, 20x24
Hardware: Data General Eclipse, Lexidata display
Software: ART DEMO by Mike Marshall

Marshall, Mike
Polito, Fred
"Target 2" 1983
Cibachrome, 20x24
Hardware: Data General Eclipse, Lexidata display
Software: by the artist

Maxwell, Delle
"Balloon Box 3" 1983
Architecture Machine Group, MIT
Cibachrome, 20x24
Hardware: Perkin-Elmer 3230, Ramtek 9300, Matrix camera
Software: by the artist

Morton, Phil
"4:3" 1983
Printer drawing, 15 x 24
Hardware: Datamax UV-1 computer, Axiom printer
Software: Zgrass

Newman, Mike
"Ed's Synapse", and "Ed's Dendrite" 1983
DICOMED Corp.
2 Cibachromes, 11x14 each
Hardware: DICOMED Imaginator Design Station, DICOMED D148SR film recorder

Norton, Alan
"Fractal Domains of Attraction — 8" 1983
IBM Research
Cibachrome, 20x24
Hardware: FP190L Array Processor, IBM 3033, Ramtek 9400 frame buffer, Matrix camera
Software: written in FORTRAN

Norton, Alan
"Fractal Domains of Attraction — 9" 1983
IBM Research
Cibachrome, 20x24
Hardware: FP190L Array Processor, IBM 3033, Ramtek 9400 frame buffer, Matrix camera
Software: written in FORTRAN

Olschafskie, Francis
"Untitled" 1983
Communication Arts and Technology
C print, 11x14
Hardware/Software: Graphic Design Workbench

O'Rourke, Michael J.
"eyelOR .9" 1983
NYIT
Cibachrome, 15x20
Hardware: VAX 11/780, Genisco frame buffer, DICOMED D-48 image recorder
Software: NYIT

Pasquale, Joe
"Hello Plugs" 1983
Digital Effects, Inc.
C print, 20x24
Hardware: IBM 4341, PDP 11/34
Software: DEI's Visions System

Peitgen, Heinz-Otto
Saupe, Dietmar
"Julia Sets — 5" 1983
Bremen University
C print, 20x20
Hardware: VAX 11/780, Grinnell frame buffer
Software: by the artists

Pinkel, Sheila
"Untitled" 1981
plotter weaving, 20x26

Porett, Tom
"Faces" 1983
C print, 16x20
Hardware: Apple II, video digitizer
Software: Steve Dompier

Porett, Tom
"Untitled" 1983
C print, 16x20
Hardware: Apple II, video digitizer
Software: Steve Dompier

Prueitt, Melvin L.
"Conflict" 1983
Los Alamos National Laboratory
C print, 18x20
Hardware: CRAY-1 computer, III FR-80 film plotter
Software: by the artist

Rivera, Gregorio
"UFO" 1983
Visible Language Workshop, MIT
Polaroid print, 20x24
Hardware: Perkin-Elmer 3220 CPU, Grinnell frame buffer, Reticon CCD scanning camera
Software: VLW

Rosenthal, Sally
"Maria" 1983
University of Illinois at Chicago
bead work, 18" x 18"
Hardware: Datamax UV-1 computer
Software: Zgrass

Schubert, Christa
"Untitled" 1983
Quikdata Telecomputing
plotter drawing, 8x11
Hardware: Data General Nova
computer, Soltec plotter
Software: Quikdata Telecomputing

Sheridan, Sonia
"Stretching Jim in Time" 1982
3M Positive Match Print: made by
Dr. Douglas H. Dybvig, 16x20
Hardware: Cromemco Z-2D CAT 400
Software: EASEL by John Dunn,
Time Arts

Tetz, Guenther
"Untitled" 1983
University of Illinois at Chicago
C print, 20x24
Hardware: Datamax UV-1 computer
Software: Zgrass

Tracy, Jean
"Summer Breeze" 1983
GENIGRAPHICS
C print, 16x20
Hardware: GENIGRAPHICS computer
Software: KXS-GE Level 4

Voss, Richard
"Mount Mandelbrot" 1983
IBM Research
C print, 15x15
Hardware: IBM 3081, IBM 4341
Software: Benoit Mandelbrot

Wilson, Mark
"Skew B" 1983
plotter drawing, 20x38
Hardware: IBM personal computer,
Tektronix 4663 plotter
Software: by the artist

Wilson, Mark
"Skew A" 1983
plotter drawing, 20x38
Hardware: IBM personal computer
Tektronix 4663 plotter
Software: by the artist

Wright, Walter
"Untitled" 1983
Digital Image Corp.
C print, 8 x 10
Hardware: Cromemco Z-2D, Via Video
digitizer, Matrix camera
Software: Digital Image Corp.

