Computers

in Art and Design

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Edited by Isaac Victor Kerlow

SIGGRAPH '91
Art and Design Show

July-August 1991
Las Vegas, Nevada

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Preface

Isaac Victor Kerlow

Pratt Institute, Brooklyn, New York
Chairman of the SIGGRAPH '91
Art and Design Show

Welcome to the SIGGRAPH '91 Art and Design Show!

This year's show continues with the SIGGRAPH tradition of showcasing some of the most outstanding visual works created with the aid of computer graphics technology. But this year's show also has a new facet. For the first time in its history, this year's show has two distinct components: fine arts and design.

The show is now presented as the SIGGRAPH '91 Art and Design Show. The addition of a design category was made in light of the increasing number of submissions to the show that were never intended to be seen – or judged – as fine arts pieces, but instead were created as designs for business or communications purposes. In recent years many of these pieces were not included in the show because the show was conceived as a fine arts show instead of an event where different kinds of visual works created and produced with the aid of computer technology could be viewed. To recognize the increasing number of design submissions to the SIGGRAPH show, we expanded the show's scope to include such works.

The Selection Process

A "blind" jury selected works in both categories the names of the creators were not revealed to the jurors during the selection process. Fine arts and design each had separate juries. The fine arts jury was composed of Timothy Binkley, Director of Computer Studies at the School of Visual Arts; Eleanor Flomenhaft, Director of the Fine Arts Museum of

Long Island; and Cynthia Goodman, an independent art historian and critic. Judson Rosebush, President of Rosebush Visions, joined the fine arts jury for the review and selection of computer animation submitted to the show. The design jury was composed of Kent Hunter, Creative Director at Frankfurt, Gips and Balkind; David Peters, Graphic Designer at 212 Associates; Donald M. Rorke, Executive Vice President of Design at The Knoll Group; and Wendy Richmond, Co-Director of the WGBH Design Lab. Isaac Victor Kerlow, chairman of the SIGGRAPH '91 Art and Design Show, participated in both juries.

There were over 1,200 entries in the fine arts category and 700 in the design category. The fine arts jury selected works entirely from slides submitted by the artists. The design jury selected works based on the actual "physical" entries (i.e. posters, books). The final selection of works for the show includes almost 60 pieces in the fine arts category and close to 70 in the design category.

The Selection Criteria

The SIGGRAPH '91 Contributor's Guidelines were mailed to past participants and to individuals interested in participating in the show. These guidelines listed the five basic criteria that guided the selection process. Entries had to

- be created with the use of a computer.
- be critically related to computer graphics technology and possess a strong aesthetic value.
- use the computer in more ways than just as a production tool.
- approach artistic creation and design in original ways.
- be concerned with contemporary art or design issues, and its sole purpose could notbe limited to illustrating specific computer graphics techniques.

In addition to the criteria included in the Contributor's Guidelines, the fine arts and design juries each established additional guidelines for fine-tuning the selection of finalists. The fine arts jury valued stylistic consistency when multiple works were submitted by the same person. The fine arts jury also opted not to give preference to styles or types of work that have been displayed extensively in recent SIGGRAPH shows unless the works were unique and especially innovative.

The design jury focused on pieces where the computer had played a crucial role in the final "look," style, or production of the piece. As one juror put it, the design jury "was not interested just in supporting technical acrobatics." A great deal of attention was paid to the functionality and adequacy of the designs as well as to overall contemporary design trends.

Fine Arts Trends

The show is about variety, not uniformity. The fine arts category in the SIGGRAPH '91 show continues with the tradition of presenting a survey of the work created with the aid of computer graphics technology. As in the past, the works included in the fine arts category cover a wide range of styles, techniques, and creative philosophies. Several trends that dominated this year's show were observed throughout the review and selection process:

- The number of fine arts entries based on 3D modeling and rendering techniques seems to have decreased in comparison to recent SIGGRAPH shows. On the other hand, the overall technical level of most 3D submissions is generally quite high and consistent.
- The number of fine arts entries based on photographic manipulation increased dramatically. This can be explained by the increased availability of microcomputer-based image processing software within the last couple of years.
- There still is a tremendous variety of technical achievement, originality, and artistic sophistication in the work submitted to the fine arts category of the SIGGRAPH '91 Show.

Design Trends

The design category in SIGGRAPH '91 is especially interesting because SIGGRAPH has never sponsored a juried design exhibition (although a curated design show was presented in 1984 in Minneapolis). Several trends dominate this year's show:

- The number of entries submitted for review was substantial considering that this is the first year that SIGGRAPH has sponsored a show that focuses on design. Most of the entrants in the design category were unfamiliar with SIGGRAPH's activities before they received the Call for Participation.
- The overall technical level of most entries is remarkably high. Almost all entries represented professionally produced projects; in contrast to the fine arts category, there were few student entries in the design category.
- The number of design entries that dealt directly with computer-human interface (CHI) design was insignificant, which came as a surprise to the jurors.
- The new design category in the SIGGRAPH '91 Show seems to have generated a lot of enthusiasm. One hopes this trend will continue in the future.

A 100% Desktop Publication!

For the first time ever in SIGGRAPH history the publication that accompanies the Art and Design Show has been entirely produced electronically on a desktop computer system. The manuscripts were all created, converted and/or edited in the Word 4.0 format. Unformatted text files were flowed into Xpress 3.0 and laid out in a document with multiple grids. The images (mostly 35 mm color slides) were sampled with a ColorGetter scanner at 12-bits per channel and converted to the 24-bit color TIFF file format. Color correction was done with Color Studio. All files were assembled in the Xpress document. Output was done at 2000 dpi on a ColorSetter imagesetter.

Fine Arts

List of Participants

Yoshiyuki Abe
Tokyo, Japan
p. 33

Stephen Axelrod
Long Beach, California

John Banks
Rising Star Graphics; Chicago, Illinois
p. 24

Chiara Boeri
Visuals, S. P. A.; Milan, Italy
p. 25

Semannia Luk Cheung
Design Vision Inc.; Toronto, Canada
p. 37

Jack Cliggett
Drexel University; Philidelphia, Pennsylvania
p. 25

Char Davies
SOFTIMAGE Inc., Montreal, Canada
pp. 36 and 39

Diane Fox
University of Tennesee; Knoxville, Tennessee
p. 20

Masaki Fujihata
Frogs, Inc.; Tokyo, Japan
pp. 17 and 30

Jeff Gates
Baltimore, Maryland
p. 23

Darcy Gerbarg
New York City
p. 29

Ken Goldberg
Hollywood, California
p. 28

Jean-Pierre Hebert
Santa Barbara, California
p. 31

Jean Ippolito
Ohio State University; Columbus, Ohio
p. 28

Amy K. Jenkins
New York City
p. 22

Eduardo Kac
Chicago, Illinois
p. 35

Azuma Kawaguchi
Tokyo, Japan
p. 18

Michael King
City of London Polytechnic; London, England
p. 33

Michael Klug
MIT Media Lab; Cambridge, Massachusetts
p. 34

C. E. Kolb
Yale University; New Haven, Connecticut
p. 40

More Fine Arts Participants

Daniel Langlois
SOFTIMAGE Inc., Montreal, Canada
p. 39

Gordon Lescinsky
University of Illinois; Chicago, Illinois
p. 26

Gary Lindahl
University of Illinois; Chicago, Illinois

Catherine Malloy
Santa Fe Interactive; Santa Fe, New Mexico
p. 25

B. B. Mandelbrot
Yale University; New Haven, Connecticut
p. 40

Akihiko Matsumoto
Tokyo, Japan
p. 18

Benoit Maubrey
Die Audio Gruppe; Berlin, Germany

Georges Mauro
SOFTIMAGE Inc., Montreal, Canada
p. 39

Marsha J. McDevitt
Ohio State University; Columbus, Ohio
p. 36

Stephan Meyers
Chicago, Illinois
p. 35

Don P. Miller
University of Wisconsin; River Falls, Wisconsin
p. 22

Lisa A. Moline
Teikyo Marycrest University; Davenport, Iowa
p. 26

Eve Mosher
Texas A&M University; College Station, Texas
p. 25

F. K. Musgrave
Yale University; New Haven, Connecticut
p. 40

Barbara Nessim
New York City

Sean Nixon
Brooklyn, New York
p. 21

Erol Otus
El Cerrito, California
p. 34

Dean Randazzo
Evans & Sutherland Computer Corp.; Salt Lake City, Utah
p. 34

Susan Ressler
Purdue University; West Lafayette, Indiana
p. 19

Kathleen Ruiz
New York University, New York City
p. 27

Ellen Sandor
Chicago, Illinois
p. 35

Mechthild Schmidt
New York City
p. 38

Peter Schröder
Thinking Machines Corp.; Cambridge, Massachusetts
p. 32

Jill Scott
Lumagraphics Productions; Sydney, Australia

Bill Seaman
Paddington, Australia

Kenneth Snelson
Kenneth Snelson Inc.; New York City
p. 35

Jennifer Steinkamp
Art Center College of Design; Pasadena, California
p. 38

Eva Sutton
New York City
p. 21

Michael Tolson
XAOS, Inc.; San Francisco, California

John Underkoffler
MIT Media Lab; Cambridge, Massachusetts
p. 34

Clara Claudia Vera
Chicago, Illinois

Annette Weintraub
New York City
p. 20

Hui Chu Ying
University of Akron; Akron, Ohio
p. 29

Design

List of Participants

More Design Participants

Animation

List of Participants

Seton Coggeshall
University of Illinois; Chicago, Illinois

Susan Alexis Collins
Chicago,Illinois

Gene Cooper
Kansas City Art Institute; Kansas City, Missouri

Cyberdada
Melbourne, Australia

Tessa Elliott
Middlesex Polytechnic; Herts, England

Masa Inakage
The Media Studio, Inc.; Tokyo, Japan

Jeff Jaffers
Melbourne, Australia

Nancy Kato
The School of Visual Arts; New York City

Stephan Meyers
Illinois Institute of Technology; Chicago, Illinois

Mark Neumann
Hi-Res; New York City

Thomas Porrett
Ardmore, Pennsylvania

Dan Sandin
University of Illinois; Chicago, Illinois

Ellen Sandor
Illinois Institute of Technology; Chicago, Illinois

Suponwich Somsaman
The School of Visual Arts; New York City

Peter Voci
New York Institute of Technology; Old Westbury, New York

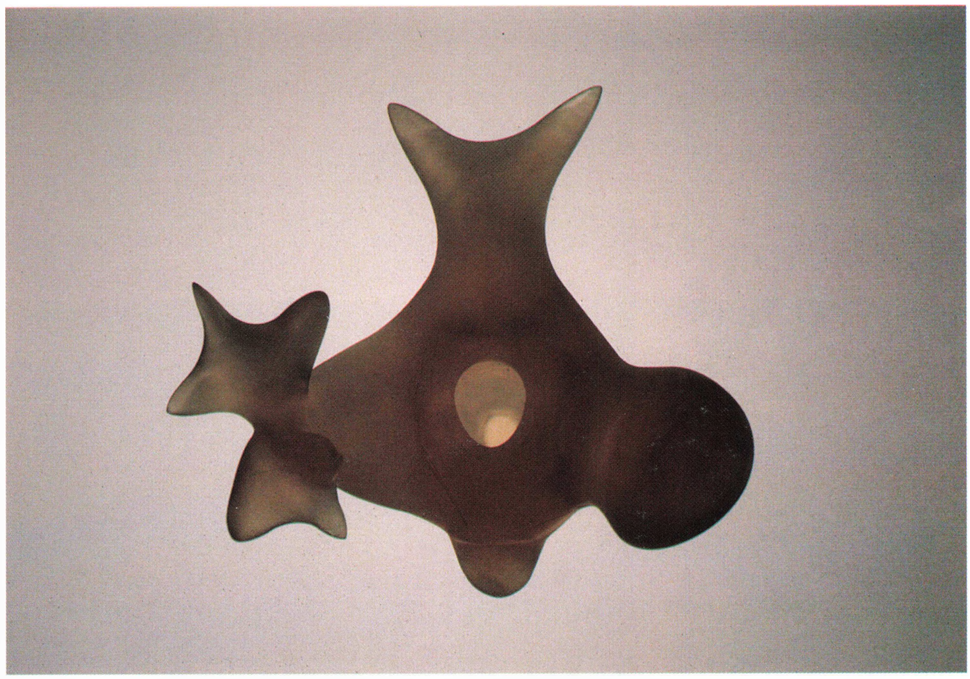
Jason White
Middlesex Polytechnic; Herts, England

Richard Wright
Middlesex Polytechnic; Herts, England

Z Communication
New York City

Fine Arts

Color Plates



Masaki Fujihata
Umiushi, 1990
Sculpture, 20 x 26

Azuma Kawaguchi, Akihiko Matsumoto
Song (from the series Opera Arias), 1989
Photographic print, 29.5 x 41.3

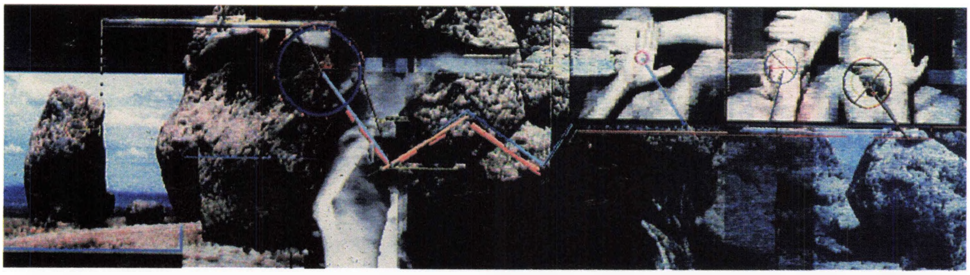
Susan Ressler
From Stone to Bone, 1991
Photographic print, 24 x 30

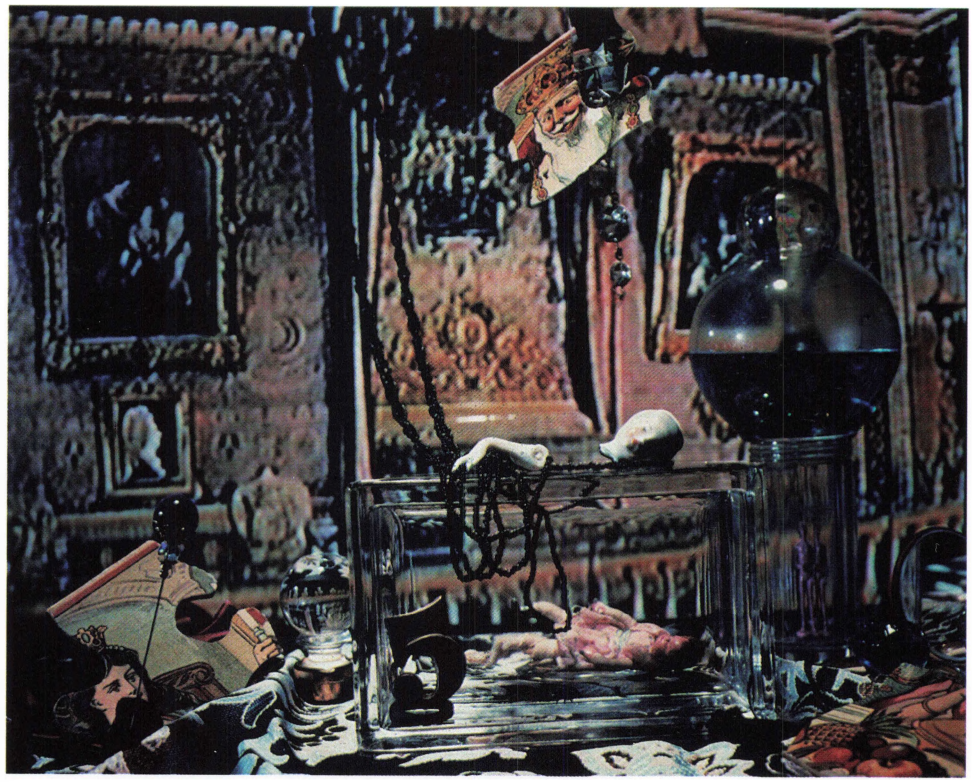
Annette Weintraub
Reconstruction, 1990
Laser Printouts, 31 x 47

Diane Fox
Floating Series #3, 1991
Lithograph, 22 x 27

Eva Sutton (top)
Disintegration #13, 1990
Photographic print, 36 x 40

Sean Nixon
Borrowings #1, 1990
Photographic print, 20 x 24



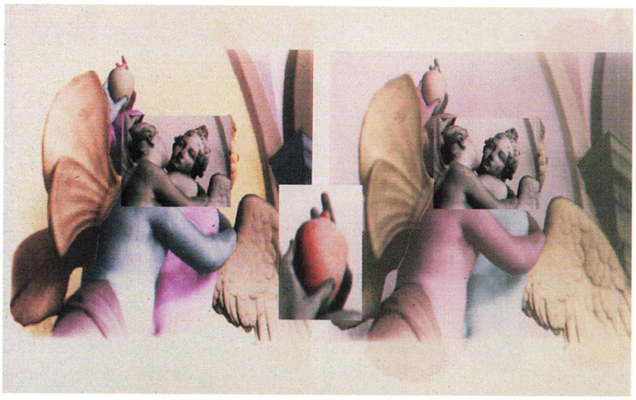


Don P. Miller
Chindi Frieze #4, 1990
Ink jet printout , 7.25 x 25

Amy K. Jenkins
Untitled #38, 1990
Photographic print, 16 x 20

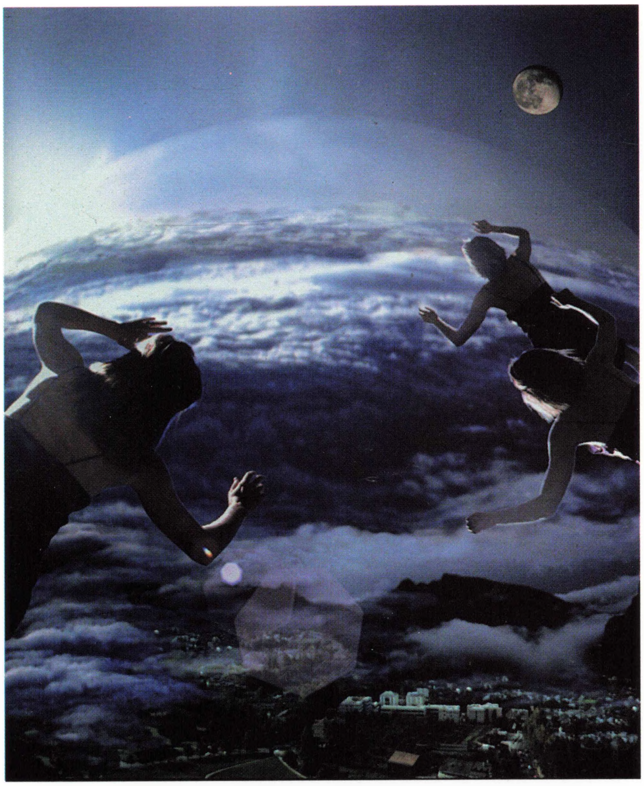
Jeff Gates
First Among Equals: A Visual Critique of the Fashion Photographs of Ruven Afanador, 1990
Ink jet printout, 30 x 24

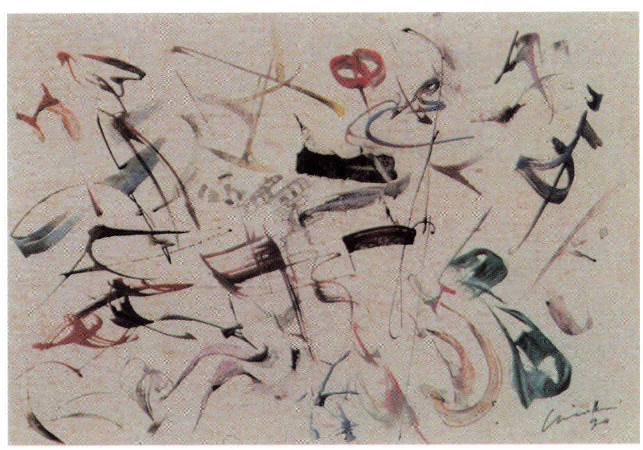
Jack Cliggett
Out of Body, 1990
Photographic print, 8 x 8



Eve Mosher
Putti, 1990
Ink jet printout, 14.4 x 24

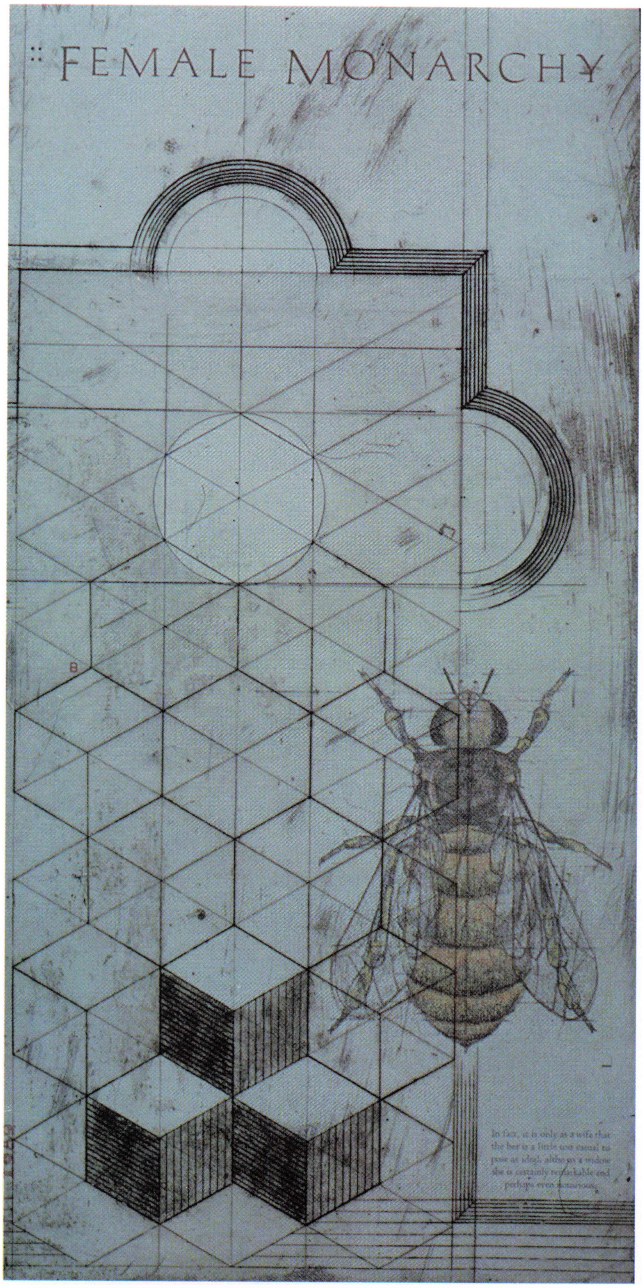
John Banks
Manuscript 42, 1991
Ink jet printout, 23 x 24

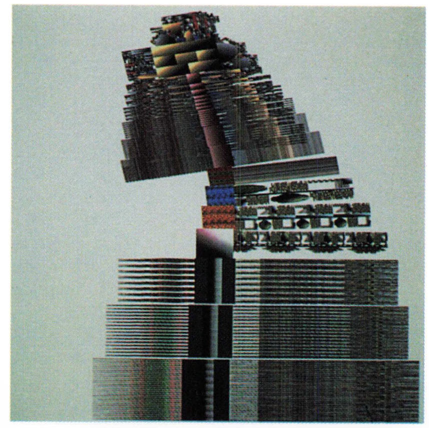




Katherine Malloy
The Flying Dream, 1990
Photographic print, 28 x 32

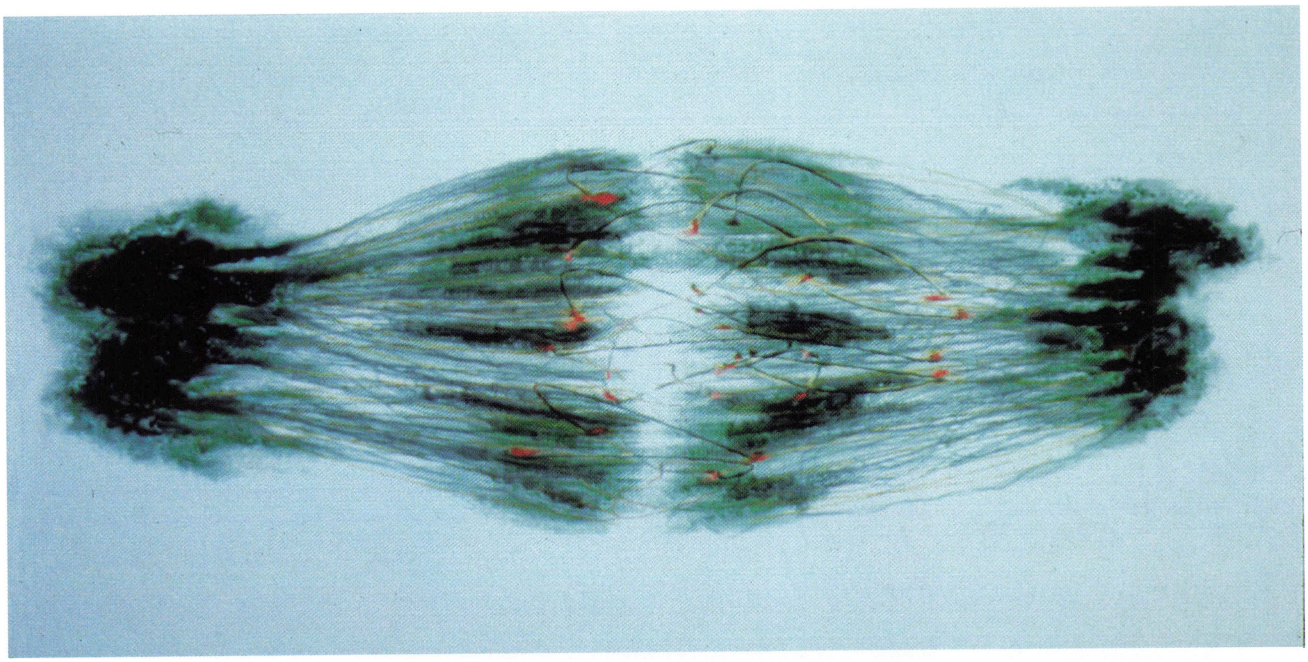
Chiara Boeri
Abstract, 1991
Ink jet printout, 33 x 46.85



