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.

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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 Ha! 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.

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 "art" to "science." 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."1

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 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 illogical to say that the computer threatens the creative process as it is to oppose the 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 moves on to another. 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 with this 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, "Working in the medium of a computer is like working in handmade paper; Darcy Gerberg's ceramic tiles entitled Auroale; David di Franceso's stone lithograph, Deborah Gichos's Eyed 2 Fl, a digitized image transferred to fabric; and Sheila Pinke's woven plotter print. Dan Sandin's holograms and David Morris's computer-aide 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 Sotomayor, a participant in M.I.T.'s Visible Language Workshop, MacNeil's 12 x 12-ft. airbrush 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 "generator 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, Gilots, and Phl Morton demonstrate a similar concern, underscoring the idea that the seminal image is perhaps more reflective of the computer's potential than the singular image.

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 Scanova. The flexibility of 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 plots, there are a number of pieces that expand our understanding of the term "handwork." They include Margot Lovejoy's fold-out, a hand-colored Cloud Book, Luciano Franchi de Aivado's Three The Band, a hand-colored digitized image on handmade paper; Darcy Gerberg's ceramic tiles entitled Auroale; David di Franceso's stone lithograph, Deborah Gichos's Eyed 2 Fl, a digitized image transferred to fabric; and Sheila Pinke's woven plotter print. Dan Sandin's holograms and David Morris's computer-aide sculpture further stretch the boundaries.

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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 color; Monique Nanass's and Herve Huitric's Souvenir de Vacances looks much like a pointilist landscape; and a good number of people — Frank Dietrich, Eleonor Kent, Eudora Fedor, Michael O'Rourke, and Alice Kiprow, to name a few — have worked in the new medium, which relies on the same formal ideas as modern abstraction painting. This fact has been a source of criticism: if it is merely mimicking other forms, why bothers to use the computer? People forget, however, that whenever artists work in a new medium, they initially draw on their visual antecedents. Earlier photography was discussed in terms of 19th-century painting, and early abstract video images of the late 1960s and early 70s were compared disparagingly to modernist painting. What is most important for artists is to acknowledge this visual history — as such and use it as a point of departure.

Not all the work in the exhibition specifically reflects conventions of fine art. 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 Geller-Smith's Shovers, and Ursula Winkler's Act III, and Calypso Camara, a collaborative work by Winkler, Vibeke Sorensen, 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 John Gilleran's Clone Baby, and Big Electric Eat, by Sandoon, Winkler, and Kit Fitzgerald. Still another genre is the dance tape, both Ola Ola and Digital Dancer by Ed Finnembaum, and Moving Along with X, Y, Axis, by Roberta Hayes and Robert Coggshell 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 Veedere Floaters addresses one aspect of the phenomenology of seeing — how our eyes perceive movement — by using real-time animated graphics as visual stimuli. Barbara Buckner's Greek to Jupiter: It's a Matter of Energy is a series of graphic depictions of energy changes in time and space. In Bob Snyder's Tim Subvolutions, images of track house are manipulated in such a way that the tape becomes a play between two-dimensional flatness and three dimensionality. In Yoshio 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 subsisted when that medium was assimilated into the art print market around 1978. 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
4. See Jacobs

Linen Prunung, an artist, is a frequent contributor to Alternative, a journal of photography, video, independent film, and artists' books. She is currently working on a history of the "video process" and is involved 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 magazines published by museums, seen in art magazines, or talked about in SoHo lofts. The excitement and power and significance today seems to be in electronic technology, especially the computer, a machine which can reveal the way to unlimited new aesthetic horizons and produce wholly new forms. And yet the idea of computer art — of an art unique to the computer — remains after twenty years an unrealized, indefinable, barely in view, its forms still to be manifested. For, ironically, most of what is understood as computer art today represents the computer in the service of those very same visual arts traditions which the rhetoric of new technology hails 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 narrower reality than 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 art-making 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 repetitive nature of hand-done 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 history of Western art — but of human communication itself as leading to this Prometheus instrument of representation. Its aesthetic — and philosophical implications are staggering, and they also have a 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 already 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 realized 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, we 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. Interactivity has been 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 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-
As impressive as they may be, such projects are fairly straightforward 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 you 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 an airplane. That's where media's going in general — the idea that recording becomes mapping. Everything is recorded. Everything is encoded into the system and is a viewer or producer or you just determine what part you're reworking."

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 begins 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 and the interactive characters more beautiful than those in Disney animation, all custom 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 view. 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 perceptual imperialism and placed in the hands of the artists and amateurs who shall inherit the world.
Integration Of Visual Techniques — First there are new combinations of known image-making 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 express this fusion with computer graphics. In this way, the viewer can anticipate effects that are only fully realized by newly emerging technology and new art forms.

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 forms. One can depict this fusion in new ways for artists to think about forms — such as intervals of dimension, “roughness dimension” and its ability to produce infinite detail. It’s 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. This history of collage and multi-screen video and film, these window frames are user directed viewpoints into ever-receding depths of 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, artist, 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 not to such a great example. For instance, in the 60s, television programming, the 70s performance art tried to stretch, dissolve, reform, destroy the formidable spectator-object boundary. “Guerilla” TV encouraged “talk back to your TV” through social action video and community TV. All acknowledged the powerful and natural interactive relationship between user and machine program. This work has such a strain on 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. 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 microphones 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 “reality.”

In the mid 1800s, for instance, picturing such things as a horse in gallop was a perplexing problem. The photographer, Maybridge, 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 us 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 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, science of space, film the analysis of motion and up to date computer graphics 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 imagery. 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 digital images and measurements of abstract relationships in “reality.” These are generally integrative impulses. It is likely they will be furthered by computer graphics’ chameleonic ability to simulate both mental and physical processes.