Installations

Gartel, Laurence M.
"Moz Ocean" 1982
324 SX70 polaroids, 5'x5'
Hardware: Cromemco Z-80
computer, video synthesizer

Gerbarg, Darcy
"Orientalia"
New York University
glazed & fired ceramic tiles
6'3" x 6'3"
Hardware/Software: Aurora
Systems, Inc.

Holtzman, Bob
"Frame Buffer Images" 1983
Hardware: 12 Conrac 19" monitors,
DeAnza IP 8400, DEC PDP 11-44,
Ramtek 9400
Software: West Coast U.

MacNeil, Ron
"Dog Rock"
12' x 12'
Hardware: Perkin-Elmer 3220 CPU,
Grinnell frame buffer, Reticon
CCD scanning camera
Software: VLW

Morris, David
"River Crystal" 1983
aluminum sculpture, 6'6" x 4'7"
Hardware: Datamax UV-1
Software: Trans Package
Fabrication: Schmidt Iron

Naimark, Michael
"Computer Eyepiece" 1983
16mm film loop and frosted
acrylic dome
Produced with the Chroma-chron
Digital Image Processor by
Raster RSRCH, Inc.
In collaboration with Ed. Tannenbaum

Sandin, Dan
Huffman, John
"Untitled" 1983
holograms
Hardware: Datamax UV-1
Software: Zgrass
Holograms printed by John
Huffman at the Fine Arts Research
and Holograph Center.

Teknai
Producer: Norie Hiraide
"Yuuzen Kimono"
cloth
Hardware: SI-11/AED 512

Video

Buckner Barbara
"Greece to Jupiter:
It's a matter of energy"
The Experimental Television Center
B & W/Silent, 4:45
Hardware: Rutt Etra Cromemco Z-2
Software: Michael Uffer
Andrea Barbakoff

Cubacub, Arturo
"Ahluvyalike" 1983
University of Illinois at Chicago
Color/Stereo, 6:10
Rastafari Audio Synthesizer
Hardware: Datamax UV-1 computer
Sandin image processor
Video/Animation: Arturo Cubacub
Poetry: Arturo Cubacub
Music and Sound: Arturo Cubacub, Jan
Judith Heyn with Michelle Fitzsimmons
Software: Zgrass

Culver, Joanne
"American Design"
Color/Ch 1, 3:05
Hardware: Bally Arcade computer
Software: Scribble Game

Gillerman, Jo Ann
"Clone Baby" 1982
Color/Stereo, 3:31
Video/Music: Viper Optics — Jo Ann
Gillerman, James Gillerman, Jim
Whiteaker
Hardware: Aurora Paint System,
Sandin image processor

Hayes, Roberta Lynn
Coggeshall, Robert
"Moving Along with X,Y Axis" 1982
B & W/Stereo, 4:23
Hardware: Grinnell image processor,
LSI 11-23 computer
Software: Robert Coggeshall
Choreography: Roberta Hayes
Electronic Music: Bill Franki,
James Wilson
Produced: SUNY/Buffalo

Hirata, Toyoko
Horiguchi, Tadashiko
"Maru, Sankaku, Shikaku"
NHK Home and Family Division
Color/Ch 1, 1:29
Computer Graphic Animation: Osaka
University
Producer: Toyoko Hirata
Animator: Tadashiko Horiguchi
Music: Hiroaki Nakamura
Hardware: Links-1

Horn, Johnie Hugh
"Everytime"
B & W/Stereo, 9:56
Hardware: Datamax UV-1 computer,
video digitizer
Software: Zgrass
Sound: Domen Music, Meredith Monk