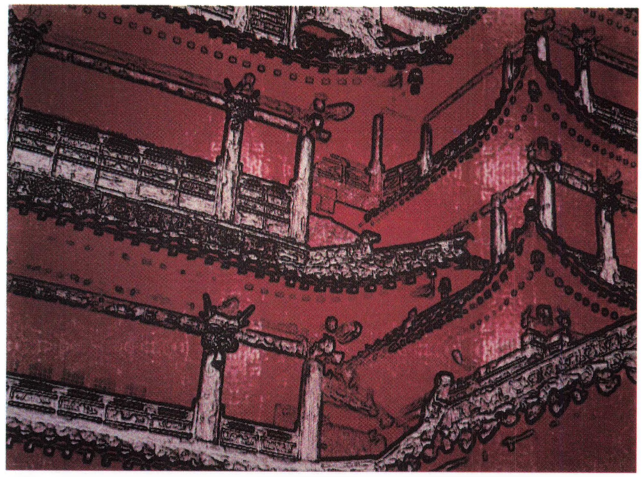


Lisa A. Moline
Female Monarchy, 1990
Etching, letterpress, and dot-matrix printout, 28 x 14

Gordon Lescinsky
Spruce, 1991
Ink jet printout, 42 x 72

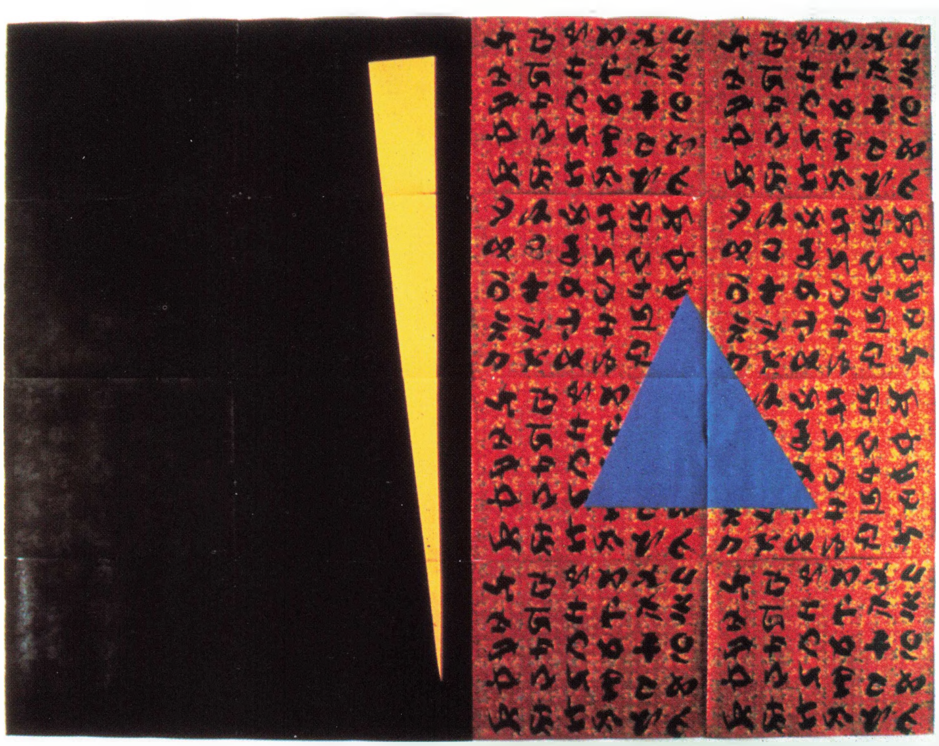


Kathleen Ruiz
Separating With Pain, 1991
Ink jet printout, 24 x 47



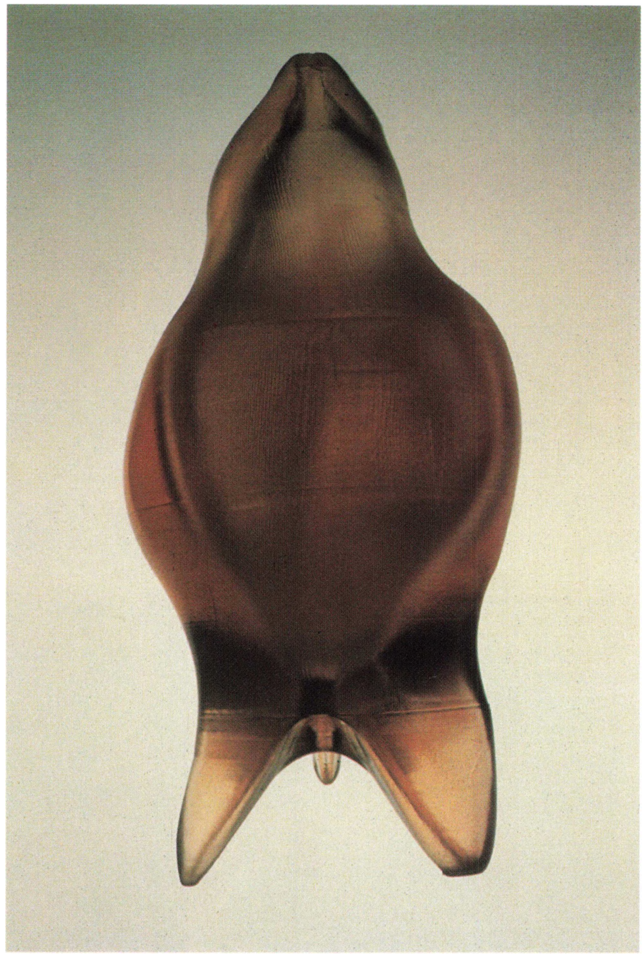
Jean Ippolito (top)
Temple Illusions, 1990
Lithograph, 22 x 30

Ken Goldberg
Finger Paint, 1991
Painting on paper, 24 x 36



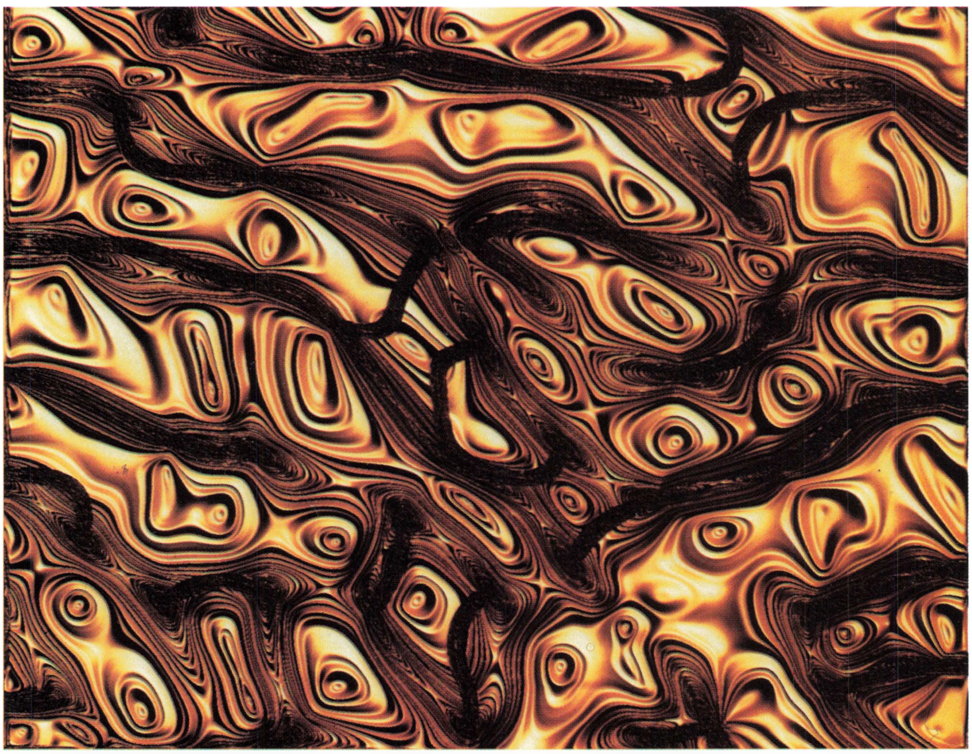
Darcy Gerbarg (top)
Iceclif, 1990
Painting on canvas, 56 x 56

Hui Chu Ying
Equilibrium #A, 1990
Silkscreen, 80 x 104

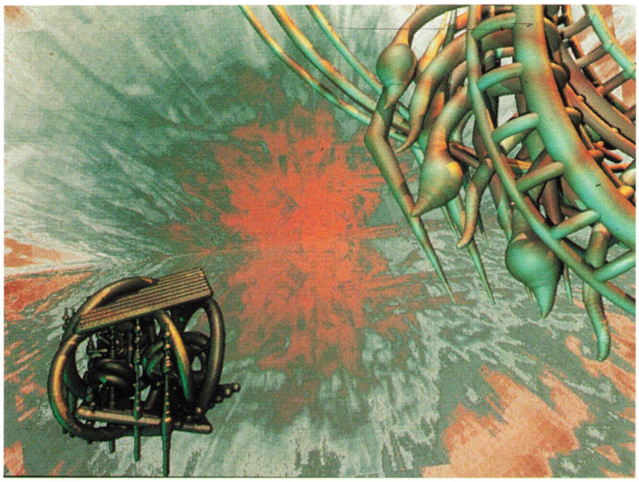


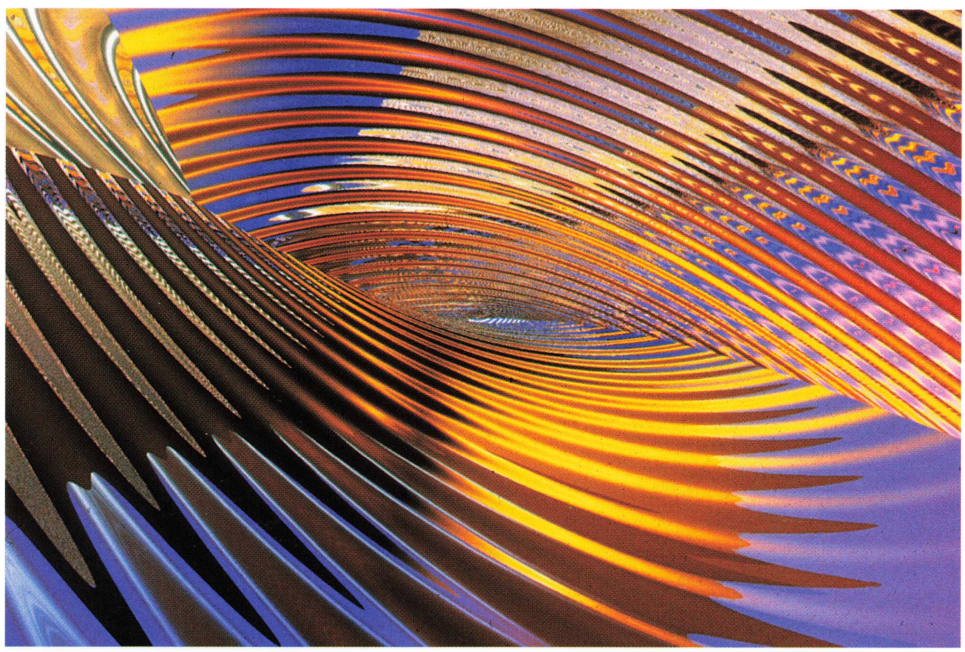
Masaki Fujihata
Twin King UBU, 1990
Sculpture, 26 x 26

Jean-Pierre Hebert
Systeme Lunaire, 1990
Pen plotter drawing, 25 x 18



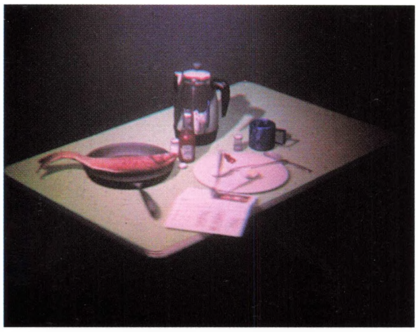
Peter Schröder
The Gold Triptych–Artifacts from an Alien Religious Site, Chaos (left panel), 1991
Photographic print, 30 x 37.5

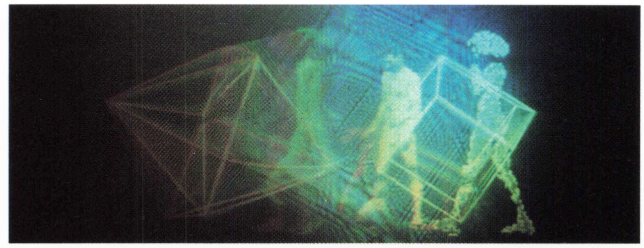


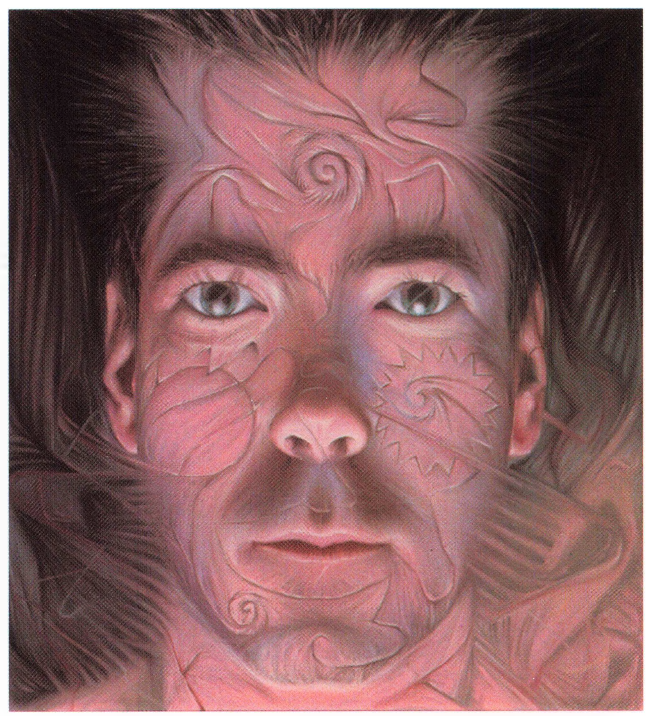


Michael King
Apocalypse Then, 1991
Photographic print, 32.5 x 25

Yoshiyuki Abe
Vibrant Drive, 1991
Photographic print, 14 x 20



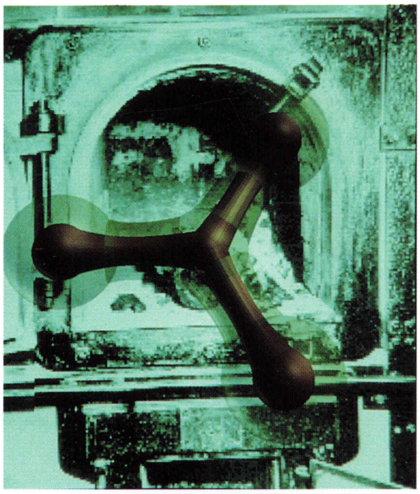


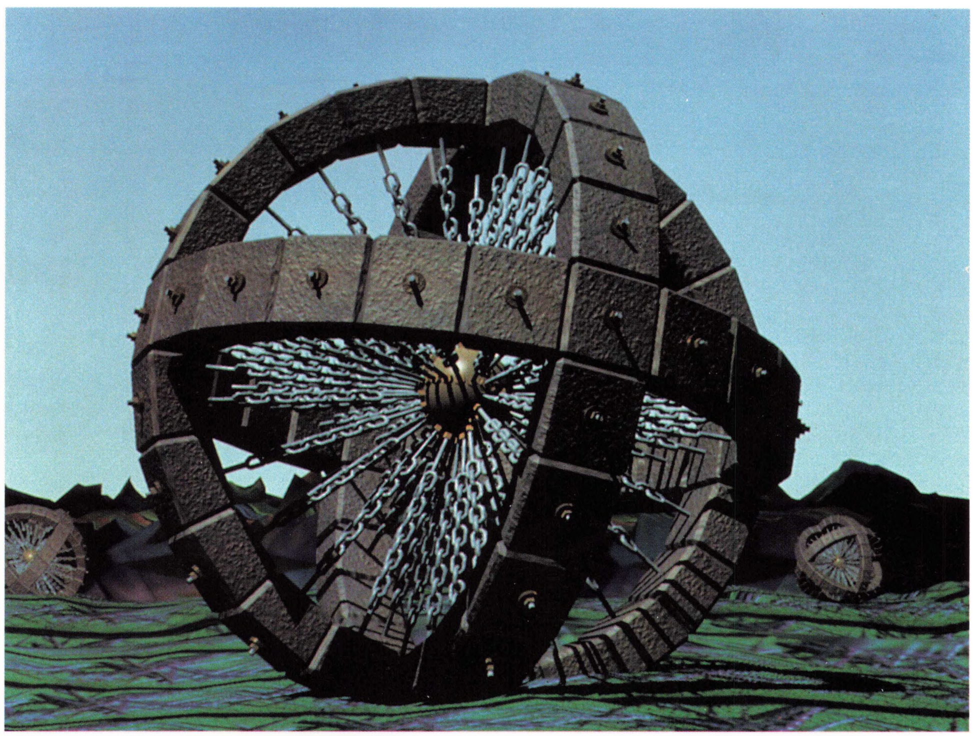


Michael Klug, John Underkoffler
Breakfast Attempt, 1990
Reflection holographic stereogram, 11.5 x 14.5

Dean Randazzo (top)
Dual, 1991
Hologram, 15 x 21

Erol Otus
Self Portrait, 1991
Ink jet printout, 36 x 30

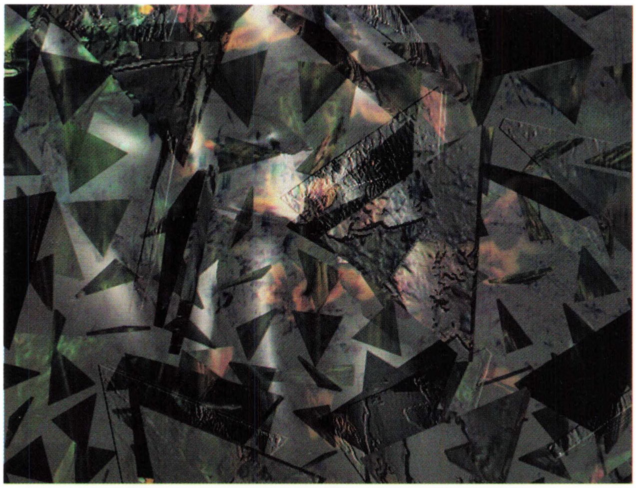


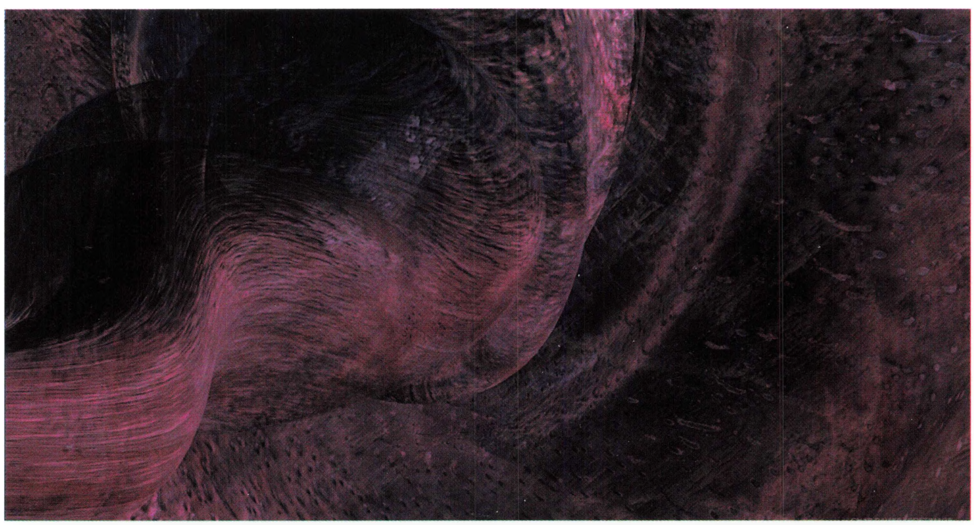


(Art)^{N} Laboratory
The Equation of Terror; (left panel: *Chemical Terror*), 1991
Stealth Negative
PHSCologram 24 x 130

Kenneth Snelson
Chain Bridge Bodies, 1990
Photographic print (stereo pair), 40 x 50

Eduardo Kac (top)
Omen, 1990
Computer hologram, 8 x 10

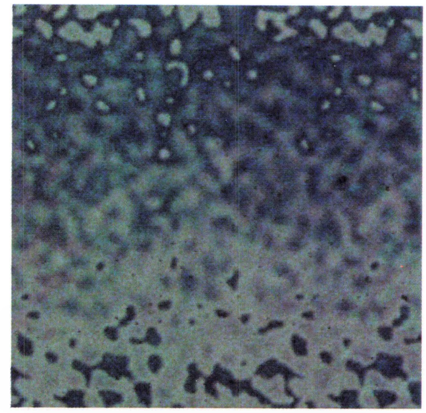




Marsha J. McDevitt
Triangles I Have Known, 1990
Photographic print, 20 x 24

Char Davies
ROOT, 1991
Photographic transparency, 42 x 72

Semannia Luk Cheung
Soul of Light, 1991
Photographic print, 13 x 24



Mechthild Schmidt
Underdog is flying, 1991
Photographic print, 12 x 48

Jennifer Steinkamp
Marbelizing a Void (Image 1), 1991
Ink jet printout, 11.5 x 11.5

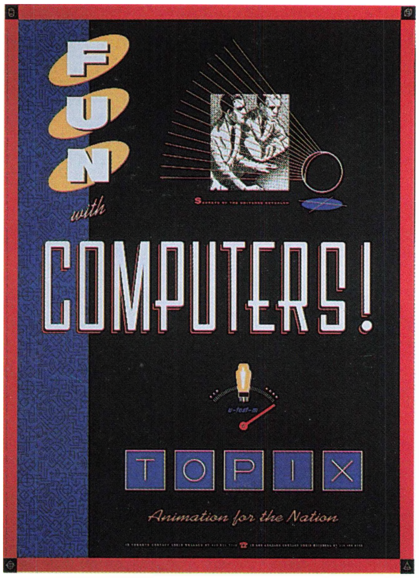
Daniel Langlois, Char Davies
SAND, 1990
Installation with photographic transparencies, sand and rocks, 312 x 6

F. K. Musgrave, C. E. Kolb, and B. B. Mandelbrot
Zabrisky Point, 1990
Ink jet printout, 20 x 40

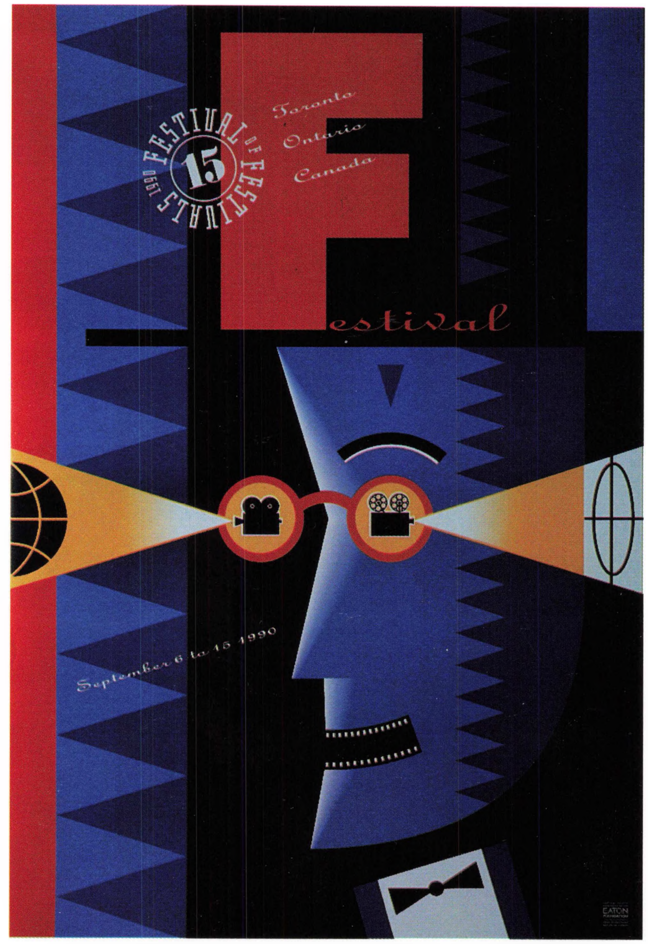
Design

Color Plates

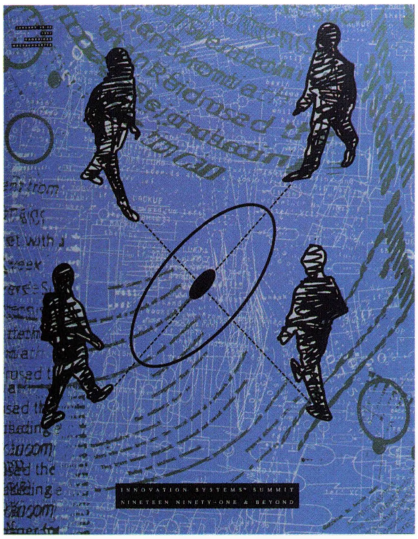
Taylor & Browning Design Associates
1990 Brazilian Ball Poster
Poster, 33 x 26.25