Ishiki, Nobuo
Kato, Akira
"Shiritori"
NHK Home and Family Division
Color/Ch 1, 1:03
Computer Graphic Animation: Osaka
University
Producer: Nobuo Ishiki
Animator: Akira Kato
Music: Mikii Yoshikawa
Hardware: Links-1

Kawaguchi, Yoichiro
"Growth"
Nippon Electronics College
Color/Silent, :45
Hardware: Links-1
Software: Growth Alorgrithums
Produced: Osaka University

Rawlings, Margaret
"Only Eyes" 1983
University of Illinois at Chicago
Color/Stereo, 2:51
Hardware: UV-1 Datamax computer
Software: Zgrass

Snyder, Bob
"Trim Subdivisions"
Color/Silent, 5:46
Hardware: Bosch B 1" Quantel
Video Processing: Bob Snyder
Camera: John Mabey

Sorenson, Vibeke
DeWitt, Tom
"Calypso Cameo"
Color/Stereo, 2:07
Hardware: Vital Squeeze Zoom,
G Valley 300 Switcher
Software: Dynamic Design Algorithm
Video: Tom DeWitt, Vibeke Sorenson
Music: Vibeke Sorenson

Tannenbaum, Ed
"Digital Dancer"
Raster Masters Inc.
Color/Stereo, 4:46
Music: "Mighty Dog Meets Jah Flea"
by Mighty Dog
Dance: Pons Maar
Hardware: Apple II, Chroma-Chron
Digital image processor, (designed by
E. Tannenbaum)
Software: Apple II, FORTH and
assembly code

Tannenbaum, Ed
"Oua, Oua"
Raster Masters Inc.
Color/Stereo, 2:50
Music: Oua Oua
Dance: Pons Maar
Hardware: Apple II, Chroma-Chron
digital image processor, (designed by
E. Tannenbaum)
Software: Apple II, FORTH and
assembly code

Tetz, Guenther
"Dots"
Color/Stereo, 8:22
Hardware: Datamax UV-1 computer,
Roland Juno-60, Moog audio
synthesizer
Software: Zgrass
Computer Graphics/Sound:
Guenther Tetz
Video: Raul Zaritsky 1983

Tetz, Guenther
"V"
Color/Stereo, 9:50
Hardware: Vector Display Device,
General PDP 11/45, Sandin image
processor, Roland Juno 60, Moog audio
synthesizer
Software: Grass
Computer Graphics/Video Synthesis/
Sound: Guenther Tetz
Editing/Additional support: Raul
Zaritsky

Van Der Beek, Stan
"Spectrum 6"
Color/Stereo, 3:27
Realized by: Stan Van Der Beek
Music: Max Van Der Beek, Ferdinand
Maisel
Video implementation: Michael
Murphy, Bob Hutchison and particpants
in the 1980 KET Video Art Residency
Produced through the facilities of
KET, supported by Kentucky Arts
Council and NEA
Hardware: Van Der Beek synthesizer,
Grass Valley Switcher

Veeder, Jane
"Floater"
Color/Monaural, 6:12
Hardware: Datamax UV-1 computer
Software: Zgrass

Winkler, Dean
Sanborn, John
Fitzgerald, Kit
"Big Electric Cat"
Color/Stereo, 6:30
Produced: Teletronics
Hardware: Quantel DPE 5000 with real
time image processing system and
additional "Dimension" frame store,
GVG-300 Switcher, VIA/Video
Computer Painting System
Software: Quantel V4 Operating system
with enhanced BBC Teletrack
Video: Dean Winkler, John Sanborn,
Kit Fitzgerald
Music: Adrian Belew

Winkler, Dean
Sanborn, John
"Act III"
Color/Stereo, 6:30
Produced: Teletronics
Hardware: Via Video Computer
Painting System, #GVG-300 Video
Switcher, Quantel DPE-5000 with real
time image processing system and
additional "Dimension" frame store
Software: Teletronics V12 operating
system ver L2.3 (written by Robert L.
Lund)

Catalog Design: David Wise

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