Reactor Art + Design
Fun With Computers
Poster, 27 x 19.5

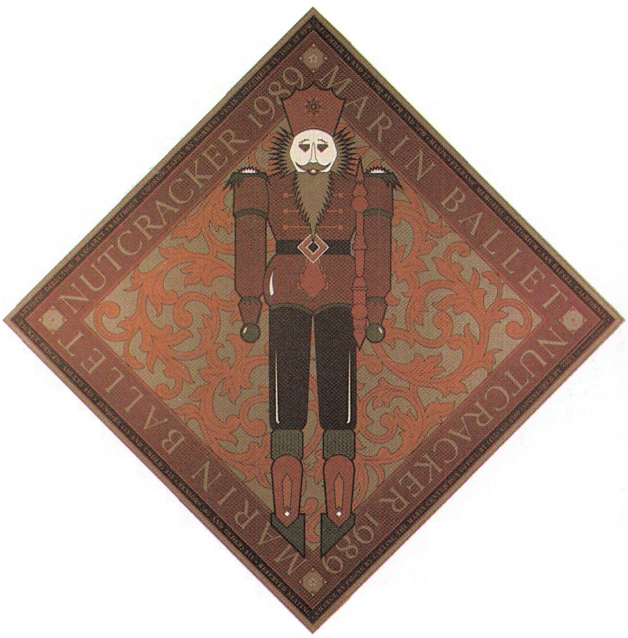


Reactor Art + Design
Festival of Festivals 1990
Poster, 36 x 24.5



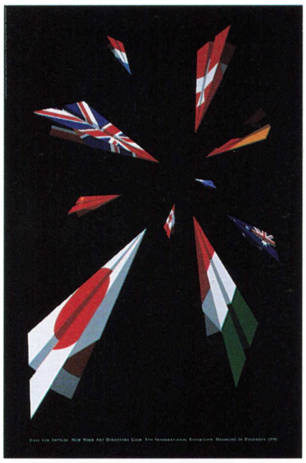
Crocker Inc.
Innovation Systems Summit
Poster, 28 x 22

Cranbrook Design Studio
The New Discourse:
Cranbrook Design 1980-1990
Poster, 37 x 27.5



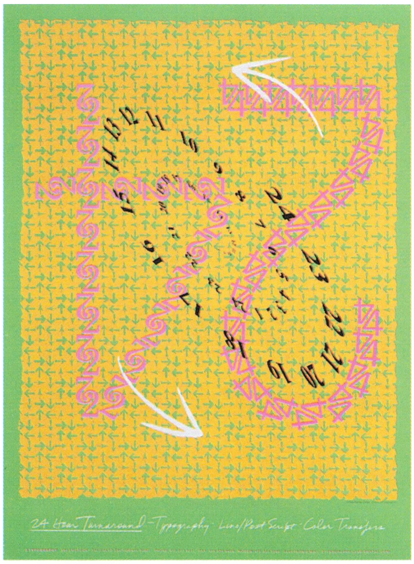
Sackett Design
Marin Ballet Nutcracker
Poster, 22 x 22

Pentagram
Design and Advertising into the 90s
Poster, 36 x 22



Pentagram
NY Art Directors Club 1991
International Exhibition
Poster, 35.5 x 24

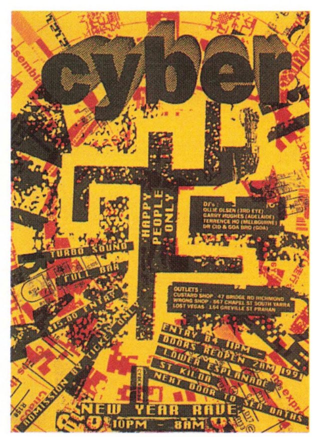
Wiggin Design Inc.
Downtown Manhattan Map
Poster, 33.75 x 22



Mark Anderson Design
Set Type in Your Sleep
Poster, 20 x 15

Mark Anderson Design
Type on Wheels
Poster, 20 x 15

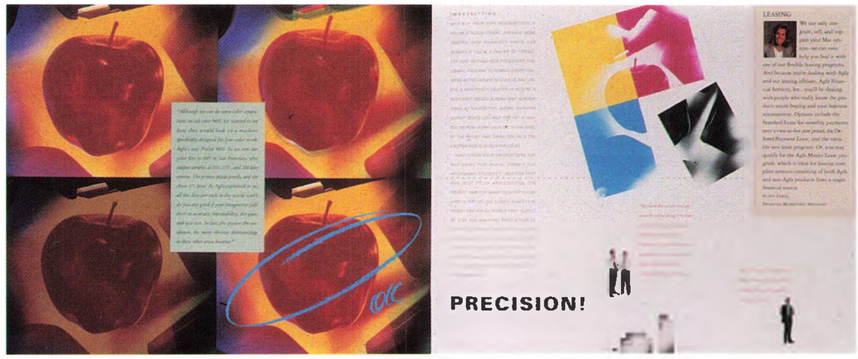
Mark Anderson Design
24-Hour Turnaround
Poster, 20 x 15

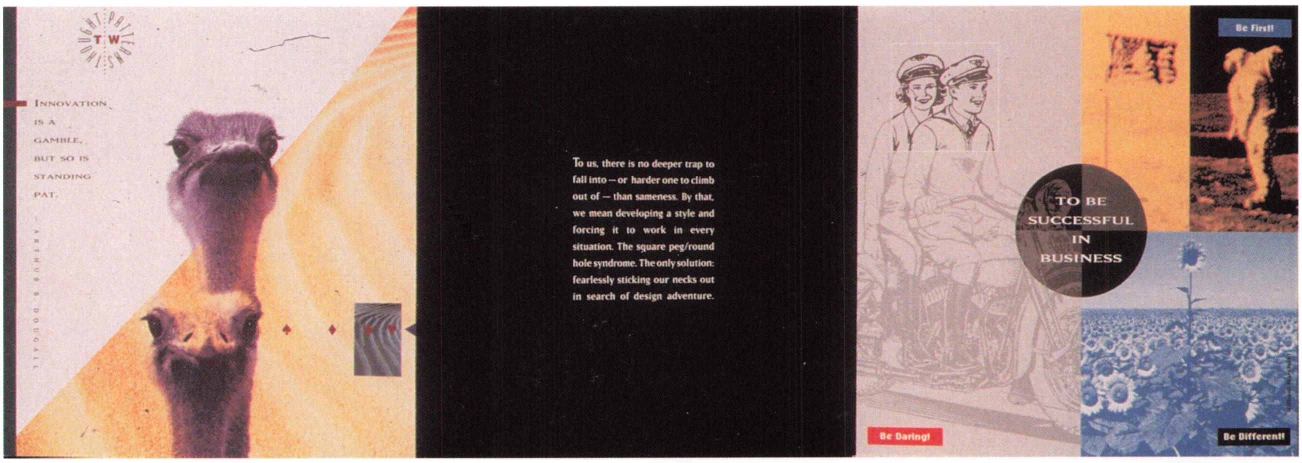


design : Weber
Design Circus
Poster, 20.25 x 13.125

Az-zet
From Easel to Machine
Poster, 32 x 46

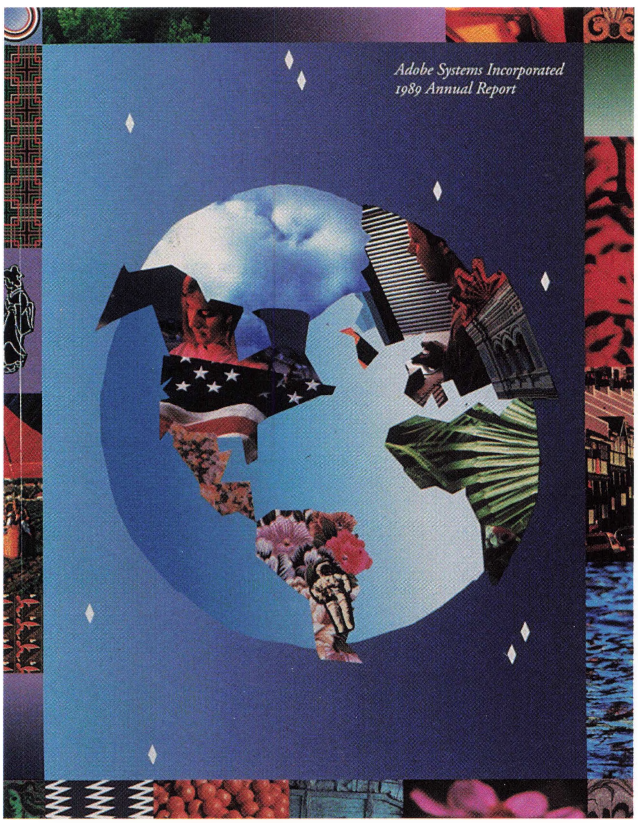
Cyberdada
Cyber-All-Night-Rave
Poster, 11.7 x 8.25





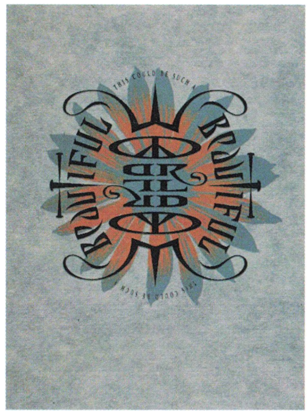
TW Design
TW Self-Promo
Brochure, 6.25 x 6.25

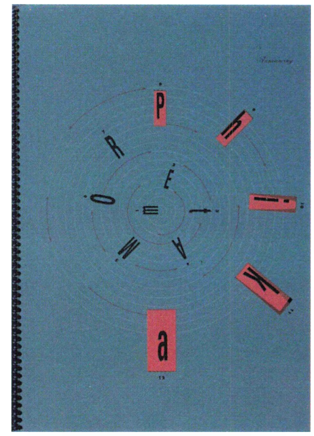
Pentagram
Afga Compugraphic
Macintosh-Based Systems
Brochure, 8.5 x 11



Adobe Systems Marketing Communications
Adobe Systems Incorporated 1989 Annual Report
Annual report, 11 x 8.5

Liska and Associates Inc.
NEC CD-ROM
Brochure, 5 x 5.375

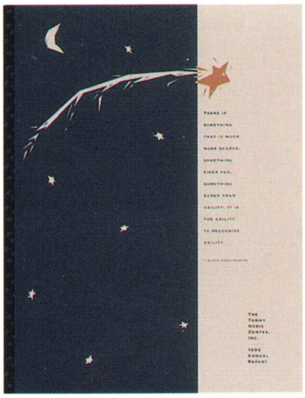


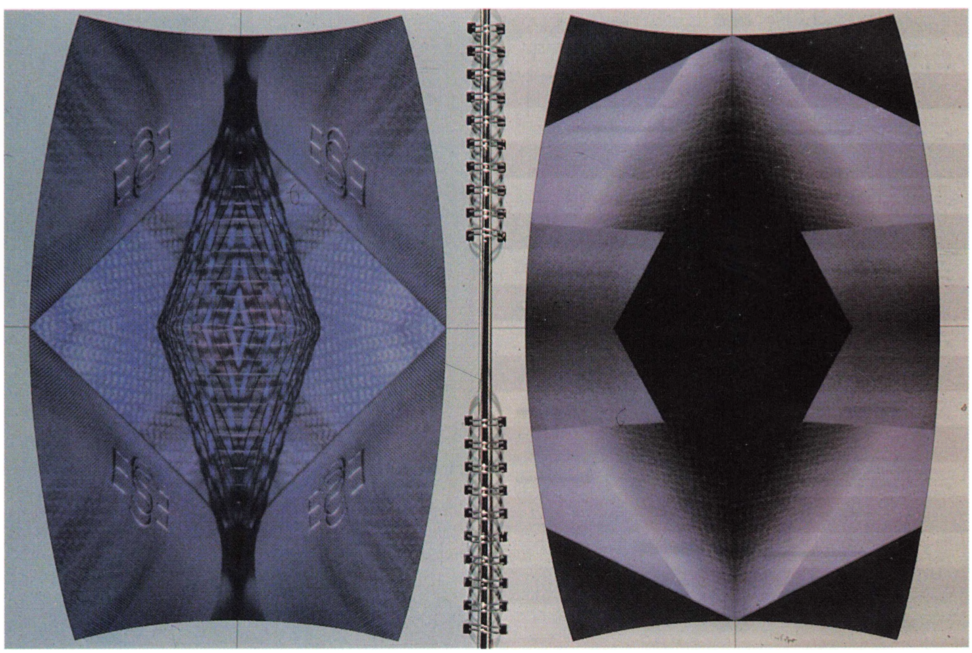


Margo Chase Design (top)
Beautiful World
Type design, 14.75 x 11

Patterson Wood Partners
Spector Report
Newsletter, 18.25 x 28

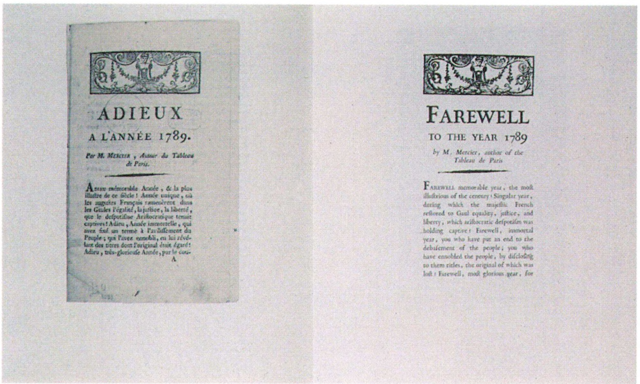
Waters Design Assoc. (top)
Graphika
Book, 12 x 18.5

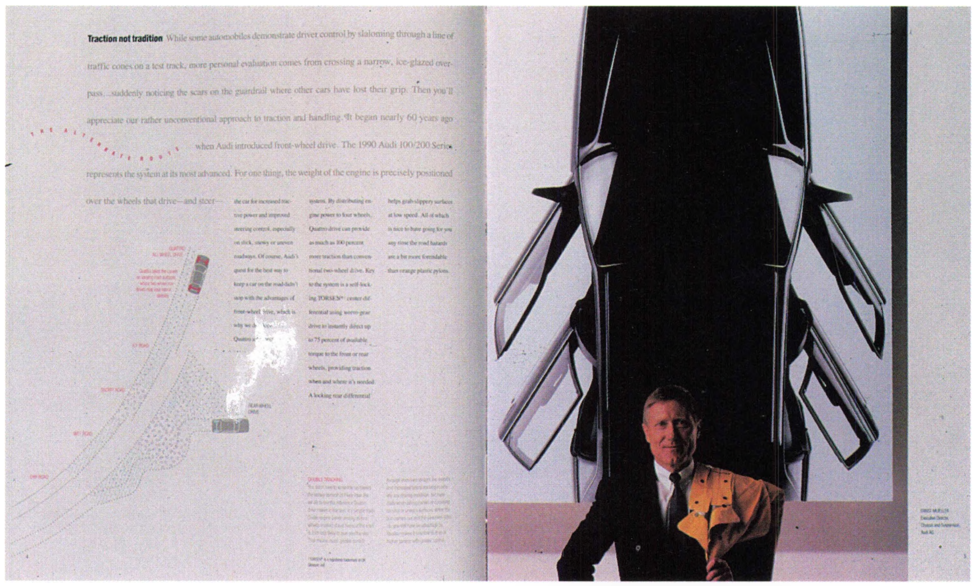




TW Design
Tommy Nobis Annual Report
Annual Report, 11 x 8.5

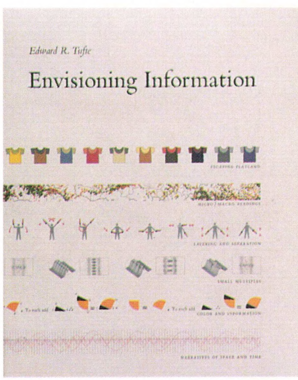
THIRST
ESSE by Gilbert
Promotional Book, 14 x 10.5

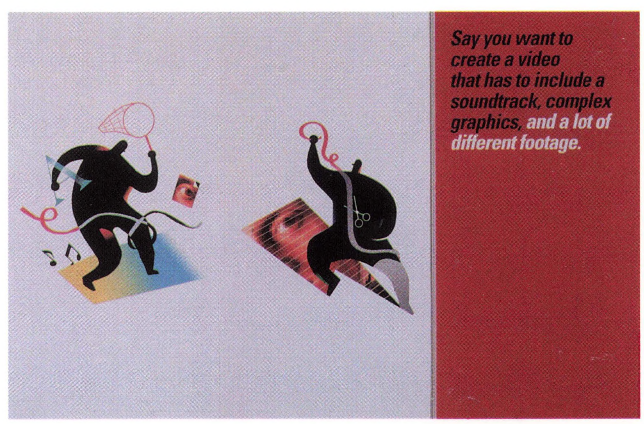




Cornell University Publications Services
1789: A Salute to the French Revolution
Book, 10 x 8.5

SHR Design Communications
Audi 100/200 Brochure 1990
Brochure, 12 x 10.25

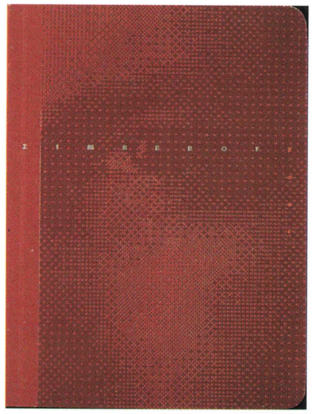


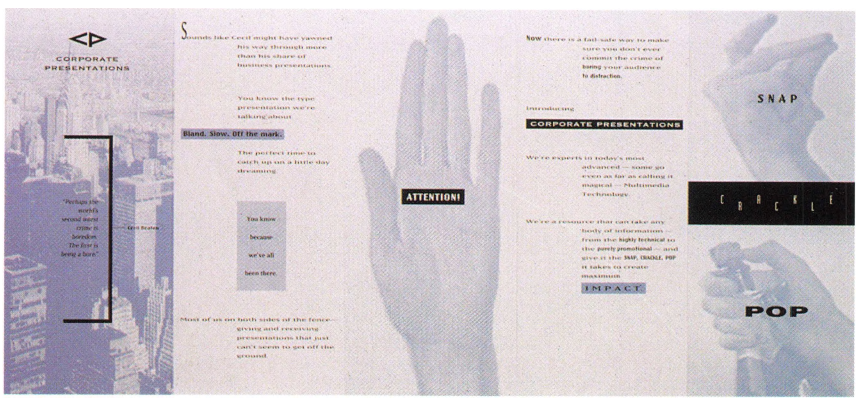


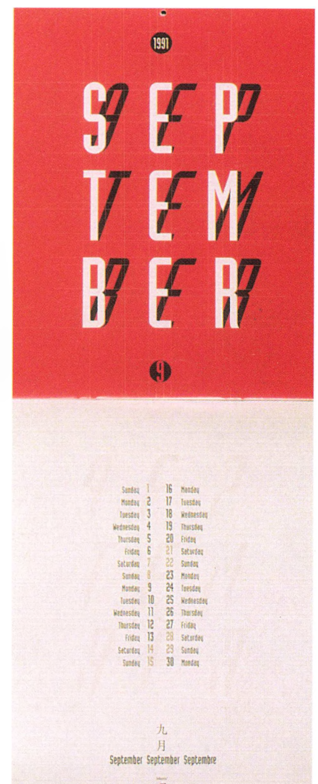
The Office of Reginald Wade Richey
Santa Monica Place Design Criteria Eatz
Brochure, 12.5 x 21.875

Edward Tufte
Envisioning Information
Book, 10.75 x 8.875

Clement Mok Design
Video F/X
Brochure, 8.125 x 4.25



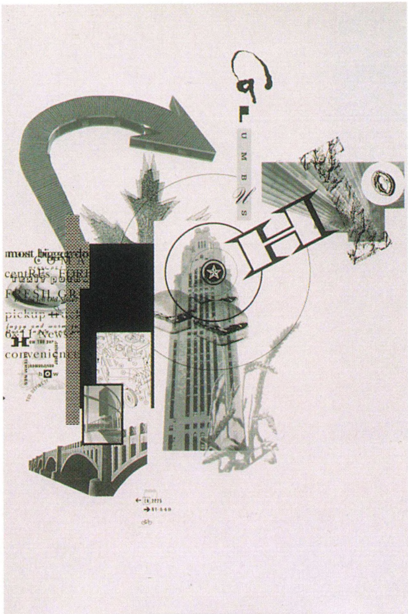


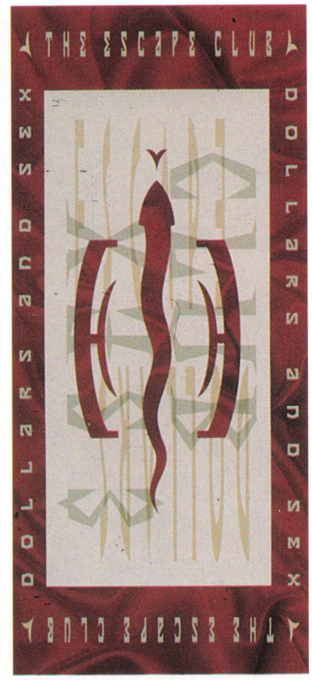


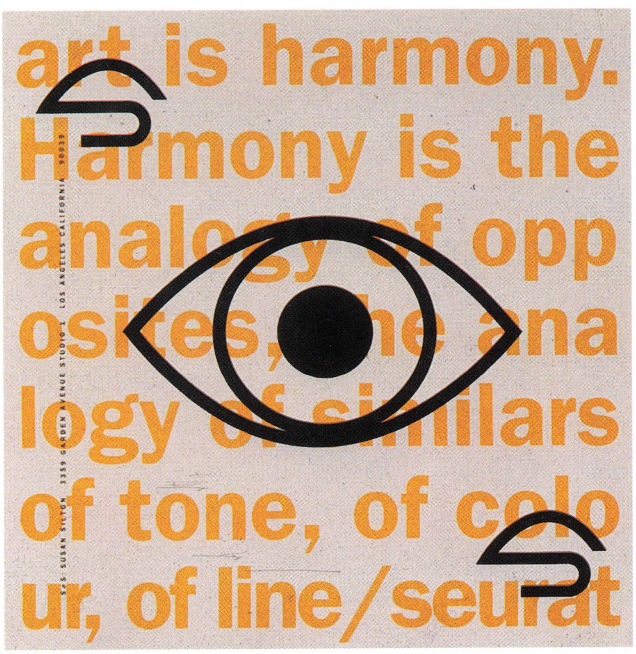
TW Design
Corporate Presentations
Brochure, 9 x 4

Lisa Levin Design
Zimberoff Promo
Book, 6 x 4

Adobe System Marketing Communications
1991 Type Calendar
Calendar, 11 x 8.5



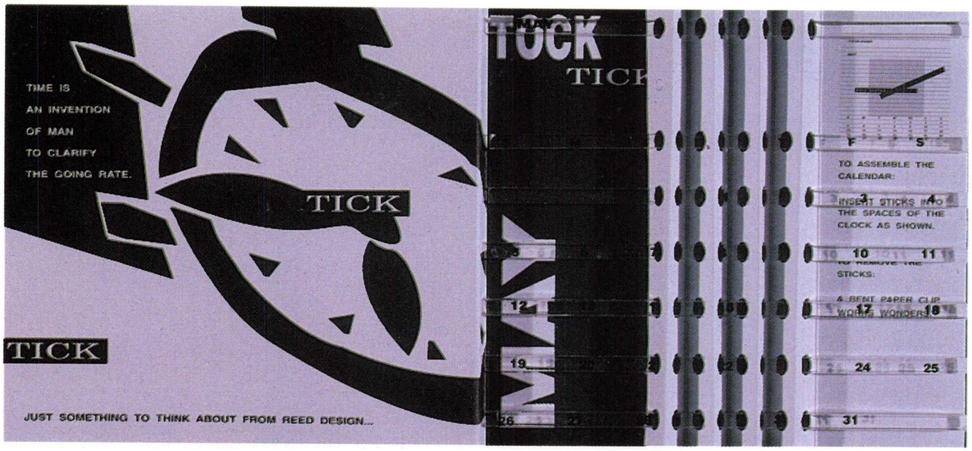


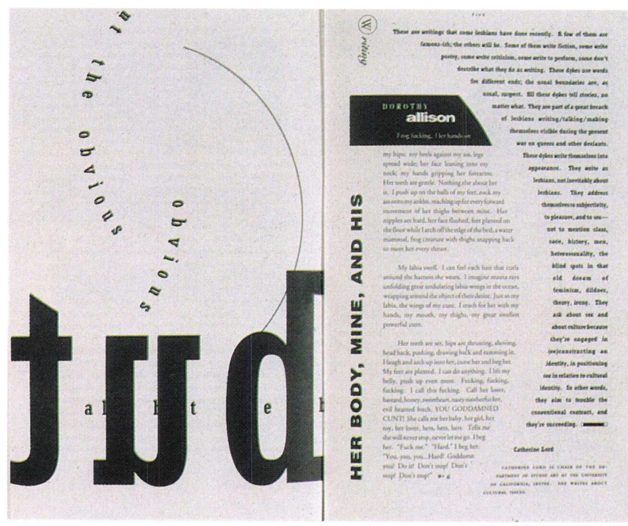


design : Weber (top)
Columbus Page
One-page ad, 17 x 11

SOS
Symmetry
Book, 8 x 9

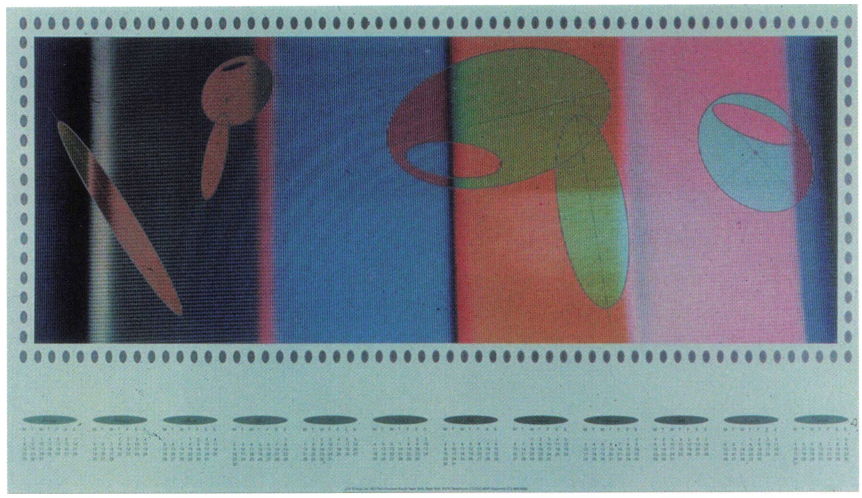
Margo Chase Design
Escape Club
CD cover, 12.25 x 12.125

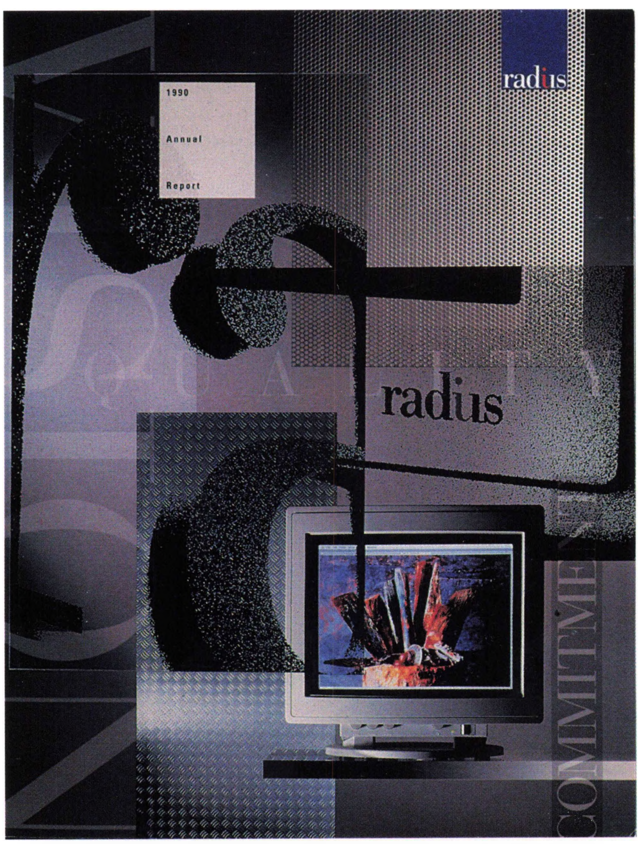




Reed Design
Calendar Clock
Calendar, 4 x 9

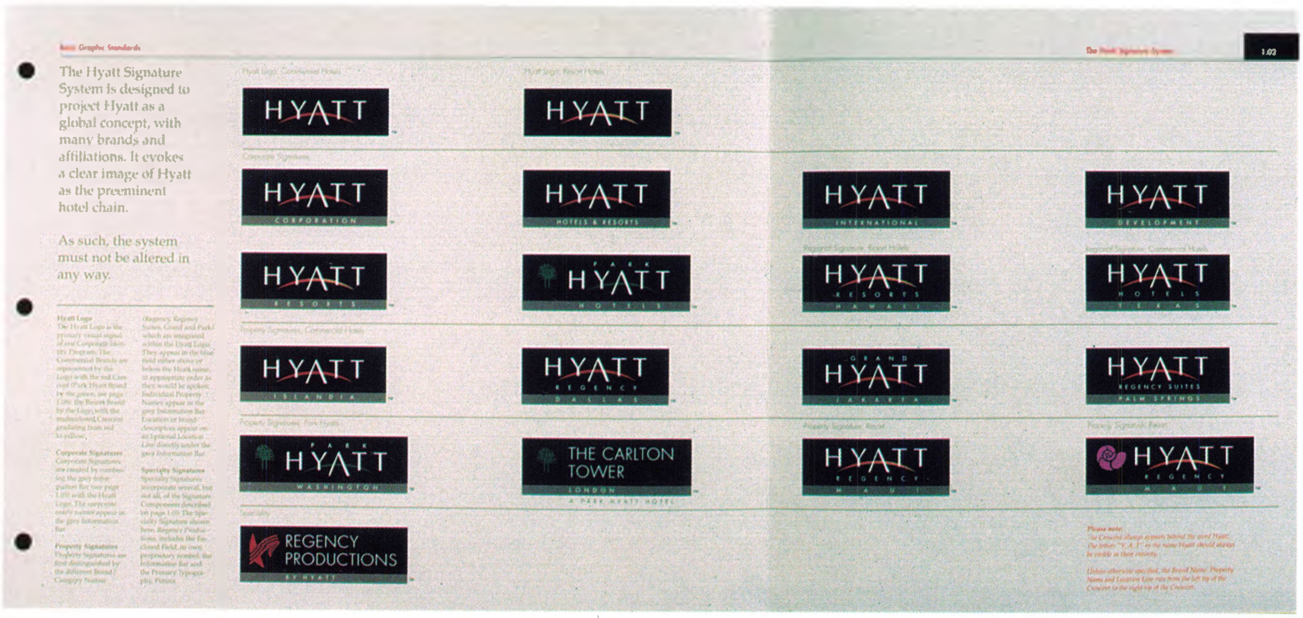
SOS
All But The Obvious
Book, 5.5 x 9





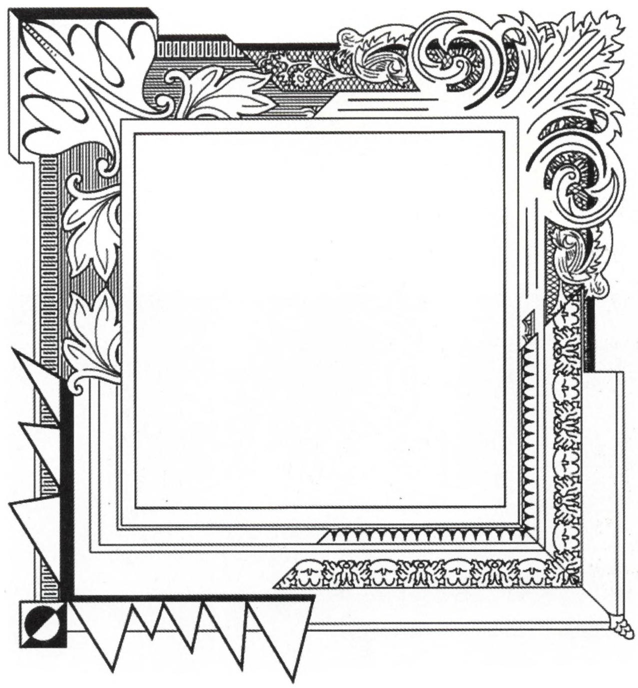
The Design Work
Radius Inc. 1990 Annual Report
Annual Report, 11 x 8.5

M plus M Incoporated
JCH Calendar
Calendar, 19.5 x 33.75



Landor Associates
Hyatt Hotels Corporate Identity Program
Standards manual, 11 x 14

Pentagram
Hotel Hankyu International
Logotype System, various dimensions



HOTEL HANKYU INTERNATIONAL

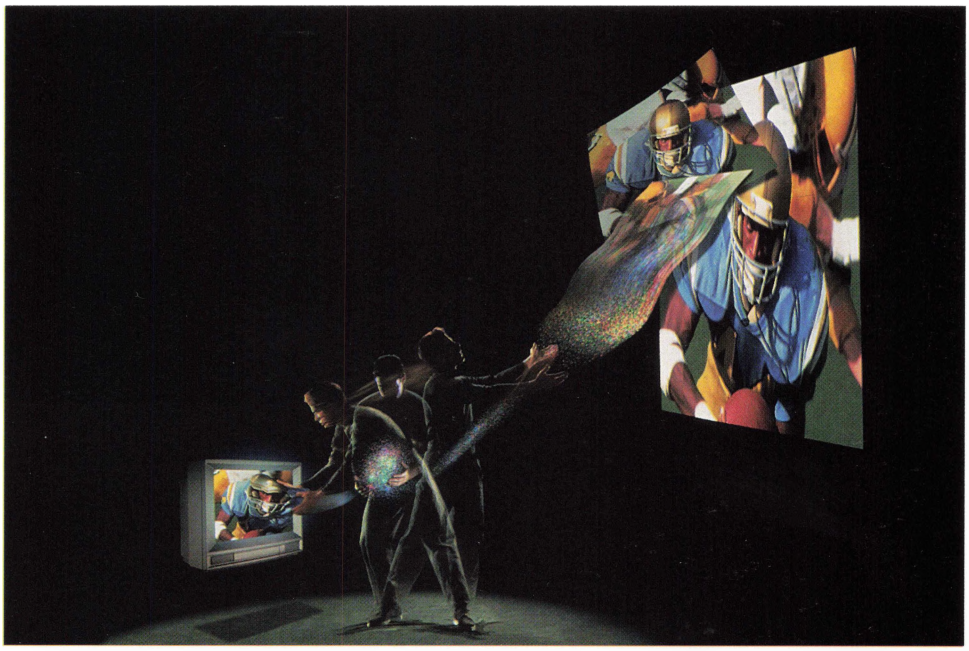
HOTEL HANKYU INTERNATIONAL

HOTEL HANKYU INTERNATIONAL

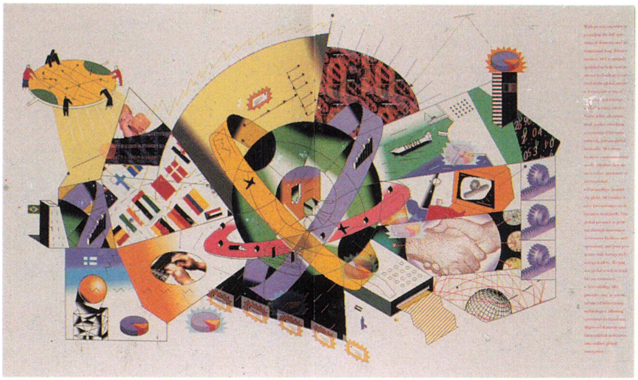
HOTEL HANKYU INTERNATIONAL

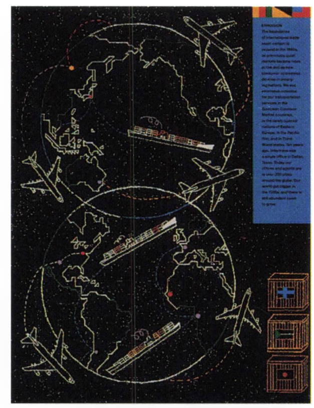
Sackett Design (top)
The *AART Group*
Stationary, various dimensions

R/Greenberg Associates
Cages
Illustration, 17.625 x 23.625



R/Greenberg Associates
Sharpvision
Illustration, 11 x 8.5



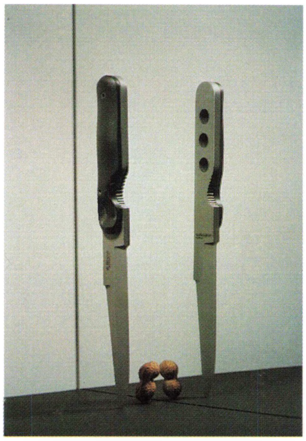


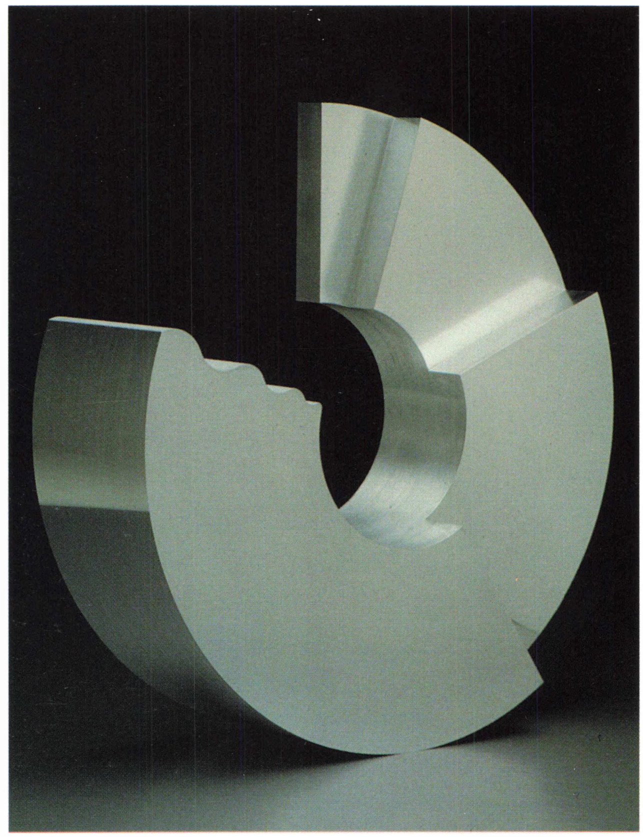
Pentagram (top)
Setting a Course for Leadership in Global Telecommunications
Illustration, 10.5 x 9

Macworld Magazine
Data Safety
Illustration, 11 x 8.5

Sullivan Perkins
Intertrans Annual Report
Illustrations, 11 x 8.5

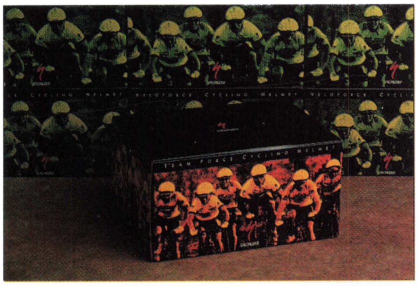
Macworld Magazine
An Exercise in Utilities
Illustration, 11 x 8.5





Uro Designs
APO Knife
Knife, 10.5 x 1 x .5

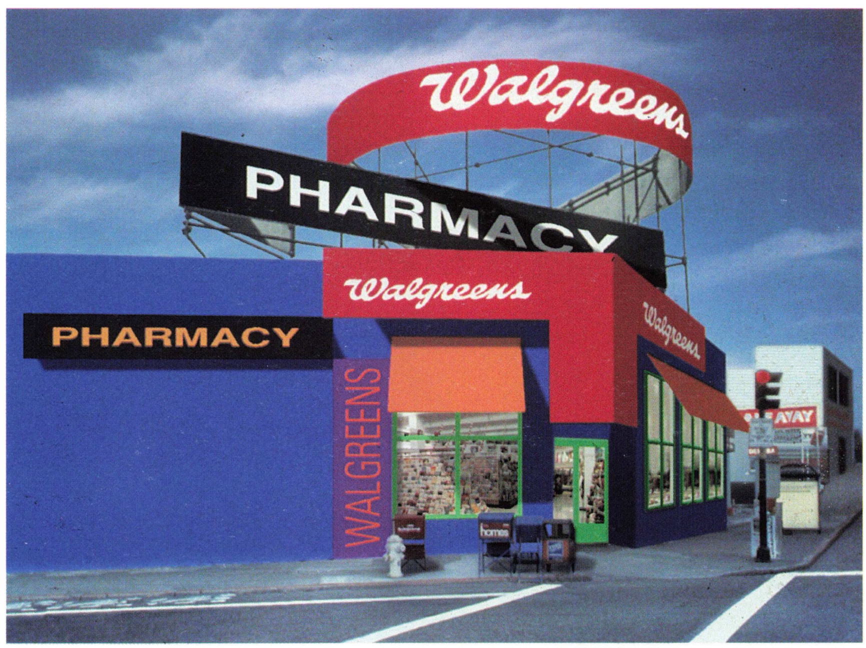
IBM San Jose Design Center
A Decade of Innovation
Three-dimensional award, 27.4 cm x 27.4 cm



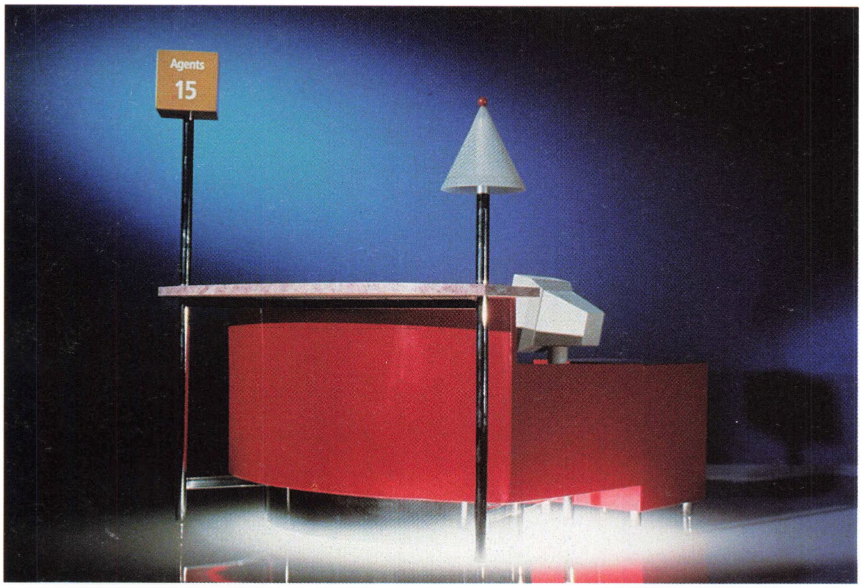
Lisa Levin Design
Helmet Package
Package, 6.375 x 12.25 x 9.25

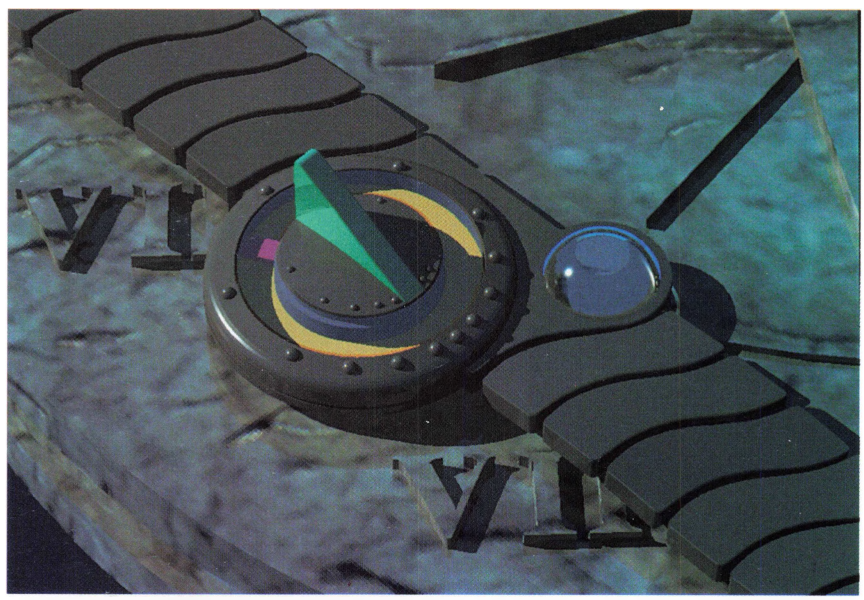
Primo Angeli Inc.
Lipton 100th Anniversary Tea Tin
Package, 5.125 x 4.5 x 4.5

Zero One
Loft Design
Architectural rendering, 13 x 16.5



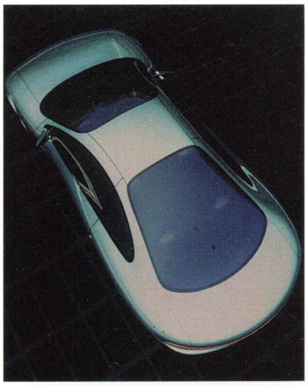
Landor Associates
Building As Sign
Architectural visualization, 8.5 x 11

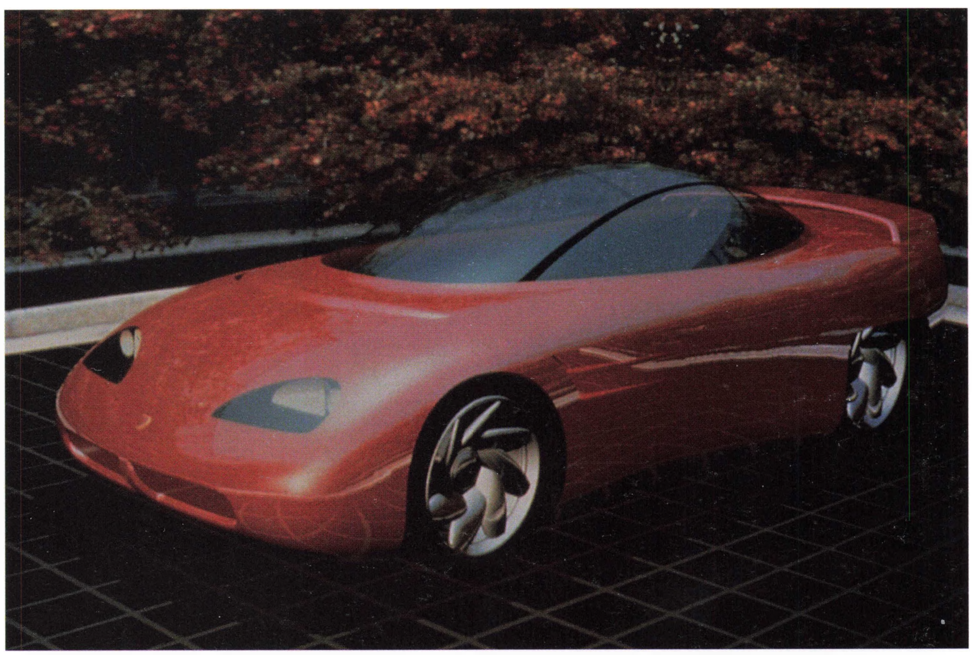




Landor Associates
Air India
Furniture rendering, 8 x 10

Texas Instruments
Sun Watch
Product rendering, 10 x 14





Evans & Sutherland Computer Corp.
Turbo Coupe
Car rendering, 14 x 11

Evans & Sutherland Computer Corp.
Sports Car
Car rendering, 11 x 14

Design Vision Inc.
BCE Place Office Interior
Architectural rendering, 22 x 20

Papers

We are currently witnessing the end of an artistic world. Artists of tomorrow will no longer produce works but something yet to be named. They will no longer create objects but rather types of microuniverses in perpetual evolution.

Abstract

These universes will be woven with uninterrupted changes, with mobile networks of lines, surfaces, forms, and forces in constant interaction, produced by the coupling of mathematics and calculators. From fractal dragons to cellular automata, from zooids to logic viruses, mathematical beings move and metamorphose in their symbolic spaces. They can change or alter the very laws by which they are constituted. They can provide the virtually autonomous substance of a new, intermediary art. The metaphor of the "symbolic bonsai" has been chosen to render the intermediary "life" of this intermediary art. Why intermediary art?

In an attempt to explain art using the words of language, even the greatest minds diverge to some extent. According to Plato, for example, art is the quest for "likelihood;" according to Hegel it aims to "reveal the truth."[1] Should art seek likelihood or truth? Is the artist a magician or a prophet? What, in fact, is truth? Plato said truth is a "divine vagabondage," which undoubtedly is why it remains beyond the reach of art, why he contends we must be satisfied with a "likely" imitation.

Since we are not gods, we cannot "vagabond;" we need laws. And this need applies to art. Thus, art must also be a science. As a product of human activity, art must obey rules inherent to the techniques used to create it. But art is also sensible representations, and as such refuses the domination of abstraction and laws. The best way to resist laws is to change them–constantly. Art itself must therefore be change–perpetual change.

1. G.W.F. Hegel, *Phénoménologie de l'Esprit*, Ed. Aubier, Paris, 1977

Bonsai

Philippe Quéau
Institut National de l'Audiovisuel
Paris, France

The Bonsai: A Living Work of Art

Living but regulated, regulated but changing—such is the truth of a likely art, of the art of metamorphosis. This is the art for which the bonsai offers a plausible metaphor.

The notion of a living work of art is not new. Hegel placed such art somewhere between abstract and spiritual works. The archetype of the living art work is the "fete man offers himself in his own honor." The free, fluid movement of "torch bearers" becomes a kind of figure, itself an "animated, living art work, as beautiful as it is vigorous."[2]

2. *Ibid.*

Whether the living element is "the work" itself or the human agents is ultimately secondary. What is important is the fact that this notion of a living work is so prevalent. Aristotle draws a formal comparison between the living products of nature and those of art and maintains that form is the principle of all production. It is form that becomes manifest in morphogenesis and in artistic creation. The seed gives birth to the tree in the same way the painter gives birth to the canvas.

Bachelard takes this formal analogy to its limit by stating that the tree is "normally a work of art." Indeed, all life that is sufficiently whole "normally" can be considered a work of art. In terms of law, the integrity of the life divulges the presence of law. Thus, whereas life guarantees change in the laws it adopts, it cannot dispense with the laws. Living art must in turn obey certain laws, without which it is condemned to vagabondage and errancy. These laws govern the general development of the work, the procedures and their composition.

Fusion of Impression and Calculation

Pure sensibility and the unutterable impression must be based on a calculation. Once the law underlying work becomes known, it is as though disemboweled. Thus, on the one hand, without laws the artwork would remain spineless. On the other hand, the work must not let its skeleton show.

To continue our tree analogy, the presence of a calculation for an art work is as necessary as that of a trunk for a tree. It is a support, a structure, and a course for the rising sap. Calculations, however, become tiresome and must be forgotten. Forces must be allowed to act and forms to react. The creative process is no longer a question of a time for analysis but of a time for fusion.

Technical reasoning must be founded in sensible expression; the idea must unite with the form. The precise moment of this union is more important than the art work itself. The work belongs to the real world. It breaks away from its creator and assumes autonomy as soon as it has emerged, becoming a mere trace of the creative act. The work is proof that fusion was one day possible, desired, and granted. Yet, in reality, the work is nothing more than an excrement of creative digestion.[3] Thus, the distinction between essential and secondary phenomena is capital. The creative act is essential, whereas the work thereby created is secondary. Artists who expect to sell their canvases are well aware of that distinction. Their works are neither their flesh nor their blood.

3. "Like excretion, the instinct to create plastic form is an act where the animal becomes as though external to itself." G.W.F. Hegel, *Philosophy of Nature.*

Artists will no longer produce works, but something that has yet to be named. They will no longer create objects, but kinds of microuniverses in perpetual evolution. These universes will be woven with uninterrupted changes, with mobile networks of lines, surfaces, forms, and forces in constant interaction. The art of metamorphoses of the universe will soon make its appearance in the world of metamorphoses of art. This art will live off the symbolic life of mathematical being.

According to Plato, mathematical things belong to an intermediary world. They occupy a position between material realities and pure ideas, between the domains of the sensible and of the intelligible. By coupling with calculators, mathematics has engendered curious beings, which people have called monsters. The principle behind the animal movement of fractal dragons and cellular automata is derived from recurrence. The iterative pulsation functions as a vital pulse, leaving the algorithm to evolve in the space of its area of application (phase space). The algorithm can modify or alter the very laws whereby it is constituted.

The Creative Act Versus the Work

We have been acknowledging the existence of the creative act as separate from the work itself. Now, we will discuss what those separate phenomena mean. In the conventional sense, art is defined above all as the production of a work. The work is created from a model, which may be an actual motif or a pretext. Emphasis is put on the originality of creation; even the most imitative works depart from their models. On the other hand, once a work comes to light, it must persevere in its being. The art object is lasting; it is a product frozen in time and one that endlessly copies itself. Whereas the artistic labor of

Despite being a tree, that is, a natural phenomenon, the bonsai epitomizes the cultural world. It is cultural in that it is physically cultivated and gardened and that it symbolizes the labor of will over chance.

begetting the work must be considered a living process, an epigenesis rich in surprises and metamorphoses, the finished work presents nothing more than a mingled mass of all the instants during which it was wrought. Although the work as a finished product clearly affirms its form, it thereby relinquishes the history of its advent. Forget-ting the genesis is a prerequisite to the completion. The project is thus obliterated by the object. The last stroke of the brush is also the rub of an eraser.

The end of the work is its limit. This point is crucial. Given that a work of art precludes our tracing the story of its creation, other than summarily, and given that the work offers a finished result rather than a process, we can conclude that something of the flash of insight inherent to the creative act remains eternally beyond reach. The work is more an object than a subject.

However dismal this prospect may seem, it is far from recent. The relationship between the artist and the work of art has not evolved for thousands of years. Plato condemns works of art and written works outright, noting they are nothing but dead productions, incapable of defending themselves. Socrates, speaking to Phaedra, does not mince words: "What is so terrible about writing is its resemblance to painting: do its offspring not present themselves as living beings, but remain majestically silent when questioned?"

The work is doomed to repetition and silence. By establishing itself in time, it copies itself indefinitely. I believe Plato's intermediary world—in other words, the mathematical-computer galaxy—is capable of proposing "works" endowed with properties that are in turn intermediary. These works are liable to elicit intermediary sensations and open up a world of intermediary art. The works in this world will be living rather than dead, voluble rather than tacit, evolutive rather than repetitive. In short, they will be more "automatic" insofar as this word (to automation = "self-moving," but also "chance") is, in Aristotle's philosophy, conventionally opposed to technical or artistic "production" (*Tekhne*).

Before proceeding further, consider that such intermediary arts have long existed. For example, we can adopt the art of the bonsai as a paradigm of an art of models. Despite being a tree, that is, a natural phenomenon, the bonsai epitomizes the cultural world. It is cultural in that it is physically cultivated and gardened and that it symbolizes the labor of will over chance. The artist's pruning provides a decisive response to the automatism of enzymatic and arborescent mechanisms. The bonsai is the victory of the mental over the vegetal realm. But if this is so, where is the omnipresent power of the creator?

There are two answers. First, the art of bonsai trees has simply been used here as a metaphorical example of a systematic competition between active principles of different natures. Ultimately, these active principles should be brought into play in a sym-

But what is the essence of the tree? To say the tree is a form is too expedient. A tree does not have a form. Rather, it is form in that it breathes and transpires. It never rests.

bolic, intermediary world, where the sensible and the intelligible manifest consistency and performance different to those experienced in the material world. Indeed, the value of the undertaking resides in this very difference. Second, the Japanese gardener is not as directive as we might think. The struggle between the two wills, the mental and the vegetal, tends to be negotiated rather than cut short. The gardener must talk and even engage in a dialogue with the bonsai; he must persuade it to grow. In the course of generations of gardeners, the bonsai and gardener have maintained a constructive dialogue. The bonsai is itself the history of a conversation. The plant has learned to speak, and the human being has had to take root.

The Bonsai as Intermediary Art

The bonsai tree provides a good example with which to develop the concept of intermediary art. The tree is clearly one of the most ancient and deeply anchored archetypes. At the same time, it is endlessly adopted as a motif. From the beginnings of time to the present, the form of the tree has proved inexhaustible. Its symbolic resources have been well borne out by painting. Computer images are now tackling its representation. Hence, after so many successes, the tree provides us with a veritable test case: If the bonsai tree is a work of art, can an intermediary bonsai be grown on computers? In what respect do these symbolically cultivated trees open the way to an automatic art? Do these automatisms simply fulfill the wish expressed earlier this century by André Breton, or do they constitute the premises of a new aesthetic project?

Then again, what is a tree? Matisse says "A tree is a leaf." That is, a tree is recurrence: It weaves its difference by repetition. It grows upward and downward. It burgeons and flowers. It is both base and foundation. It is master of its own form. It uses its strength. The oak and the alder, the hornbeam and the elm, the willow and the beech, the pine and the spruce make up its various essences.

But what is the essence of the tree? To say the tree is a form is too expedient. A tree does not have a form. Rather, it *is* form in that it breathes and transpires. The sun and the rain, the day and the night accompany its incessant metamorphoses. It never rests. The boughs reveal sustenance procured by the roots. And as the tree ramifies, it affirms its mastery of new spaces. It abandons bleak three-dimensional geometries to explore fractional dimensions, fractal shapes.

The form of the tree has conquered the world. Everything that flows is a tree. A river and lungs, an arterial network, and a nervous system are all trees. The universality of the tree is due to the fact that it is, a priori, a form of the flow of time in space. It draws the form of time and the force of space and results from the sum of their constraints. The tree is a living force. The tree and the forest are living with an incessant life.

Language cannot apprehend what is pure fluency by nature. So if language fails in its attempt to render nature, what hope is there for the image? How are we to grasp the colors without forms and the forms without end? What is a tree?

Pictorial Representation

The painted tree hides the wood of real trees. Thus, pictorial art needs to take up the challenge to convey their tufted confusion, the intertwining of form and space by means of relatively simple tools—the canvas and the brush. The history of painting abounds in trees dreamed up or rethought, trees that are delirious, opulent, luxuriant, teeming, lavish, prolific. Their forms are muscular or full blown, meticulous or ascetic. Painters seek their architectural truth or give them theatrical postures.

All graphic metaphors are mobilized to "render" a given aspect: Leonardo da Vinci creates braids and interlacing forms. Théodore Rousseau paints plantlike fronds of hair. Claude Monet simulates the rippling sea in his foliage. Van Gogh draws trees of flame. Cézanne rediscovers his favorite geometric shapes. Where is the truth of the trees?

The Chinese painter-poet Su Tung-p'o (1036-1101) wrote, "Trees, bamboo and a few other plants possess a constant characteristic form (*Hsing*) and, moreover, have a fundamental expression (*Li*), which can be very seriously transgressed. If the painter does not attain this quality with precision, his error is far greater than if he had failed to grasp the external form adequately."

The quest for this "fundamental expression" is not only a technical quest. It requires a certain view, a systemic approach. Tchen Jen, a Chinese monk in the eleventh century, devoted an entire work to the apple tree in blossom. He attributed sensitivity to deeply imbedded structures, to latent models, to obscure forces at work: "In the apple tree there is a hierarchical system such that its branches never grow on all sides: nor do the flowers bud by chance, but each has its own predetermined place."

The tree is first and foremost growth, movement, and vital impulse. Van Gogh said trees must be made to "grimace." Clearly, there is a substantial distance between the "representation" of the tree and the "simulation" of its vital energy. In short, even for those who have abandoned all hopes of bringing alive the twisting and pain of self-begotten trunks, the problem of graphic representation remains a formidable one. The trunk grows staunchly upright, affirming its strength and its expression, but all those countless, invertebrate leaves, fluctuating and luminous, must also be dealt with. The leaf is the last boundary of representation.

Computer Images

Having thus measured the limits of pictorial representation, what can we expect from models and algorithms?

Where can computer images lead us when even the most penetrating gaze is incapable of analyzing the profusion of verdant crowns? Gaston Bachelard has warned us of the danger of misused calculations: "Applying the mechanical to the living may be comical, but applying geometry to the vegetal is the ultimate in ridicule."[4] At the risk of ridicule, I shall present several tree "models" applied to image synthesis.

4. G. Bachelard, *L'air et les songes*, Ed. Jaie Corti, Paris, 1943, p. 235.

Jules Bloomenthal from the New York Institute of Technology (NYIT) was one of the first people to attempt a "realistic" representation of the tree. He emphasized the efficiency of calculations at the expense of a rather elementary analysis.

Bloomenthal defines his model as follows: "The branches of a tree can be described simply as a list of points in a three dimensional space, and as a list of connections (the branches) between these points." For variation, he called on random number generators. Parameters such as the number of the branches are calculated in an aleatory manner, starting from average values. The geometry of the trunk and branches is rendered by a simple "generalized cylinder." The leaves are likewise digitized from photographic sources, then cut into three sections to allow them to be bent by the wind.

Peter Oppenheimer has used a similar model at NYIT. His trees do not try to be an exact arborescent structure but a surface realism. Although the matter the trunks are made of is acceptable, his trees are oddly reminiscent of vermicelli.

William Reeves has developed another essentially aleatory model called a "particle system." A particle system is not a static entity. The position, orientation, attributes, and dynamics of each particle are defined by a sum of aleatory functions subject to constraint. This allows the creation of numerous variations. The parameters are interdependent without being bound in a linear relation. The breadth and height of the tree and the length and thickness of the branches vary together. The "twigs" are recursively generated by the "branches," which endow them with their own parameters. The other parameters are adapted to the given height. This recursive generation algorithm produces regular structures. Hence, Reeves proposes a posteriori processing to simulate real conditions: the effects of gravity, dominant winds, and sunlight.

Bloomenthal's and Reeves' models are basically aleatory; they do not involve strict botanical analysis. Others have chosen to exploit the knowledge of plant anatomy acquired by botanists. Their approach gives rise to a totally different philosophy, one where the tree is seen as a complex organism in search of an incessantly disrupted equilibrium.

In this second approach, discrete models have been used to account for plant morphogenesis. Chaetomorpha, the green seaweed, was described by Lindenmayer's L parallel rewriting system as early as 1968. L systems are presented as sequences of states that may, for example, represent the cells of the given organism. State transitions are simultaneous and depend on a gram-

A particle system is not a static entity. The position, orientation, attributes, and dynamics of each particle are defined by a sum of aleatory functions subject to constraint.

5. P. de Reffye, "Modelisation de l'architecture des arbres par processus stochastiques," Doctorat d'Etat, Paris, 1979. Also see M. Jaeger, "Representation et simulation de croissance des vegetaux," doctoral thesis, Strasbourg, 1987.

mar G = A, R, x, where A is the finite set of symbols of possible states, called the alphabet, R represents the sum of the transition rules, and x stands for the initial state. If the longevity of a cell depends not only on its position with regard to neighboring cells but also on its mother cell, in other words, if the grammar allows the preceding generation to be memorized, growth is qualified as a "temporal interaction" process. If state transition is likewise dependent on neighboring cell status (diffusion mechanisms), "local interaction" systems are involved. The interaction speed across the filiation (time) can be modelized, as can local propagation between neighboring cells (space). Finally some systems undergo "erosion" during development, in other words, they are systems whose grammar can modify itself.

Other research has shown the possibility of generating the structure of various trees without using a generative grammar, using a combinatory growth motor instead. Ramifications are made to increase by recurrence. The following ramification is obtained by randomly drawing a branch from the preceding ramification and by drawing a direction in space. A new twig thus sprouts on this branch in the chosen direction. Above all the combinatory method allows effective control of overall parameters (such as the Strahler number), which impose shape-related constraints on the tree. Whereas the chance factor involved in random drawing allows wide variety of individuals to be obtained, they remain strictly within the framework of a given tree "species," summarized by geometric parameters derived from botany, such as the ratio of branch length to branch diameter and the angle between "mother" and "daughter" branches.

Philippe de Reffye[5] has analyzed a mathematical model of the coffee tree based on experimental growth curves. His model places considerable emphasis on stochastic processes and aleatory developments capable of creating structural irregularities. It also takes into account weight and resistance of materials for the bending of the bough, the buckling of vertical shoots, or phenomena related to breakage. Finally, he ascribes substantial importance to the four parameters characteristic of tree growth: activity, viability, ramification, and number of axillary buds.

The CIRAD team in Montpellier used this method to simulate numerous trees (coffee tree, cotton tree, palm, frangipani, poplar, spruce, beech, litchi) as well as plants and flowers (daffodil, tulip, lilaceous and araceous species, vine, fern). Anticipated developments concern calculating the gene for the branches within a given tree or among different trees. Evaluation of the luminous flux at any moment is likewise envisioned.

The CIRAD simulation method has numerous applications in botany, agronomy, forestry, and landscape design. One of its most interesting perspectives is the possibility of simulating fossil trees. Indeed, it provides

Far from being an arrogant, barbarian art object, mathematics is a transcendental tool of knowledge. Intermediary art is an art of manner, a neomannerist art, concerned not so much with nature as such or its deformation as with its transformations.

a magnificent example of creating intermediary art: Such models allow us to shape at will, in the same way as one cares for a bonsai year after year, generation after generation. It is no longer a question of a tree or a model but of artistic simulation of a nature. Finally we would like to cite the most developed simulation model of living vegetable environments. It consists of creating a model that translates not only plant growth but genetic evolution of the species itself. Hypotheses are formulated on the factors likely to reinforce a given species in its struggle against the pressure of selection. It then becomes possible to induce a "mutation" in a given characteristic and to evaluate the performance of this mutation. Numerous reiterations of such a procedure are possible.

Minor modifications encouraged or inhibited by the selective pressure of the "environment" lead to a reinforcement or dying out of the "species." A priori criteria are used, such as the aptitude to capture light, the resistance structures manifest to their own weight, and the efficiency of seed dissemination. These are "genetic" parameters that are the object of "mutations" in the course of successive generations. A mutation occurs when the efficiency of growth characteristics is maximized according to one or several of the adopted criteria. For example, it is possible to seek out the evolutionary trajectory whereby seed dissemination capacity or the ability to capture light is optimized. Simulation becomes extremely valuable when it allows the confrontation of several "plants." The "selective pressure" of the "environment" is highly interactive in this situation, as the environment is itself made up of species struggling for supremacy. This veritable "plant war" ultimately yields results similar to those obtained by nature insofar as can be seen from paleontological analysis of fossil plants.[6]

The Simulated Tree

Armed with these various models, it is clear that the simulation of intermediary trees is another art that leaves painting behind. It is a systemic art. The simulated tree is not a painted tree because it evolves from a complete interactive system, including the represented individuals, the species' characteristics, and the environment. Symbolic calculations grow trees that are no longer illusory appearances but are entities in a state of permanent metamorphosis. Nature was already known to be an artist, as was the fact that "a blade of grass no more resembles another blade of grass than a Raphael resembles a Rembrandt" (Bergson). Now that we have managed to tame the very procedure of inventive flowering and budding repetition, we must show we are capable of subduing this prolific matter by making it express that without which art does not exist: emotion that can be shared.

The lesson is fully contained in the end: The seed and the bud are

6. See K. Niklas, "Computer-simulated plant evolution," *Scientific American*, May 1986.

but moments, and ever refuted moments at that. An art content to present no more than seeds, be they large or small, would fall short of its initial objective. As Hegel stated, "When we wish to see an oak in the sturdiness of its trunk, the expansion of its boughs and the masses of its foliage, we are dissatisfied if, in place of the oak, we are shown an acorn."[7] It is a matter of establishing the bases of a veritable intermediary art, an art capable of providing us with real enjoyment of this world, situated at the crossroads between the domains of the sensible and the intelligible.

7. G.W.F. Hegel, *Phenomenology of Mind*, op. cit.

This world is the site of mathematical beings. Mathematics is a necessary point of transition. For Plato, it is the intermediary images of ideas. For Aristotle, it is beings involved in matter. For Pythagoras, it comprises both the models and the substance of things. Leaving aside the nuances of interpretation, the essential point is clear: Mathematical things are bound to sensible things, thus to art.

What function can be ascribed to this intermediary art, of which mathematics constitutes the matter? As was hinted earlier, intermediary art is above all an art of metamorphosis, first, in that it uses a material destined to metamorphose constantly and, second, in that metamorphosis constitutes a novel function that cannot be fulfilled by the classical arts of the sensible world.

Far from being an arrogant, barbarian art object, mathematics is a transcendental tool of knowledge. Intermediary art is an art of manner, a neomannerist art, concerned not so much with nature as such or its deformation as with its transformations. These subtle metamorphoses that the eye does not follow can only be enjoyed thanks to mathematical beings, the intelligible version of such metamorphoses.

The "intermediary artist" so urgently demanded in our age of reason has already existed. Leonardo Da Vinci has shown us the way. He was not "intermediary" by virtue of his dual culture but because he allowed that culture to rove between heaven and earth. "He is the master of visages, of anatomies, of machines. He knows what a smile is made of; he can put it on the frontage of a house, in the curves of a garden: he untangles and freezes filaments of the waters, tongues of fire ..."[8]

8. P. Valery, *Introduction à la Methode de Leonard de Vinci*, Ed. Gallimard, Paris, 1960.

It is up to art to trace the unpredictable path of forms in our universe caught in the throes of fusion. At the bend of the rustling forests, art alone allows us to share the countless smiles of forms.

This essay discusses the dichotomy between visual, animated images and the abstract computer program that generates them. This digital and numerical base adds an extra dimension to the animation, whereby the creative experience is divided into a number of different levels.

Abstract

Digital images are informed by the status of their algorithmic source, creating in the viewer a kind of numerical perception, thereby introducing scientific knowledge into our understanding of the visual. But because of the computer's formalism and arbitrariness, the relation between algorithmic source and the electronic visual effect is not stable. Imagery is of a different experiential type to logical structures, and this causes their disjuncture or alienation, although they are logically and deterministically connected. Thus synthetic images do not appear "human" or manmade but objective or "natural," like photographs.

The underlying algorithm is so contingent that in terms of being an accessible entity it hardly exists at all without reference to its sensory manifestations. The actual substance of the animate is diffused into so many different levels at once, it loses its ontological identity. These effects lead to a description of a computer animation as an object able to vitalize both tangible and intangible spaces and become a super-animate.

Superanimism:
The practice of formalised imagery

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Introduction–The Word Made Flesh

Through computer modeling, a type of animation has evolved that does not depend on the result of the manual dynamics of traditional animation but on a construction of multidimensional objects in symbolic space. This new kind of animation exists on more than a visual or poetic level and can be thought of as having the status of "real" and objective entities with ontological depth and, in some contexts, being able to function as bodies of knowledge.

As an example of the changing critique of the image, consider three possible ways of representing a common cloud. To begin with, take a painting of a cloud formation by an artist such as the eighteenth-century landscape painter John Constable (Figure 1). This painting tells us as much about how the artist painted the cloud as it does about the cloud itself. The fluffy brush marks and impasted surface encourage the eye to delight in the variety of the technique for its own sake, almost as a distraction from the idea of "cloudness" or at least a redefinition of it. The painting is an impressionistic rendering of a meteorological condition, not designed to provide us with more information.

In comparison, photography is considered a transparent medium. A photograph of a cloud gives us pretty much a one-to-one correspondence with its referent (Figure 2). It provides us with accurate information about a portion of the sky at a particular moment in time. But the information is still limited to what a cloud looks like, and it is not clear how this representation can be expanded without moving into diagrammatic representations and compromising visual realism.

Computer renditions of synthetic clouds are now visually indistinguishable from photographs (Figure 3). But in the case of a digital image we can extend our critique beneath the surface of the image to examine the rationale of the algorithm that generated it. We can ask the same question concerning the realism of this

Figure 1. *Cloud Study: Horizon of Tree*, John Constable. Oil painting, 248 mm x 292 mm. London, Royal Academy, 1821.

algorithmic model as we can concerning the realism of the image—whether it is a fractal or impressionistic self-model,[1] a textured morphological model,[2] or a physically based model composed of differential equations.[3] Furthermore, this digital structure or algorithm might allow the imagery to be animated, not just passively like recording a film, but moving in a dynamic interactive space.

We can compare algorithms like this with the knowledge we have about the nature of cloud phenomena and evaluate the result according to our priorities. That is, even if the picture does not look like what we think a cloud should look like, an appeal could be made to the accuracy of its mathematical basis to secure its legitimacy. We would not, for example, be dismayed to hear someone argue for the validity of an unfamiliar looking cloud picture by referring to the means by which it was modeled. Armed with this means of perception we might then go into the nearest street and carefully examine the sky overhead for shapes that correspond more closely with our new conception of clouds.

Thus, the popular scientific discourses of chaos and fractal theory are mediated through imagery to the public and are able to exert an influence on perceptual habits, producing an almost numerical perception. Digital images have depths and attendant processes that cannot be clearly demarcated and instead diffuse their being and meaning onto many levels. Let us take a closer look at the dynamics behind this process.

Animating Information

Traditional animation has been limited to morphology. Whether we are drawing figures by hand or manipu-

1. R. P. Voss, Fractal Forgeries, in R. A. Earnshaw (ed.), *Fundamental Algorithms for Computer Graphics*, Springer-Verlag, 1985.

2. G. Y. Gardner, "Visual Simulation of Clouds," in *Proceedings of SIGGRAPH '84*, 1984, pp. 11-20.

3. J. Kajiya and B. P. Von Herzen, "Ray-tracing Volume Densities," in *Proceedings of SIGGRAPH '84*, 1984, pp. 165-175.

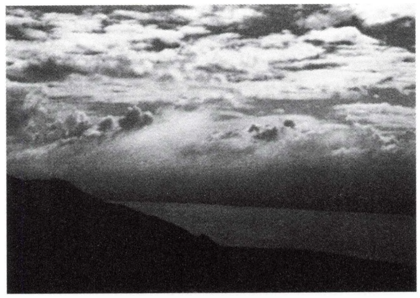

Figure 2. *Sea Fog Turning into Cumulus Clouds*. Photograph.

lating models during stop-frame recording, we are basically animating shape, whereas we can now talk in terms of animating information. Although commercial animation systems still mainly imitate manual methods, such is the potential of the computer that animating by mathematically controlled methods is an irresistible lure.

This kind of computer animation begins life as no more than implicit or latent in digital memory, like a digital muse waiting to be algorithmically unfurled. The animation is constructed by formal rules acting on a symbolic structure, and its realization as videographics can take on any one of a limitless number of forms depending on the animator's interest or intentions. Because of the lack of uniqueness or authenticity in the representational format chosen, computer animations are properly referred to as visualizations — our ability to create that which is visible. A computer animation exists informally in an intuitive space with other visual objects, but it is derived from a formal space within the computer's memory. By substituting the term *visualize* for *represent* we create a context in which the animate can exist as an independent visual object in its own space while at the same time retain a formal relationship with the virtual world of digital sequences defined inside the computer.

Deterministic Alienation and the Numerical Image

The formal, logically defined relationship between the image and its model can serve to rupture their intimacy, as much as to structure it, by both the sheer algorithmic complexity that accompanies the transition from data to model and/or algorithm

Figure 3. Still from animation by Semmania Cheung, 1988. Copyright CASCAAD, Middlesex Polytechnic.

to image and the constant element of arbitrariness in its conventions. Suppose we try to formalize this stratification of the logistics of digital creativity, using the following classification.

Ideal Space. This is the lowest level at which mental objects might be conveniently formalized. It simply refers to a more or less coherent abstract idea like "there are five regular tessellations in the plane," or perhaps a platonic object like a sphere, theoretically defined.

Logical Space is where abstract ideas are transformed into formal notation, usually mathematical. In our context, the notation is probably an algorithm or program, such as encoding a sphere to be represented by a center of origin (*x y z*) and a length of radius (*r*) or the procedure by which it is illuminated and rendered.

Symbolic Space. Objects exist in symbolic form, in our case as digital symbols or numbers, like a data file for a three-dimensional model or the representation of a picture of a sphere stored as a file of pixel values that could be further processed or edited.

Sensory Space is generally the space of everyday experience or perception, such as when a picture of a sphere displayed on a monitor. For computer animation, at present this space has two main aspects, which we can call electronic space (on a TV screen) and interactive space.

This contrived taxonomy is not meant to function as a simple hierarchical ordering of conceptual and perceptual modes. That is, a space described lower down the list is not always defined and directed by the one immediately preceding it. This is partly because earlier stages are constantly suffering feedback from their effects on later stages (such as debugging an algorithm by inspecting an image it has generated). But also, each perceptual space is engaged on so different a level of experience as to require vastly different ways of coming to terms with the objects that dwell there. This frequent inability to relate the objects of one space to associated objects in another can lead to effects we might term *deterministic alienation*.

The most obvious causes of deterministic alienation are the mathematical characteristics of algorithms described as chaotic or nondeterministic systems in which future states cannot be predicted from their starting conditions. For users there is a feeling of dislocation between the simple and uninteresting looking mapping function that exists in logical space as only a few dozen lines of programming code and the intricate and changing patterns of dots and clouds of color that continuously dance in front of their eyes on the video display unit (VDU). Although this particular experience is limited to the mathematicians who study such dynamics or the computer enthusiasts for whom it is a recreational pursuit, the same effect of alienation is a general occurrence among computer graphics programmers.

Startlingly exotic graphics are possible because the computer is divorced from physical limitations and often becomes isolated from common aesthetic idioms.

Most programs written for serious applications are several thousand lines long and contain many separate functions and algorithms. To make the job practical, they are usually written by a team of programmers under the supervision of a software architect who lays down the basic structure of the project, assign portions of it to various team members, and ensures compatibility between their contributions. It is plain to see that no one person can grasp the operation of such a complex piece of software and that individual programmers can quickly lose track of the detailed flow of their own particular module without constantly refreshing their memory. Users of a computer graphics package can have only vague ideas about how the images they design are actually produced.

In addition to the considerations of software construction, there are the workings of the graphics hardware, the processors, memory architecture, display controller, and so on, that have to remain shielded from the quizzical gaze of the user. The fact is that computer science has now become such a highly specialized field that no one person can really say how a computer–either hardware or software–actually works. Some people do have knowledge of the general principles involved, for example, the binary operators, scan converters, or z-buffers, like any modern scientific discipline, but if we compare this kind of specialized knowledge that scientific practice entails with the physical production of drawings and paintings and sculptures, we see that large areas of the working processes of computer media will always remain veiled. The introduction of scientific techniques to the arts supplements the hallowed mysteries of creativity with bland wonderment at the power of mathematics and electronics.

Apart from the practical and technical hindrances to a complete understanding of the generation of a numerical image, there is a huge difficulty in trying to switch one's level of awareness from the visual space of the electronic image to the logical space of the program, to the ideal space of the concept. Each shift involves a complete change in perception, and each transition from one space to another can be achieved by a number of different routes. Trying to retain one's feelings of admiration when describing a Vermeer interior in terms of radiation interchange can be like trying to describe the feelings of first love in terms of hormonal chemistry. Each class of experience operates in a different space, independent of any necessary basis for comparison.

The complexity of the process of rendering a simple combination of geometric primitives using even a mathematically straightforward algorithm leads inevitably to lighting interactions of inscrutable subtlety. The density of interreflections and shadowing in such images can often be so great that it is difficult to dis-

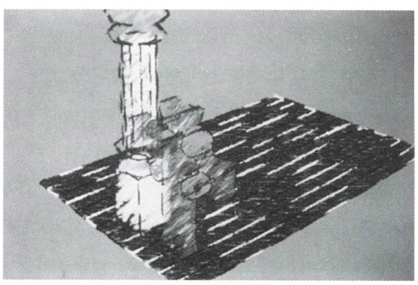

Figure 4. *Cross and Column.* Simon Schofield, digital image, 1989. Courtesy of the artist.

cern whether they are legitimate or the result of some error in the calculations. Usually if the algorithm appears to work for simplified test lighting conditions, we allow ourselves to trust that the algorithm works in more complex situations as well, unless our eyes detect something quite obviously wrong.

These issues, as potent as they seem at present, will doubtless shift their emphasis as future computer graphics users, who have known little else, find it easier to familiarize themselves with the operation of these systems unlike the problems older generations have had in changing from traditional media. It can be surprising how the wonderment of a newcomer to computer graphics can change to a casual acceptance of the behaviour of the computer as it scans down the screen, automatically shading in assorted geometries. New methods of modeling and rendering are constantly being developed which may require the continual acquisition of new artistic practices. Startlingly exotic graphics are possible because the computer is divorced from physical limitations and often becomes isolated from common aesthetic idioms. There is a point at which the workings of the computer itself are no longer questioned, no longer an issue, and bewilderment at its idiosyncrasies is replaced by a submission to whatever system of operation the computer has been designed to offer. In this way the effects of creative alienation become internalized and implicit, with the result of a fragmented relationship between the means and ends of digital media.

One of the aims of the process of scientific visualization is to try to overcome this stratification of experience, or in this case, of knowledge by using visual perception as a way of accessing, or perhaps, of reintegrating knowledge. Interactive visualization spaces are especially efficient in attempting to compensate for the cognitive schism by articulating a space that allows an intuitive understanding of an abstract object to be moulded. But this process does not directly bridge the gap between our perceptual spaces. Rather, it allows us to come to terms with them by replacing the old static object that was so difficult to get to grips with, with a completely new interactive object programmed specifically to be more responsive and accessible. Easier "understanding" can now be a design feature of scientific visualization.

Synthetic Realism

The synthetic image itself is by nature phenomenologically autonomous. Electronic imagery is by definition not created by any mechanical or physical process. On examining a synthetic image we see it is too detailed, too precise to have been executed by the human hand. But it does not look "mechanistic" either; it does not have the regularity or symmetry we associate with graphs and chart plotting. In fact, we generally cannot make out how the image has been made; there is no evidence of craftsmanship, no brush marks. This leads to an associated phenomenological effect of synthetic imagery–that it has not been made, that it has somehow occurred naturally without human intervention or volition, like the swirling patterns of oil in a puddle.

The realism of synthetic photography is exposed as one of a wider catalogue of styles.

Photographs are perceived in the same way. People feel the photographic method to be defined and mechanica–although not entirely inaccessible–and that its results are objective and able to function as statements of fact.[4] Although this judgment is generally true, it is often reduced to a triviality. All photos tell us is that a scene once existed. They are a mute witness, they do not help us understand, and we usually end up reading our own stories into the pictures. Recent photographers have tried to subvert this acquiescence to photographic veracity by constructing and photographing impossible scenes, liberally employing special effects and compositing.

4. R. Barthes, *Camera Lucida*, Flamingo, 1981.

If this can be a strategy in photography then it is doubly possible as a strategy in synthetic photography. Photographic realism is now exploited as a style to validate and confirm the fantastic. In computer graphics this stance is given added impetus by the fact that realistic rendering is but one alternative to visualization and frequently not the most efficient for communicating the desired information. For this reason realism as a method has no claim to truth; the pluralism of computer graphics reduces it to a specialized technique mainly appropriated to disciplines such as architectural simulation.

New rendering systems currently being developed can subsume synthetic photography into a wider language of pictorial styles and visualization techniques, deliberately forging the styles of other media and appropriating their modes of perception. For example, a picture rendered with stochastically shaded patches provides all the cues for its reading as painterly brush marks (Figure 4). The recognition of this familiar process allows the viewer to empathize with the supposed means of production expressed in appearance if not in fact, and this in one sense reduces the alienation caused by the usual pristinely shaded artifacts.

The realism of synthetic photography is exposed as one of a wider catalogue of styles. A computer is in principle capable of simulating this or any other definable process and possesses no intrinsic "style" or language of its own, or any of which is relevant to this context. This freedom enables the computer to make its completely arbitrary connections between digital constructs. Some of these connections can be functionally specialized as in three-dimensional rendering and, although still strictly deterministic, can become inaccessible and alienating. Some others can appear straightforward like diagrams and other more complex visualizations can be disguised at later stages and at different levels to control their perception and their understanding.

Imaging software is now habitually customized for many jobs in a kind of mathematical montaging until the desired effect is achieved.

The Computer as a Mediatory Fabric

It is better to think of the abstract digital structures that form the basis of the animation discipline as merely a coding, a raw unformed state, rather than as the complete embodiment of the images that arise from them. It is even possible that the data could be completely random and still be rendered into some meaningful form, such as in synthetic texture generation. The animations generated create a new sensory electronic object so they only seem existent when in this tangible state and previously seem quite dormant. But although this appears to be restricting our conception of animation to the level of the visual, the computer expands the definition of animation by providing schemata of correspondence between different visualizations of data. In fact, the source or data and their attendant processes are now nothing more than a mediatory fabric from which their diverse materializations can extrapolate themselves. The database can even be said to remain undefined as an accessible object until a process to externalize it has been applied. It is only then that it is made real, perhaps in visual terms, so it can be apprehended at a human level. Using this fabric as an internal abstract medium, one animate can be said to represent or revisualize another, initiating a self-reflexive loop linked in a logical or symbolic space. It is in this space that animates may be said to talk to each other.

In the environment of an animation production company we have a situation where the predefined procedures to create photosynthetic effects are still not flexible enough to produce the desired kind of rendering of each object efficiently without extensive editing of the scene description and/or software package. Although the advanced global lighting models that architectural scientists are developing for fast parallel processors would give animators the ability to just about build their own movie sets inside the computer, now that designers have discovered the power that mathematical modeling gives them, it seems unlikely that they will want to stick to the specialized methods others have provided for them.

Imaging software is now habitually customized for many jobs in a kind of mathematical montaging until the desired effect is achieved. The freedom this offers encourages effects that are straying far from previously accepted styles. After the algorithmic base has been refreshed many times, the coherence of the mathematical structure "behind" the imagery begins to recede until we reach a stage when an endless chain of visualizations have no obvious "real" referent, only a clearly and logically defined yet purely conventional and mutable internal fabric.

The wider variety of rendering systems will tend to bring computer animation in the media industries closer to the practice of visualization graphics, especially now that the novelty of conventional three-dimensional rendering has worn off and new stylistic devices are sought. In the developing use of computer graphics, distinctions between "image" and "model" will continue to shift erratically, as they have in the dichotomy between form and content. Although strictly deterministic, numerical images are indeterminable; generally speaking, they cannot be studied to uncover the functions by which they were formed. They are phenomenologically autonomous and generatively inscrutable.

The form of output for computer graphics may itself be seen as an extension of the visualization process. Because computer graphics has no innate language, many different media can be used to externalize imagery, and we can compare realizations with photographic techniques, pen plotters, video, hypermedia, and interactive systems. The variety of final output is linked to an underlying logical fabric in the computer, but this fabric is just as fluid and contingent as the images it produces.

The diversity of the relationship between digital images and computers in the dynamics of visualization can help reinforce the experience of the visual as an independent class of objects rather than define them as a mere reflection of abstract mathematical forces. The capability for interactively accessing the image space does not recover this intimacy because each time it is engaged, it redefines the object under scrutiny. The computer both constructs a formal relation between logical space and the animate and at the same time undermines it by its arbitrariness and by effects such as deterministic alienation, producing a fluctuating dynamic space rich in conceptual ambiguity.

As articulated by popular alchemical metaphors, the origin of the art of animation are the beliefs of animism — the attribution of the qualities of life to inanimate objects.[5] But the kind of computer animation discussed here substitutes the transmutable metaphysical substance of alchemy for a digital metaphor, a universal formalism that is both always applicable and yet purely textual. It is a superanimism, not just synthesizing the appearance of living things but a simulation possessing an internal relational fabric able to generate infinite realizations of itself.

5. R. Cardinal, "Stirrings in the Dust," in *Animating the Fantastic, Afterimage* No. 13, Autumn 1987.

Premature over-promotion of any and all "artwork" created with computers has caused art critics to feel as if they are being asked to admire the Emperor's New Clothes. At the same time, computer artists accuse art critics of being uninformed, myopic, and hopelessly out of touch with the new media concerns.

Abstract

Artists visiting computer art shows disdain the oft-exhibited science fiction grotesqueries masquerading as art: Bad critical reception is said to be because of this "nerd" aesthetic. On the other hand, technical-minded factions also wonder when computer artists will actually learn to program, or produce something besides canned paint system imagery and indecipherable bad video tapes. Such squabbling and shifting of the blame from one group to the next is not the way to correct the problem.

Adding to the problem is the fact that standards by which we have evaluated computer art have evolved outside of the "high art" community and tend to be too low. Often the concepts of science and tools of technology are merely appropriated and exhibited as art without true artistic transformation or social context. Furthermore, when work refers to contemporary art world trends, it often does so as a form of imitation or serves merely to reinforce what we already know about image making. Without true understanding of either art or science and technology, this work can hardly help being superficial.

We need to fairly evaluate work using standards as high as those by which the rest of the arts are judged. We need to extend beyond the isolation of our small community and address broader issues. Most importantly, we need to take advantage of the uniqueness of computing and push its properties to their limits. Only as these issues are addressed and resolved will computer art gain in significance and authenticity.

The Emperor's New Art?

Delle Maxwell
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At the SIGGRAPH '89 conference the panel session entitled "Computer Art –An Oxymoron?" intended to bring some members of the established art world institutions together to discuss the status of computer art. The panel's loose consensus seemed to be that theoretically, it could exist at some point, but in practice, now, there weren't very many examples of interesting work to be found. The lack of involvement with idea and content was cited. Yet some panelists, through misuse of jargon, revealed their unfamiliarity with computers and the technical milieu, and were unable to provide any clues to what this new content might be.

With each question asked after the session, the gap in understanding widened further. Audience members confused technical issues for content. Some people seemed to think that the current state of hardware and software was too primitive for real art to emerge yet. Others used the terminology of the marketplace to predict the future: Meaningless phrases such as "narrowing the gap between imagination and reality" were in abundance. Some implied that many artists' work is bound by the limitations of the prepackaged software. How can artists do much with this tool without an in-depth exploration of its language? Why do they re-render the works of other nineteenth-and-twentieth-century artists? A computer artist wondered what it would take to have his photorealistic work recognized as art, and that he would have work ready and available for critical review in the fall. None of the panelists offered their services.

There was a general feeling of dissatisfaction after the session. Artists felt that their questions were left unaddressed and that they were being written off as insignificant. Panel members seemed unable, unwilling or embarrassed to articulate specifically just why computer art was falling short of expectation. The two factions seemed to exist in parallel worlds, unable to pass through an invisible though palpable barrier.

As a result of these events, questions arise. Has the computer art establishment woven, promoted, and cloaked itself in some miraculous cloth–a cloak of legitimacy? Are the critics who are unable to see this cloak unfit for their jobs, as was the case for those citizens in Andersen's fairy tale, or are they like the child who declares that the Emperor is, indeed, naked?

Unfortunately, the confusion and dissatisfaction with computer art is not uncommon. Every year, visitors to computer art exhibits and animation shows voice their disappointment. Every year, the high hopes and promises we have for the technology in an artistic context fail to materialize. These aren't just the grumblings of the general public; artists, enthusiasts, and engineers alike join in mutual complaint.

Yet we hold a common belief that there *is* something different about using computers in the visual arts. "Radically different," "revolutionary potential," "unique requirements," "transformation of space and time," and "novel medium" are the types of descriptions found in articles on computer art. Are they just the hyperbole of the marketplace? Or can computer art become a legitimate, significant member of the art world, as well as be respected for its technical achievement? If so, when can we expect this to come about? It can succeed:

When we can evaluate work fairly, using standards as high as those by which the rest of the arts are judged. When the question *How did you do it?* is not the only appropriate question to ask. When computer art stops imitating other art styles, and artists show a greater commitment to learning the language and concepts of computing.

The Ghetto

Early on, the mainstream "high" art world dismissed computer art as a peculiar hybrid, a carnival novelty like "spin art" or orchestrated laser shows. In response, rejected artists and engineer-artists created their own forum for theory, criticism, and exhibition of work. This forum has evolved into a community of organizations that have their own infrastructures; heros, critics, prophets, historians, public relations, conferences, awards, and publications. It should be kept in mind that that vanguard art has always had to battle recalcitrant traditional critics and a sometimes hostile public, and that alternative critics are needed. But eventual recognition of the new work is assured only if the alternative work, critical theory, and infrastructure are equal in quality to that which is being challenged.

Our situation is not unlike that of science fiction writing vis-a-vis the world of literature. To understand the comparison, consider the astute observations of the Polish science fiction author Stanislaw Lem.[1] He classifies the world of the literary arts into two groups: The Lower Realm, as exemplified by crime fiction, erotico-romance novels, science fiction, and the like, better known in the U.S.A. as "trashy books," and the Upper Realm, characterized by philosophy, poetry, and novels by writers such as Joyce,

1. Stanislaw Lem. "Science Fiction-A Hopeless Case: With Exceptions." From *Microworlds* (New York: Harcourt, Brace, Jovanovich, 1984) p. 47. The essay was originally published in 1973.

Early on, the mainstream "high" art world dismissed computer art as a peculiar hybrid, a carnival novelty like "spin art" or orchestrated laser shows.

Sartre, Bellow, and Sarraute, acknowledged to be worthy of distinction.

In the Lower Realm, science fiction exists as a "socio-culturally isolated realm" of work, a ghetto of sorts. Its publications, conferences, and exhibits exist as "junior versions," separate from those in the mainstream. Rarely does any cross-fertilization with mainstream literature take place. Writers from what he calls the Upper Realm occasionally make excursions into genres such as science fiction or crime fiction, yet still retain their reputations as respected writers. (They have already made their reputations in the cultural mainstream and are allowed such occasional lapses.) In those cases, when authors such as William Burroughs venture into the Lower Realm, they are acclaimed and congratulated as one of the "brotherhood." Due mention is given in the publications, and their presence is offered up as proof of the validity of the genre.

On the other hand "...there is no return service."[2] Science fiction writers in the Lower Realm, that is, those in the science fiction ghetto, are snubbed when they attempt to gain invitations and acceptance into the Upper Realm. (Consider the analogous situation with the SIGGRAPH panel "Computer Art: An Oxymoron?"–the mainstream critics were invited, yet provided little encouragement for computer art or invitations for artists to show in museums or galleries.) This situation naturally creates frustration for those in the Lower Realm.

Out of this frustration, separate institutions and means of sharing information are developed. Consequently, people in their own in-groups tend to evaluate and promote one another's work. Criticism is sometimes more of a public-relations affair than an objective evaluation. Promotion is used as a method of justification. This kind of promotion combined with the isolation from the Upper Realm of literature fosters the application of lower standards of judgment. Honesty compels us to recognize the science fiction ghetto's difficulties with lower standards as problems in our own group as well.

We must also recognize that the lack of high evaluation standards is partly the fault of the computer graphic marketeers who have promoted everything indiscriminately as Art. They have realized that using the arts as "softeners" and "humanizers" of the public image of computers is a powerful marketing strategy. In belief that the newest must be the best, dozens of premature efforts have been marketed as works by "great masters of a new age." And artists themselves have been heard prefac-

2. *Ibid.*, p. 67.

As a result of this early over-inflation of the value of computer art, those who seek authentic vision were bound to be disappointed when they found only a few examples worth remembering.

ing discussions of their work by "This is the first known use of ...," which is more appropriate to the marketing of the newest commercial product.[3] Some illustrators and image-makers of dubious talent have evolved as artistic savants. In our own short-term self interest, we have allowed this to happen.

As a result of this early over-inflation of the value of computer art, those who seek authentic vision were bound to be disappointed when they found only a few examples worth remembering. Instead of a new reality, they got the old one back, in pixels. In addition, it is now often difficult to filter out marginal work, because some of these practitioners have been long entrenched in the computer graphics establishment. One cannot fix the blame only on this establishment. Every year new artists join the cadre: Often, instead of bringing in new ideas they merely rework old images with new techniques. We need to extend beyond this isolated ghetto mentality, address broader issues, forge connections with the rest of the art world, and insist on higher standards.

How Did You Do That?

Considering computer graphics' origins in engineering, and its affiliation with science and industry, it should be no surprise that much of its imagery has evolved from the concerns of engineers, scientists, and industrialists. This also explains why often computer imagery is the visual result of the process of problem solving, or the illustration of a technique.

Computer graphics is important in scientific illustration or visualization, as a method of distilling large data sets into a format that enables visual analysis. It is essential in simulation–the process of making computer models of physical processes or natural phenomena. In mathematics, forms nonexistent in our everyday Euclidean space can be constructed and explored. New modeling techniques and photorealistic rendering algorithms have been invented to simulate the appearance of objects and scenes in the real world. In these contexts the question "How did you do it?" is perfectly valid, and a compliment to the skill of the programmer. "Is that a photograph, or is it computer generated?" is a question often asked in admiration.

Evidences of technical advances comprised a significant proportion of earlier computer art shows, with improved revisions showing up every year. Many of these advancements manifested themselves in forms familiar to us from the world of special

3. Yet to be fair, it must be said that the same charge can be leveled at the art community at large. The point is made by Suzi Gablick that "Culture in postmodern society has been increasingly 'administered'... controlled by means of corporate management techniques, public relations, and professional marketing." In *Has Modernism Failed?* (New York: Thames and Hudson, 1984) p. 13. (In this sense, we are NOT isolated from the rest of the arts community!)

effects: Monsters, shiny reptilian forms, psychedelic environments, horrifying versions of the human form. Shiny spheres, checkerboards, fractals, and warped human faces show up everywhere, as technical benchmarks, as calendar pinups, and as stars of animation. Such work can be evaluated using criteria such as cleverness, complexity, and visual double-entendre. Yet, in the art world, such technical criteria have traditionally been a secondary issue at best. Thus, work like Arcimboldi's allegories of the seasons, human faces cleverly composed of tiny fruits, vegetables, and other appropriate seasonal items, or Dali's painting of Lincoln's face alternating with a lady's backside as a function of viewing distance will never attain first-rank status, and remain gimmicky technical curiosities. Furthermore, as in special effects, meaningless display of technical wizardry can be used to cover up nonexistent content. Remember the movie *Howard the Duck*?

These stereotypical computer images are recycled so often as to evoke laughter (or groans) from the viewers. Worried by such inbred imagery, artists have tried to point out these errors to the engineers. However, it is *not* easy to clearly explain the difference between artists like Arcimboldi and Leonardo da Vinci, or between illustration and art, and misunderstandings have occurred. Being more "artistic" can be misconstrued as re-rendering old masters instead of the more dubious historical pictures. Demo animations without content can be fixed by adopting stereotypical traditional animation storylines. Mathematics can be used to create sentimental, romantic landscapes. And the marketing departments of hardware and software companies are only too glad to offer it up to the public as art.

The Flip Side

Nowadays computer artists' work comprises the bulk of computer art shows, but where is the revolution? After ousting the engineers from the limelight, the successors do not always offer much additional vision, innovation, or integrity. Artists, too, mimic other art styles. Here too, computer art has many of the shortcomings of the rest of the current art scene. The advantages of imitation notwithstanding, "...work inevitably smothers itself in a receding spiral of stylistic vampirism".[4] In addition they often use tools in trivial ways. Good work is possible, and has been done, with any kind of system, but most does not live up to the inflated claims for "radical difference" or "new ways of seeing," although it does has novelty value. A cautionary statement from seventeen years ago still hold true: "...[a] basic dichotomy is present: on the one hand, those composers and artists who are concerned only with the *act* of being involved with the technology; and on the

4. Dan Cameron, "The New York Problem." *In Flash Art.* No. 152, (1990) p. 120. Referring to work of contemporary New York artists.

other hand, those who use technological means to achieve an end more relevant to the world we live in. Much of the interest in the former tends to die out as the novelty wears off..."[5]

5. Douglas Davis, *Art and the Future.* (New York: Praeger,1973). Quoting an interview with the sculptor James Seawright.

Digitized, manipulated, scaled, warped, repeated, colorized photo collages abound, creating their own family of stereotype. When artists work with canned programs with limited sets of options, they are hard put to add their individuality to the result. More often what we see is appropriated imagery, clip art, instant image libraries which can be permuted endlessly, and carelessly executed "art marks" added for effect. Moreover, all this art is created with great speed. "Faster and denser"[6] might be added to the marketing belief that "newest is best." Just because one can do something fast does not mean everything *should* be done fast.The conclusion is that artists must act as better filters and selectors of the perpetual stream of visual media detritus.

6. Subscription page in *Mondo 2000.* Volume 2, Summer 1990. p. 160.

Many images from mathematics and science are misrepresented as art. At times, artists simply appropriate the images and take them through format and color changes. Just using good design techniques and color selections does not automatically transform images into art, however. This appropriation and piggybacking on other disciplines is a bit of a cheat. On the other hand, artists and designers can be valuable partners with scientists and engineers. (This is especially true in the realm of design, when visual principles can be used for the presentation of information and data.) But computer artists can't just copy science and pass it off as art. An idea must be assimilated, understood, and then transformed, otherwise the result can be merely bad simulacrum of science. The response to "How did you do it?" could become "But they don't even know *how* to do it!"

What other questions may be asked?

Misuse occurs both in the realms of engineering and art. Some images made with the latest techniques are flawless and clever, yet woefully tasteless and content-free. Some images made by people with visual sensitivity and awareness of artistic issues have nothing added to them by having been made on a computer except perhaps the value of self-consciously embracing the new electronic age. Here we get the worst of both worlds: Trivialized research and trivial art. The mutual lack of understanding between artists and engineers is a problem that still needs addressing. Artists and engineers are not yet familiar enough with one another's milieu to know what is first-rate, and what is just a hack. Yet the two groups can be a tremendous resource for one another. Through dialogue and questioning we can begin to clear up some of these misunderstandings.

A technology that is already so integrated into so many levels of work and daily life must have implications for the arts. Yet this certain something in computer art still remains rather elusive.

We can ask other questions besides "How did you do it?" We can ask instead how the process of abstraction inherent in computing may change the basic nature of how we make art. To illustrate this point further, consider the field of experimental mathematics–the discipline created by the intersection of computer science and mathematics. Here, the act of solving problems by formulating them in computational terms has now enabled mathematicians to discover new theorems. This approach is fundamentally different than the more traditional use of computer techniques such as exhaustive searches to solve known problems (such as the four-color theorem). Will a comparable field evolve from the intersection of art and computer science?

What is significant?

We all go on in the belief that there is *something* about computer art that is significant. A technology that is already so integrated into so many levels of work and daily life *must* have implications for the arts. Yet this certain *something* in computer art still remains rather elusive.

At this point consider computer art that has been acknowledged to be worthy. Often-cited successful computer artists include Harold Cohen, Manfred Mohr, Larry Cuba, and Myron Krueger, to mention a few. Looking at their works, we can hardly say they are all alike. Yet their works are the result of a common fundamental premise: All of the artists have devoted a great deal of time and effort to learn how to use computers and have utilized concepts inherent in and inspired by computing. They have developed their own programs and methodologies.

Larry Cuba has used transformations and interpolations in combination with music to produce wonderful abstract studies in rhythm, thus using the computer's ability to continuously transform objects over time. Manfred Mohr's exploration of structure using the computer's repetitive and spatial modeling capabilities results in the spare and elegant studies he has pursued for many years. Myron Krueger's best-known computer-driven video installations called *Videoplace* allow participants' video images to interact with computer-generated "critters" and other images on a video projection screen. It is historically important as one of the first systems to explore the idea of playful human-computer interaction.

Harold Cohen has worked for nearly twenty years on an image generating expert system he calls Aaron. Pamela McCorduck, in her recent

Similarly, computer artists need to be more aware of the concepts, methodologies, and consequences of computing. Only then will they be free to choose the tools they want [...]

book *Aaron's Code*, has cited a number of reasons why Cohen's and Aaron's work is significant. Among these are Cohen's realization that a computer program might represent knowledge that led to the act of making art,[7] that Aaron itself is a work of art that makes art, and that Aaron is a contingent system, analagous to natural systems everywhere–such as weather patterns, or even the way a human being develops "...their presence rule-based but their outcomes (or products) unpredictable."[8] And furthermore, as an example of the intersection of art and AI, "Aaron embraces, embodies, and comments upon some the central ideas of late twentieth-century intellectual ferment".[9] This work is obviously more complex and thought-provoking than most of the work that has been claimed as computer art.

It becomes clear that both the computer software and resulting images or environments bear the stamp of their authors. Perhaps this is why canned programs for artists have their own look, which the artist is often fighting. By learning a programming language the artist has a chance of supplying the direction for his or her work, rather than following the trends of the marketplace.
Not many artists, however, have taken the advice of the composer Dick Higgins who, in 1970, published "Computers for the Arts," a pamphlet suggesting that composers, poets, and artists should all learn a programming language as a means of access to computers. In retrospect, Higgins seems to have hit upon the obvious step to take.

Another way to look at the point is to consider how musicians, writers, and filmmakers know the languages of their respective arts. Similarly, computer artists need to be more aware of the concepts, methodologies, and consequences of computing. Only then will they be free to choose the tools they want and ignore those they find irrelevant.

Learning a computer language is not necessarily easy; it may be one of the hardest tasks at hand for the artist. And it is time consuming. But it is important to keep in mind that the work does not have to look as "perfect" as that on television–the artist is not constrained to one "correct" methodology or visual result. And finally, even if the artist never becomes an expert programmer, the knowledge gained provides perspective, and enables more congenial collaboration, if needed, with engineers and scientists.

Concepts whose origins are in the world of computing offer a wide range of ideas and influences. Among these are the modeling of

7. Pamela McCorduck. "Aaron's Code: Meta-Art, Artificial Intelligence, and the Work of Harold Cohen." (New York: W.H. Freeman and Company, 1991). p. 5.

8. Ibid., p. 7.

9. Ibid., p. 9.

complex behaviors, modularity, languages, self-similarity, branching structures, procedural modeling, simulation, cellular automata and artificial life, the exploration of non-Euclidean spaces, expert systems and the promise of eventual AI. Each raises its own multiple issues and questions: Only a few will be mentioned here.

Simulation, in its computational sense, is the making of computer models of physical processes or natural phenomena. These metaphorical models allow for the replication and study of phenomena which are too complex to apprehend in reality, or enable "impossible" viewings, as in the compression of time or spaces too large to normally grasp. A branch of simulation that is likely to have great effect in a number of fields is Artificial Life. According to Christopher Langton, the organizer of the Artificial Life workshops in 1987 and 1990: "...the general consensus on the "essence" of Artificial Life at the workshop was converging on the following vision: Artificial Life involves the realization of lifelike behavior on the part of man-made systems consisting of populations of semi-autonomous entities whose local interactions with one another are governed by a set of simple rules."[10] These above ideas and those of feedback and chance, of contingency, of adaptation–as with Aaron–and later, artificial evolution, will become increasingly important.

Virtual Reality, as anyone who has recently read *The New York Times*, *The Wall Street Journal*, *The Village Voice*, *Esquire*, *The Face*, or *Mondo 2000* must know, is a type of interactive simulation that allows the participant to be "inside" of an artificial environment. In the most well-known scenarios, the effect of "being there" can be achieved by wearing a headset that displays the synthetic environment through tiny TVs (one for each eye) and provides sound cues. Hand motion is tracked via a "data glove." Real hand motions trigger actions in the virtual space: virtual objects may be handled, or a pointing finger can be used to propel oneself about. Multiple uses are being envisioned for virtual reality: hopefully many will be in the arts. Teresa Carpenter, in an article in the Village Voice tells us that "...my husband [Steven Levy] had reported in Rolling Stone that Eno, Peter Gabriel, and Laurie Anderson were exploring the possibilities of virtual reality for performance. The idea was this:
Each artist would construct a world where he would be joined by the other two. The audience, watching three large screens, could see what each performer was seeing."[11] Virtual Reality, once artists get access to it, may help to redefine how we experience the world.

The idea of human-machine interactivity in art raises multiple issues. In interactive systems, is the creator an artist, a programmer, an inventor, a dungeon master, a collaborator? Is the participant an artist, a

10. Christopher G. Langton, editor. *Artificial Life*. (Redwood City, CA: Addison-Wesley, 1987) p. xxiii.

11. Teresa Carpenter. "Slouching Toward Cyberspace." *Village Voice*. March 10. p. 38.

Our classic notions of originality too may have to change. Is art in the software, the output, or a performance? What is real and what is a copy?

selector of limited options, or someone just having a good time? Do interactive systems show any real options for the participant, other than those already programmed by the system's designer? Who will control its content–from whose viewpoint will the world be presented? Is being a participant rather like being the kid who was given a coloring book to fill in, in his own style, the lines which someone else has drawn?

The idea of a free-flowing dialogue between human and machine is still mostly at the stage of a call-and-response, yet some environments like Myron Krueger's Videoplace have become more conversational. The everyday network communications mechanisms already in place that allow exchange of information all over the world are more flexible at this point, and are actually quite amazing. Networks, news groups, and electronic mail enable information flow all over the world. This communications technology is in the background; there is no conscious "art" to it–it just enables a channel whose content constantly ebbs and flows, depending upon the people involved. This global community of people holds ongoing conversations, exchanges programs and data, and plays in this virtual space. Additional bandwidth will undoubtedly allow for the rapid flow of images and sound. New artists' networks have already been started and may be promising as well.

The social consequences are worth noting too. Consider the danger of becoming obsessed with technique, and absorbed in computers to the exclusion of the real world–a problem that may become more prevalent with virtual reality. Consider the distance an artist puts between idea and execution. It is a tortuous and circuitous route, this maze of instructions, hardware, and code used to produce images. Why do we do it? Do we create these system so that we can finally act as gods of our own little universes? There are also issues of privacy and the control of information–urgent enough to require the creation of groups like the Electronic Frontier Foundation in response to government crackdowns on hackers.

Our classic notions of originality too may have to change. Is art in the software, the output, or a performance? What is real and what is a copy? A loss of commodity status is implied when similar yet unique images may be in abundance. Can a computer program still create originals after the artist has died?

We have embraced the technology and many of its concepts, yet we seldom manage to push our ideas far enough. Perhaps it is a symptom of the immaturity of the discipline that we usually follow old paradigms and metaphors. What we should now be asking is What is the nature of art in our world shaped by science and technology? One way to know will be to gain more knowledge and experience of this science and technology for ourselves.

Conclusion

When will the cultural world at large become more interested in work generated by using computers? It will when computer art breaks out of its ghetto. It will when the promoters stop calling any image generated by a computer for whatever reason "Art." It will when we are more informed about different aspects of computing, algorithms, mathematics, visualization, simulation, and interactivity and how these ideas can affect our culture, instead of blindly appropriating them and passing them off, untransformed, as art. It will when we begin to learn more about our tools and the standards and issues of the rest of the art world. I am not implying that computer art should adopt the forms, ideas, and styles, of mainstream art–that would be denying its uniqueness. I refer, rather, to having an awareness of today's issues, and a comparably high set of standards for discussing work. Computer art needs criticism that is fair, objective, and uncompromising. The trash and the noise must be filtered out. Artists must stop depending on and listening to the apologists and promoters. Inflated marketing terminology won't provide true understanding or direction for computer art. Instead, let us instigate serious artistic and cultural dialogues, and engage in genuine self-reflection. "Nothing kills a legitimate movement faster than the failure to develop a principle of rigorous internal self-criticism."[12]

Some mainstream critics take computer art about as seriously as "spin art," and keep wishing it would die a similar natural death. (Yet I must say that there have been two recent articles in the mainstream art magazine Artforum. One, appearing in the October 1990 issue discussed the images of chaos theory.[13] Cautionary as the review was, it was a positive step. The second, appearing in the April 1991 issue, presented the goings-on in the cyberspace frontier of virtual reality from an art critical viewpoint.)[14]

Perhaps computer art will be noted as an historical curiosity, like Scriabin's "color keyboards," or the allegorical paintings of Guiseppe Arcimboldi. But, I believe that rather than abating like trendy fads, computer art will gain in importance. The mainstream art-world critics should be at least wondering about the significance of its persistence. Criticism from the realm of computer art may assume more significance. This new generation may supplant members of established critical set, but let this new group also be committed to ideas and quality.

Working with computers is difficult—and time consuming. It implies a long-term commitment, a desire to learn the tools well, and leaving the expectation of instant art behind.

12. Charles Newman, *The Post-Modern Aura*. (Evanston: Northwestern University Press, 1985) p.177.

13. Vivian Sobchack, "A Theory of Everything: Meditations on Total Chaos." *Artforum*, October, 1990 pp. 148-155.

14. Vivian Sobchack, "What in the World: Vivian Sobchack on New Age Mutant Ninja Hackers." *Artforum*, April, 1991.

Fine Arts

List of Works

Works are listed in alphabetical order by artist's name; dimensions are in inches, with height preceding width and depth; page numbers refer to the location of reproductions in this book; all cities in the U.S.A. except where noted. All notes are based on information supplied by the entrants; all efforts were made to double check technical information.

Yoshiyuki Abe
(Tokyo, Japan)
Vibrant Drive, 1991
Photographic print, 14 x 20, p. 33
Hardware: IBM AT 80486 compatible and a homebrew frame buffer.
Software: "Raytracer" written in C by the artist.

Stephen Axelrod
(Long Beach, California)
I Las Vegas, 1991
Interactive installation
Hardware: IBM compatible 386/20, Truevision Targa 15,1991 card, Pioneer 600A videodisc player, Carroll touch screen, On-line audio board.
Software: Written by the artist in C and "Toolbook."

John Banks
(Rising Star Graphics; Chicago, Illinois)
Manuscript 42, 1991
Ink jet printout (IRIS), 23 x 24, p. 24
Hardware: Apple Macintosh IIcx, slide scanner, Vista graphics card, Thunderbox, Wacom tablet, PC-compatible.
Software: Adobe Photoshop (Macintosh), Lumena (PC), VIP (Visual Image Processing).

Chiara Boeri
(Visuals, S. P. A.; Milan, Italy)
Abstract, 1991
Ink jet printout (IRIS), 37.4 x 49.2, p. 25
Hardware: Quantel Graphic Paintbox, Iris Graphics 3047 Printer
Software: Quantel
Notes: The goal was to produce exhibition quality artwork using collage methods printed on the Iris printer. VISUALS has written special software to accommodate transparent file handling across all systems. For final output, the computation at print resolution is usually done utilizing either Wavefront rendering software or the Quantel Graphic Paintbox. Just as an example, NURBS-based surface models might be exported to Wavefront via IGES format, then rendered in a high-resolution 3D scene; the entire image could then be exported to the Quantel Graphic Paintbox for image retouching and photo composition, prior to print/output scanning. Of course, the entire process could be carried out in reverse order as well, starting with 2D paintbox image manipulation, and followed by image export for integration with 3D scene rendering. Printing was done on the Iris Graphics 3047 4-color ink jet printer, which is capable of outputting images received from a variety of formats (Wavefront, Quantel, CDRS 200, etc.), and can print on fabric as well as on paper. Print resolution is 12 dots per millimeter (150 DPI, halftone, which is the international standard for top quality art books and magazines).

Semannia Luk Cheung
(Design Vision Inc.; Toronto, Canada)
Soul of Light, 1991
Photographic print, 13 x 24, p. 37
Hardware: Silicon Graphics 4D 25-70, IBM RISC 6000.
Software: Alias 2.4.2.
Process: Ray traced to simulate the dance of light on the crystals.

Jack Cliggett
(Drexel University; Philidelphia, Pennsylvania)
Out of Body, 1990
Photographic print, 8 x 8, p. 25

More Fine Arts

Hardware: Polaroid Spectra System Microtek 3002 Apple Macintosh IIfx System 6.07. Onyx camera, color scanner, 20 Meg RAM, Connectix Maxima. Quantum 170 Meg Hard Drive, SYQUEST 45 Meg removable storage, Apple Macintosh II, 24-bit color video monitor.
Software: Adobe Photoshop 1.1.0.7.

Char Davies
(SOFTIMAGE Inc., Montreal, Canada)
ROOT, 1991
Photographic transparency (backlit Duratran), 42 x 72 x 4, p. 36
Hardware: Silicon Graphics.
Software: SOFTIMAGE.
Notes: The process of using interactive 3D software is a vital element of this work, for the technology allows me to visualize in ways intriguingly related to the content being explored. The three-dimensionality of the working space allows me to bypass the picture plane and create embodied form in virtual space, a process that denies tactility and permits a spatial correspondence between my body and the created form. By simulating the natural interaction of light and shadow with the material surface, I am able to create "realist" effects from our experience of the physical world, yet at the same time–most significantly–I can subvert these and cultural constructs (such as empty, geometric space) to fuse "figure" and "ground."

Diane Fox
(University of Tennesee; Knoxville, Tennessee)
Floating Series #3, 1991
Lithograph, 22 x 27, p. 20
Hardware: Apple Macintosh.
Software: Aldus Pagemaker, Applescan.
Notes: The image is derived from original photographs scanned into the computer, manipulated in Pagemaker, and then produced as a photolithograph with monoprint.

Masaki Fujihata
(Frogs, Inc.; Tokyo, Japan)
Twin King UBU, 1990
Sculpture, 26 x 26, p. 30
Hardware: Stereo lithography.
Software: Designbase.
Notes: One of the goals of computer graphics is sculpture. For me these objects are fruits that I picked up during my exploration into the forbidden field of forms. Normally we cannot touch these kinds of forms but now we can generate the real objects from this data.

Masaki Fujihata
Umiushi, 1990
Sculpture, 20 x 26, p. 17
Hardware: Stereo lithography.
Software: Designbase.
Notes: (same as in *Twin King UBU*)

Jeff Gates
(Baltimore, Maryland)
First Among Equals: A Visual Critique of the Fashion Photographs of Ruven Afanador, 1990
Ink jet printout, 30 x 24, p. 23
Hardware: Apple Macintosh IIcx, Howtek scanner, Fuji ink jet printer.
Software: Studio 8.
Notes: The main photograph was taken directly from a newspaper fashion spread that appeared in the *Baltimore Sun* during the 1988 Summer Olympics. Using the computer's ability to sort and collage, I have added elements which reinforce and comment upon the original photograph's blatant use of gender stereotypes and political iconography.

Darcy Gerbarg
(New York City)
Iceclif, 1990
Painting on canvas, 56 x 56, p. 29
Hardware: Apple Macintosh II, NuVista board, Dunn film recorder, Wacom tablet.
Software: Adobe Photoshop.

Ken Goldberg
(Hollywood, California)
Finger Paint, 1991
Painting on paper, 24 x 36, p. 28
Hardware: IBM RT.
Software: Drawing package for composition.
Notes: Automatix industrial robot guiding artist's finger across fingerpaint.

Jean-Pierre Hebert
(Santa Barbara, California)
Systeme Lunaire, 1990
Pen plotter drawing, 25 x 18, p. 31
Hardware: Sun 4, HP 7585 B plotter.
Software: Written by the artist.

Jean Ippolito
(Ohio State University; Columbus, Ohio)
Temple Illusions, 1990
Lithograph, 22 x 30, p. 28
Hardware: Sun Sparc Station.
Software: Post Imaging Processing (APE) by Jeff Light.
Notes: 4-color lithograph. Ink colors mixed by hand and layered, paper is Rives BFK.

Amy K. Jenkins
(New York City)
Untitled XXXVIII, 1990, p. 22
Photographic print (C-print), 16 x 20
Hardware: Sony Mavika digital camera, Apple Macintosh IIfx.
Software: Adobe Photoshop.
Notes: The artwork is begun by photographing various elements with a digital camera. Those images are then combined and manipulated with a computer system. The artwork is then completed by re-photographing the monitor with a traditional camera with various objects in the foreground. The artwork describes the tension and harmony of elements existing in various states of being that represent the disintegration of the boundaries of real and unreal, seen and imagined.

Eduardo Kac
(Chicago, Illinois)
Omen, 1990
Computer hologram, 8 x 10, p. 35
Hardware: Apple Macintosh II.
Software: Swivel 3D.
Notes: A holographic poem, or holopoem, is a poem conceived, made, and displayed holographically. This means, first of all, that such a poem is organized in three-dimensional space and that even as the reader or viewer observes it, it changes and gives rise to new meanings. Thus as the viewer reads the poem in space–that is, moves around the hologram–he or she constantly modifies the structure of the text. A holopoem is not a poem composed in lines of verse and made into hologram, nor it is a concrete or visual poem adapted to holography. The sequential structure of a line of verse corresponds to linear thinking, where as the simultaneous structure of a concrete or visual poem corresponds to ideographic thinking.

Azuma Kawaguchi, Akihiko Matsumoto
(Kawaguchi Design Studio, and Akihiko Matsumoto Photo Office; Tokyo, Japan)
Song (from the series Opera Arias), 1989
Photographic print, 29.4 x 41.3, p. 18
Hardware: Personal Computer PC-9801 RA (NEC), i80387, Super Frame.
Software: Super Tableau PREMIUM (Sapiance Corp.).
Notes: This work is made from the cooperative work of a photographer and a computer graphics artist.

Michael King
(City of London Polytechnic; London, England)
Apocalypse Then, 1991
Photographic print, 32.5 x 25.1, p. 33
Hardware: PC-compatible.
Software: "Sculptor," written by the artist.
Notes: The modeling software works only with spheres; the image has roughly 20,000 spheres.

Michael Klug, John Underkoffler
(MIT Media Lab; Cambridge, Massachusetts)
Breakfast Attempt, 1990
Reflection holographic stereogram, 11.5 x 14.5, p. 34
Hardware: Symbolics LISP Machine, HP/SGI/DEC workstations, in-house custom printing hardware.
Software: S-Geometry for modeling, Rendermatic in-house for rendering.
Notes: This work represents the state of the art in standard polygonal rendering techniques and full-color computer graphics reflection stereogram technology as of the date of its completion. Characteristics such as realistic reflection mapping, texture mapping, transparency and even shadows combine to form a very realistic image. The creation of this piece entailed a two-step process. In the first, conventional modeling and rendering software was used to construct the depicted scene, with the systems modified to produce renderings distorted in accordance with the eventual requirements of the subsequent optical holography step. The computer was then instructed to generate three hundred views of the scene, which were rendered from slightly-differing viewpoints arrayed evenly along a line and representing the eventual location of the viewer's eyes. In the second half of the process, color-separated film footage of the views was laser-projected, frame by frame, in a holographic setup to produce three hundred separate, contiguous holograms on a single holographic plate; this was repeated for each of the three color-separated channels. Finally, these three "master" plates were carefully registered and optically combined into a single "transfer" hologram. This hologram reconstructs each of the original three hundred views (with the three color channels now overlapping) in distinct but abutting regions of space, so that a viewer's eyes always intercept rendered views of the scene that are appropriate to their location. Included in the work are three distinct images, comprising an extreme left, a middle, and an extreme right view of the stereogram subject matter. The holographic stereogram itself exhibits striking, stable colors and an uncanny tangibility

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that result from work in color-control technology and non-distortive holographic geometries undertaken at the MIT Spatial Imaging Group; these techniques are as yet unduplicated and unavailable, to the best of our knowledge, anywhere else in the world.

Daniel Langlois, Char Davies, Georges Mauro
(SOFTIMAGE Inc., Montreal, Canada)
SAND, 1990
Installation with photographic transparencies (backlit Duratran), sand and rocks, 42 x 72 ea. image, 9 cu. ft., p. 39
Hardware: Silicon Graphics.
Software: SOFTIMAGE.
Notes: The installation consists of two independent curved walls, each 8 ft. x 8 ft. set up on 10 ft. x 10 ft. of floor, set with a curved backlit transparency on each wall. The two images that comprise the entry SAND are frames from a 3D computer film currently in progress. Exhibiting them as still images gives us the opportunity to focus attention on their content as metaphor. Although all the objects in the scene are synthetic, they are wrapped with textures that were digitally scanned from actual rocks and sand. Taken out of context from the film, the view of the beach is a meditative image in which time, represented by the lapping water on the shore, stands still. The under-the-surface image immerses viewers in a moment in time and place where our human bodies cannot usually go. The SAND scene used to create the beach image has 850 models of pebbles and 125,00 triangles. The scene used for the under-the-surface image has 400 models of pebbles and 150,000 triangles. Both scenes contain multiple lights and raytraced shadows, transparency, reflection, refraction, and fog–as well as texture maps digitally scanned from actual rocks and sand. The deformation effect visible in the under-the-surface image was created with refraction. All modelling, animation and material definition were accomplished interactively with the 3D animation software SOFTIMAGE.

Gordon Lescinsky
(University of Illinois; Chicago, Illinois)
Spruce, 1991
Ink jet printout (IRIS), 42 x 72, p. 26
Hardware: AT&T Pixel Machine.
Software: Original program in C using Pixel Machine's DEVtools.

Gary Lindahl
(University of Illinois; Chicago, Illinois)
Windowscapes, 1990
Video installation
Hardware: Truevision Targa Graphics card/camera, Diaquest edit controller.
Software: Written in RT1.
Notes: Sound by Sumit Des.

Catherine Malloy
(Santa Fe Interactive; Santa Fe, New Mexico)
The Flying Dream, 1990
Photographic print, 28 x 32, p. 25
Hardware: Apple Macintosh IIcx w/8 Mb RAM, Raster Ops 264 board & La Cie's read/write CD storage, Barneyscan c/s 3535 Slide Scanner.
Software: Adobe Photoshop.
Notes: Shot 35 mm slides of "component" imagery, assembled and manipulated them with Adobe Photoshop in 24-bit mode. The 9000K file was output to 35 mm color negative and printed as a traditional color photo print.

Marsha J. McDevitt
(Ohio State University; Columbus, Ohio)
Triangles I Have Known, 1990
Photographic print, 20 x 24, p. 36
Hardware: Sun 4/110, Parallex Frame Buffer, Solitaire Film Recorder.
Software: Ohio State University/ACCAD custom software.

Benoit Maubrey
(Die Audio Gruppe; Berlin, Germany)
Audio Ballerinas, 1990
Performance
Hardware: Electronic Clothes with Digital Memories and Loudspeakers.
Notes: The performers record and reproduce sounds using computer chips; they use solar or battery power.

Don P. Miller
(University of Wisconsin; River Falls, Wisconsin)
Chindi Frieze #4, 1990
Ink jet printout, 7.25 x 25, p. 22
Hardware: Amiga 1000 w/15 Meg. RAM, Panasonic WV-1400X black and white video camera for input of live and photographic copy, Xerox 4020 ink jet printer.
Software: Digi-View and Digi-Paint by NEW TEK, TOPEKA KS.

Lisa A. Moline
(Teikyo Marycrest University; Davenport, Iowa)
Female Monarchy, 1990
Etching, letterpress, and dot-matrix printout, 28 x 14, p. 26

Hardware: IBM PC, dot matrix printer.
Software: Drawing Assistant.
Notes: The hand-drawn computer graphics were printed directly on the etching.

Eve Mosher
(Texas A&M University; College Station, Texas)
Putti, 1990
Ink jet printout, 14.4 x 24, p. 25
Hardware: SunStation, Matrix-QPR.
Software: Artisan.

F. K. Musgrave, C. E. Kolb, and B. B. Mandelbrot
(Yale University; New Haven, Connecticut)
Zabrisky Point, 1990
Ink jet printout (IRIS), 20 x 40, p. 40
Hardware: Network of 9 DEC 5000 workstations.
Software: C-Linda, Optik Raytracer (custom).
Notes: The painted deserts of the American Southwest are the inspiration for this rendering. The variety of pastel tones is evoked with a procedural texture. This image was conceived as a technical illustration for the mirage model, seen in the foreground. It also serves as a sophisticated color study, through the use of stochastic color functions.

Barbara Nessim
(New York City)
Random Access Memories, 1991
Interactive installation
Hardware: Apple Macintosh IIx.
Software: MacPaint, Hypercard.
Notes: This installation consists of a computer sitting on a table; connected to it is a mouse pointing device. Next to the computer is a laser printer, a paper cutter and a stapler. The computer screen displays, at 2-second intervals, 200 different drawings, input by hand via digitized drawing tablet. A click on the mouse deletes the drawings and brings up 18 flags on the same screen. The viewer/participant selects a flag on the screen, with the mouse pointing device. A sequence of drawings appears, selected randomly from the 200 drawings. In addition, 16 drawings are selected randomly to create a mini-book. The laser printer delivesr an 8.5" x 11" piece of paper printed with 8 drawings on one side. On the other side there are six drawings including the image of the flag selected as the front cover and some informative text for the back cover. The layout of the drawings enables the viewer/participant to construct the mini-book (2.75" x 4.25"). Instructions are provided for the proper folding, cutting, and stapling. By interacting with the computer, all participants share in creating their gift, the miniature book. Because of random selection no two books are the same. Each mini-book is a unique work of art.

Sean Nixon
(Brooklyn, New York)
Borrowings #1, 1990
Photographic print, 20 x 24, p. 21
Hardware: Apple Macintosh IIfx.
Software: Adobe Photoshop, Nikon slide scanner.

Erol Otus
(El Cerrito, California)
Self Portrait, 1991
Ink jet printout, 36 x 30, p. 34
Hardware: IBM AT, TARGA 32 & VISTA Graphics Boards, Summagraphics Tablet.
Software: GiantPaint and Vista Tips Paint Systems. 1642 x 1745 pixel image painted entirely on the computer.
Notes: Using a computer to create images offers something unavailable in any other medium: The ability to retain many copies of an image at different stages of development, and view or work on them easily at any time.

Dean Randazzo
(Evans & Sutherland Computer Corp.; Salt Lake City, Utah)
Dual, 1991
Hologram, 15 x 21, p. 34
Hardware: Evans and Sutherland ESV 3+.
Software: Custom.

Susan Ressler
(Purdue University; West Lafayette, Indiana)
From Stone to Bone, 1991
Photographic print (Cibachrome), 24 x 30, p. 19
Hardware/Software: Kodak Premiere, Targa Board, TIPS.
Notes: Source material was recorded via still video as well as conventional photographic transparencies. All manipulations done on Premiere.

Kathleen Ruiz
(New York University, New York City)
Separating With Pain, 1991
Ink jet printout (IRIS), 24 x 47, p. 27
Hardware: Apple Macintosh II.
Software: Adobe Photoshop, Truvel Scanner, Iris Graphics Printer.
Notes: My work is concerned with the forms and structure of nature as essentially spiritual. Working within the ephemeral realm of the computer naturally enables this exploration.

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Ellen Sandor, Stephan Meyers
($(Art)^N$ Laboratory; Chicago, Illinois)
The Equation of Terror (tryptich), 1991
Stealth Negative PHSCologram,
24 x 130, p. 35
Hardware: AT & T Pixel Machine, SUN III, SUN IV, RAYLIB, PICLIB.
Software: Written by the artists.
Notes: $(Art)^N$ is a collaborative comprised of artists, computer technicians, mathematicians, and scientists who have developed a new 3D visualization medium called a "Phscologram" (pronounced *skol-o-gram*) that mimics the effects of holography, although it is generated through the use of computers and four-color process printing. In the phscologram process, we start with multiple views (usually thirteen) of a scene, and slice them into very thin vertical colums with a computer. We then mix all the vertical columns from all the images to make a single image. This mixing process is called interleaving. We then laminate this image onto the back of a piece of plexiglass. Onto the front of the plexiglas, we laminate a barrier screen, which is a sheet of black film with thousands of vertical slits. These tiny slits allow you to see only one image at a time from any angle. Since your two eyes are separate, they are at different angles to the phscologram, and you see a different image in each eye. Once the images are in the computer, they are interleaved to form a computer tape. This is then output on a high-resolution prepress scanner. This scanner produces four black and white images, each of which corresponds to a single colour; these are used to expose transparent Cibachrome film. The scanner also prints the barrier screen. After the barrier screen and the film are laminated onto the opposite sides of the plexiglas, the finished work is displayed in a lightbox or sculpture.

Mechthild Schmidt
(New York City)
Underdog is flying, 1991
Photographic print, 12 x 48, p. 38
Hardware/Software: Video Camera, Quantel Paintbox and Harry.
Notes: The end of apartheid seems near. A still frame evokes the idea of motion and time; as the dancers move, the image transforms itself from color to black and white.

Peter Schröder
(Thinking Machines Corp.; Cambridge, Massachusetts)
The Gold Triptych–Artifacts from an Alien Religious Site (left: *Chaos*, center: *Conception*, right: *Order*), 1991
Photographic prints (C-print),
30 x 37.5 ea., p. 32
Hardware: Connection Machine System 2, Matrix film recorder.
Software: Artificial Evolution software by Karl Sims.
Notes: The images were computed on a massively parallel computer, the Connection Machine System 2. The images are represented in symbolic, resolution-independent form and were recorded for the submission slides on a Matrix camera at a resolution of 1280 by 1024 pixels. The final prints will be made from a 12.21K by 10K resolution to insure that no pixel artifacts can be detected in the final print. The system uses artificial evolution to generate the images. Symbolic mathematical and procedural representations (the genes) are mutated to give rise to changing images. The act of selection (and thus guidance of the evolutionary process) is performed by the artist. Creating images with this system incorporates a large element of chance while at the same time the artist is in ultimate control (the God, so to speak, of this evolutionary universe) and can push the evolution in a desired direction by mimicking the process of natural selection in the sense of best fit to the artist's vision. This element of chance forces the artist to cooperate with the process of evolution, and thus to give up some autonomy, and at the same time gives to the artist images that would be impossible to generate if one had to actually come up with the algorithmic description of the final image oneself. By running this system on a massively parallel computer, the interactivity necessary for this process of negotiation is made possible.

Jill Scott
(Lumagraphics Productions, and Perceptive Systems Pty.; Sydney, Australia)
Machinedreams, 1990
Interactive installation
Hardware: IBM 286, ENSONIC SAMPLER, MIDI control, five video cameras, VOX 4 input mixer/monitor, U-matic player, video monitors.
Software: Written by the artist.
Notes: Sound by Andrew Quinn.

Bill Seaman
(Paddington, Australia)
The Watch Detail, 1990
Interactive installation
Hardware: Apple Macintosh II, Interface from modem port to Pioneer 4200 NTSC

Display Sony PVM 2" monitor, Mixer with effect send/receive.
Software: Hypercard, Alessis MIDI Proverb reverb.

Kenneth Snelson
(Kenneth Snelson Inc.; New York City)
Chain Bridge Bodies, 1990
Photographic prints (stereo pair), 40 x 100, p. 35.
Hardware: Silicon Graphics Personal Iris.
Software: Wavefront Technologies.
Notes: Most people familiar with graphics computers have heard the expression "free viewing" or "free fusion" of stereo images, a fool-the-eye method of seeing stereo pictures in 3D without the aid of a device. Free fusion is also a delight for the spatial senses once the technique is mastered. At last year's SIGGRAPH, a friend told me he'd grown so used to free viewing on his computer that the instant he sees two stamps on an envelope he instinctively refocuses hoping that they might turn out to be in stereo. On a graphics computer, system permitting, one can use two software camera windows side-by-side, and view directly in 3D to readily place object on the z axis without the need for electronic spectacles.

Jennifer Steinkamp
(Art Center College of Design; Pasadena, California)
Marbelizing a Void (Images 0, 1, 50 and 100), 1991
Ink jet printouts, 11.5 x 11.5 ea., p. 38
Hardware: Silicon Graphics 25 TG.
Software: Alias.

Eva Sutton
(New York City)
Disintegration #13, 1990
Photographic print, 36 x 40, p. 21
Hardware: PC-compatible, Howtek scanner, Apple Macintosh, Sun 3, Dunn film recorder.
Software: Lumena, Adobe Photoshop, written by the artist.
Notes: By appropriating imagery from photographs (primarily old prints found in junk shops, flea markets and garbage bins) and recombining these images (by computer), I create a kind of a digital photo-montage. Relying on the nearly seamless quality with which the computer can mix or overlay images and because of the historical verisimilitude which photographs possess, the works exist as falsely constructed historical relics. The purpose of such a relic is to invite the viewer into "trusting" the image with feelings of familiarity and nostalgia, while simultaneously subverting these feelings by presenting elements in juxtapositions that may be perceived as uncomfortable or ambiguous. Various computer systems were used to "build up" a composite of multiple images. Source material was scanned into a PC running Lumena paint program using a flatbed scanner. Images were digitally overlaid within Lumena to create the resulting composite. The composite was then subjected to various image processing filters on the PC, a Mac II (primarily using Photoshop software) and a Sun 3 workstation (using software written by the artist) to achieve the final result. Images are then output to a film recorder onto 8 x 10 b/w sheet film.

Michael Tolson
(XAOS, Inc.; San Francisco, California)
Phage, 1991
Installation
Hardware: Silicon Graphics Iris.
Software: Xaos Tools, written by the artist in the C programming language.
Notes: "PHAGE" from the Greek word phagos meaning "one that eats," is literally a work in progress, driven by the metaphor of image-as-ecosystem. The title derives from the fact that the visible image at each moment constitutes a snapshot of a population of brushstrokes that is in constant flux, with each stroke, as an independent dynamic entity that is born, evolves and dies, leaving its imprint as it grazes on fields of color, texture, and light. Since these strokes are modifying their environment as they themselves evolve, what results is a non-linear, or "chaotic" system, which will never repeat itself. Apart from the system's evolving population of strokes, there are ongoing global "geologic" processes of metamorphosis, erosion, drift, and accretion as well as "atmospheric" processes of changing light and shadow. The image is evolving in real time on a Silicon Graphics 4D workstation, and being output at standard video resolution via a framebuffer.

Clara Claudia Vera
(Chicago, Illinois)
La Difunta Correa, 1990
Installation
Hardware: Apple Macintosh II.
Software: Adobe Photoshop.
Notes: The installation is composed of two wooden tables, one shorter and a little bit wider than the other. The room is semi-dark. On the top of the shorter table there is an unglazed clay basin full of

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water. In this basin, computer manipulated images of body gestures and common personal objects like a wedding ring and a baby pacifier are reflected in the water by a hidden camera. The images are to be experienced like apparitions of miracles. On the taller table there is a clay plate into which white water is dripping from the ceiling very slowly. This is an element of time and of allegory common to everyday life. On the floor surrounding these tables, in no particular order, are several clay, wood, plastic, and metal jars, platters and other objects. Some of these objects have been broken and put together again. Also some other things like fruits and vegetables are cast in clay and transformed by using color or textures. This spiritual space will carry with it the memory or perception of offerings proffered by those who considered this place to be sacred in another mental and emotional time.

Annette Weintraub
(New York City)
Reconstruction, 1990
Laser Printouts, 31 x 47, p. 20
Hardware: Apple Macintosh II, 8 Mb, Raster Ops 364, Personal LaserWriter.
Software: Studio 8; Studio 32, Adobe Photoshop, PosterWorks.
Notes: Twenty five laser prints tiled and laminated on Lenox paper. This work incorporates photographic fragments of historical and contemporary structures as well as core elements of architectural language. I altered photo fragments in which architectural conventions (such as window, column, arcade, frieze, vault, facade, and figurative ornament) are dematerialized, combined, and layered. I also included vernacular artifacts of urban environments in the form of signage and fragments of type. Superimposed over this collage of fragments are transparent linear pattern elements which imply the grid of the city, architectural plans, and cloth patterns—the "fabric of the city". Compositing is done with a computer; the photo fragments are digitized, then altered, manipulated and repainted. I have chosen to work in a pixelated, low resolution mode, instead of using the capacity of the software to create photorealistic images. The broken and fragmented quality of the images is consistent with my content and I like the contrast between the broken quality of the image seen close up and its more photographic reading at a distance. Additionally, the pixel/grid element represents a tie between my art in traditional media and the signature imprint of the computer. The images in this series were output as tiled and laminated laser prints. The grid of tiled pages also reintroduce an element of the patterning grid and repetition of the urban environment.

Hui Chu Ying
(University of Akron; Akron, Ohio)
Equilibrium #A, 1990
Silkscreen, 80 x 104, p. 29
Hardware: Apple Macintosh II.
Software: PixelPaint.
Notes: My concern as an artist centers on the integration of computer graphics with the silkscreen printmaking process. The involvement of computer technology symbolizes the mechanical and rational thought processes of the human mind. Discipline and order, strongly emphasized by my Chinese heritage, are brought about during the early stages of the artwork and are continued throughout the entire process. I translate the computer prints into a finished piece of artwork with the use of traditional silkscreen media. Each of the works are made up of fragments which go together to create a larger whole. These works are rearranged on different days to exploit the multiple variations possible within the limits I have established.

Design

List of Works

Works are listed in alphabetical order by company; dimensions are in inches, with height preceding width and depth; page numbers refer to the location of reproductions in this book; all cities in the U.S.A. except where noted; all works created in 1990-91 except where noted.
All notes are based on information supplied by the entrants; all efforts were made to double check technical information.

Adobe Systems Marketing Communications
(Mountain View, California)
1991 Type Calendar
Calendar, 11 x 8.5, p. 56
Adobe Systems Marketing Communications (designer)
Gail Blumberg (art director)
Jim Hildreth (illustrator)
Adobe Systems Inc. (client)
Hardware: Apple Macintosh II, Linotronic 300 (output).
Software: Adobe Illustrator, Adobe Photoshop, Adobe Type Library.

Adobe Systems Marketing Communications
Adobe Systems Inc. Annual Report, 1989
Annual report, 11 x 8.5, p. 51
Luanne Seymour Cohen, Karla Wong (designers)
Luanne Seymour Cohen (art director)
Jim Hildreth (illustrator)
Adobe Systems Inc. (client)
Hardware: Apple Macintosh II.
Software: Adobe Illustrator, Adobe Patterns and Textures, Adobe Photoshop, Adobe Separator, Aldus PageMaker.

Az-zet
(Moscow, USSR)
From Easel to Machine
Poster, 32 x 46, p. 49
Andreer Andrej (designer)
Hardware: IBM PC.
Software: Paintbrush.

Clement Mok Design
(San Francisco, California)
Video F/X
Brochure, 8.125 x 4.25, p. 55
Clement Mok (designer)
Doris Mitsch (art director)
Digital F/X (client)
Hardware: Apple Macintosh IIcx.
Software: Adobe Photoshop, Pixel Paint Professional.

Cornell University Publications Services
(Ithaca, New York)
1789: A Salute to the French Revolution
Book, 10 x 8.5, p. 54
Deena Wickstrom (designer)
Richard Howland-Bolton (illustrator)
Cornell University Library (client)
Hardware: Apple Macintosh II
Software: Microsoft Word, Aldus PageMaker 3.0, Fontographer.
Notes: The original font was created with Fontographer software so that the English translation would recreate the feeling of reading the original text in French. It took one month to create the font.

Cranbrook Design Studio
(Bloomfield, Michigan)
The New Discourse: Cranbrook Design 1980-1990
Poster, 37 x 27.5, p. 45
P. Scott Makela (art director)
Cranbrook Academy of Art (client)
Hardware: Apple Macintosh IIfx, Scitex Visionary.
Software: Adobe Photoshop.

Crocker Inc.
(Boston, Massachusetts)
Innovation Systems Summit
Poster, 28 x 22, p. 45
Martin Sorger, Bruce Crocker (designers)
Bruce Crocker, Martin Sorger (art directors)
Martin Sorger (illustrator)

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Idea Scope Associates (client)
Hardware: Apple Macintosh IIcx, AppleScan.
Software: Aldus Freehand, Aldus PageMaker.

Cyberdada
(Doncaster East, Australia)
Cyber-All-Night-Rave
Poster, 11.7 x 8.25, p. 49
Troy Innocent (designer)
Jeff Jaffers (client)
Hardware: Apple Macintosh, Apple IIc.
Software: Aldus Freehand, Multiscribe.

Design Vision, Inc.
(Toronto, Canada)
BCE Place Office Interior
Architectural rendering, 22 x 20, p. 72
Mary Lynn Machado (illustrator, designer)
Del Terrelonge (art director)
Santiago Calatrava (architect)
Yabu Pushelberg (interior design)
Brookfield Development Corp. (client)
Hardware: Silicon Graphics 4D 25-70.
Software: Alias 2.4.2.

design : Weber
(Hilliard, Ohio)
Columbus Page
One-page ad, 17 x 11, p. 57
John Weber (designer)
Rudy Vanderlans (art director)
John Weber (illustrator)
Emigre Magazine (client)
Hardware: Apple Macintosh IIcx, Apple Portrait Display, Hewlett Packard Scan Jet Plus.
Software: Aldus Freehand, Image Studio, Superpaint.

design : Weber
Design Circus
Poster, 20.25 x 13.125, p. 49
John Weber (designer)
John Weber (art director)
John Weber, Rudy Vanderlans (illustrators)
Columbus Society of Communicating Arts (client)
Hardware: Apple Macintosh IIcx, Apple Portrait Display, Hewlett Packard Scan Jet Plus.
Software: Aldus Freehand, Image Studio, SuperPaint, Aldus PageMaker.

Evans & Sutherland Computer Corp.
(Salt Lake City, Utah)
Turbo Coupe
Car rendering, 14 x 11, p. 71
Lon Zaback (designer)
Evans & Sutherland Computer Corp. (client)
Hardware: Evans & Sutherland ESV Graphics Workstation with Advanced Rendering System (ARS) Hardware.
Software: Conceptual Design and Rendering (CDRS).
Notes: CDRS is an industrial design software package that runs exclusively on Evans & Sutherland workstations.

Evans & Sutherland Computer Corp.
Sports Car
Car rendering, 11 x 14, p. 71
Gary Morales (designer)
Evans & Sutherland Computer Corp. (client)
Hardware: Evans & Sutherland ESV Graphics Workstation with Advanced Rendering System (ARS) Hardware.
Software: Conceptual Design and Rendering (CDRS).

Graphics Press
(Chesire, Connecticut)
Envisioning Information
Book, 10.75 x 8.875, p. 55
Edward Tufte (designer)
Hardware: Apple Macintosh II, Scitex.
Software: Adobe Illustrator, Microsoft Word, SuperMac PixelPaint Professional.

IBM San Jose Design Center
(San Jose, California)
A Decade of Innovation
Three-dimensional award, 10.75 x 10.75, p. 66
Randall Sexton (designer and art director)
IBM Corp. (client)
Hardware: IBM Main Frame/Host System.
Software: IBM CADAM, CATIA, NC Machining.
Notes: Each step–or "terrace"–in the piece represents an improvement in capacity, performance, reliability and floor space spanning 10 years–implying a decade of innovation.

Landor Associates
(San Francisco, California)
Hyatt Hotels Corporate Identity Program
Standards manual, 11 x 14, p. 60
Dean Wilcox (designer)
Margaret Youngslvod (art director)
Bruce McGovert, Peter Kesselman, Linda Clark (illustrators)
Hyatt Hotels (client)
Hardware: Apple Macintosh IIx, Apple Macintosh IIci, Apple Macintosh SE.
Software: Adobe Illustrator, Quark Xpress, Microsoft Word.

Landor Associates
Air India
Furniture, 8 x 10, p. 70
Richard Kung, Patrick Poinsot (designers)

Richard Kung (art director)
Air India (client)
Hardware: Apple Macintosh II.
Software: DynaPerspective, Studio 8.

Landor Associates
Building As Sign
Architectural rendering, 8.5 x 11, p. 69
Richard Scheve (designer)
Lynnly Labovitz (art director)
Bruce McGovert, Keith Cottingham (illustrators)
Hardware: Apple Macintosh IIfx with 300 Mb Hard drive, RasterOps 19" Color Monitor with 24 bit Videocard, Sharp flatbed scanner, 35 mm BarneyScan, Relax external cartridge drive with 44 Mb removable cartridges
Software:

Lisa Levin Design
(San Francisco, California)
Zimberoff Promo
Book, 6 x 4, p. 56
Lisa Levin (designer and art director)
Tom Zimberoff (photographer)
Tom Zimberoff Photography (client)
Hardware: Apple Macintosh IIcx, AppleScan.
Software: Aldus PageMaker 4.0.

Lisa Levin Design
Helmet Package
Package, 6.375 x 12.25 x 9.25, p. 67
Lisa Levin (designer and art director)
Roger Paperno (photographer)
Specialized Bicycle Components (client)
Hardware: Apple Macintosh IIcx.
Software: Aldus PageMaker 4.0, SuperMac PixelPaint.

Liska and Associates Inc.
(Chicago, Illinois)
NEC CD-ROM
Brochure, 5 x 5.375, p. 51
Brock Haldeman, Richard Taylor (designers)
Steven Liska (art director)
NEC Technologies, Inc. (client)
Hardware: Apple Macintosh IIci, NEC CD-ROM reader.
Software: Quark Xpress, Microsoft Word, Adobe Illustrator.

M plus M Incoporated
(New York City)
JCH Calendar, 1989
Calendar, 19.5 x 33.75, p. 59
Takaaki Matsumoto (designer)
Takaaki Matsumoto, Michael McGinn (art directors)
JCH Group Ltd. (client)
Hardware: Apple Macintosh IIcx.
Software: Adobe Illustrator.

Macworld Magazine
(San Franciso. California)
An Exercise in Utilities
Illustration, 11 x 8.5, p. 65
Steve Lyons (illustrator)
Nancy Paynter (art director)
Macworld Magazine (client)
Hardware: Apple Macintosh.
Software: SuperMac PixelPaint Professional.

Macworld Magazine
Data Safety
Illustration, 11 x 8.5, p. 64
John Hersey (illustrator)
Joanne Hoffman (art director)
Macworld Magazine (client)
Hardware: Apple Macintosh.
Software: Aldus Freehand.

Margo Chase Design
(Los Angeles, California)
Escape Club
CD cover, 12.25 x 12.125, p. 57
Margo Chase (designer and art director)
David Provost, Sydney Cooper (photographers)
Atlantic Records (client)
Hardware: Apple Macintosh IIci.
Software: Adobe Illustrator 3.0, Quark Xpress.
Notes: All line art logos and type were created or set on the Apple Macintosh. Mechanicals were pasted up using lino output and position prints for color and then separated and stripped in the traditional way.

Margo Chase Design
Beautiful World
Type design, 14.75 x 11, p. 52
Margo Chase (designer and illustrator)
Margo Chase Design (client)
Hardware: Apple Macintosh IIci.
Software: Adobe Illustrator 3.0, Adobe Photoshop.
Notes: The lettering was created using Adobe Illustrator. The daisy was scanned in, separated and colored with Adobe Photoshop.

Mark Anderson Design
(San Francisco, California)
Set Type in Your Sleep, 1989
Poster, 20 x 15, p. 48
Earl Gee (designer)
Mark Anderson, Earl Gee (art directors)
Earl Gee, George Jardine (illustrators)
Z Typography (client)
Hardware: Apple Macintosh IIcx, Linotronic L-300 (output).
Software: Quark Xpress, Adobe Illustrator, Aldus Freehand, Apple MacDraw.

More Design

Notes: One of a series of three posters for a supplier of typography, announcing the new night shift hours, depicting a happy art director catching some ZZZs content that his typographic needs are being met.

Mark Anderson Design
Type on Wheels, 1989
Poster, 20 x 15, p. 48
Earl Gee (designer)
Mark Anderson, Earl Gee (art directors)
Earl Gee, George Jardine (illustrators)
Z Typography (client)
Hardware: Apple Macintosh IIcx, Linotronic L-300 (output).
Software: Quark Xpress, Adobe Illustrator, Aldus Freehand, Apple MacDraw.
Notes: One of a series of three posters for a supplier of typography, announcing speedy delivery service, conveyed by the moving image of a checkerboard-zooming Z on wheels.

Mark Anderson Design
24-Hour Turnaround, 1989
Poster, 20 x 15, p. 48
Earl Gee (designer)
Mark Anderson, Earl Gee (art directors)
Earl Gee, George Jardine (illustrators)
Z Typography (client)
Hardware: Apple Macintosh IIcx, Linotronic L-300 (output).
Software: Quark Xpress, Adobe Illustrator, Aldus Freehand, Apple MacDraw.
Notes: One of a series of three posters for a supplier of typography, announcing 24-hour turnaround, symbolized by an upside down 24 combined with spiraling hours, overlapping a field of arrows.

Patterson Wood Partners
(New York City)
Spector Report
Newsletter, 18.25 x 28, p. 52
Caroline Kavanaugh (designer)
Peg Patterson (art director)
Various (illustrators)
Spector Group (client)
Hardware: Apple Macintosh IIcx.
Software: Aldus PageMaker 4.0, Quark Xpress, Aldus Freehand.

Pentagram
(New York City)
Setting a Course for Leadership in Global Telecommunications
Illustration, 10.5 x 9, p. 64
John Hersey (illustrator)
Peter Harrison (designer and art director)
MCI Communications Corporation (client)
Hardware: Apple Macintosh II, IIcx, Crossfield (output).
Software: Adobe Illustrator, Adobe Photoshop, SuperPaint, Quark Xpress.

Pentagram
(in collaboration with Dentsu Inc., Osaka; OUN Corporation, Tokyo; Intradesign, Inc., Los Angeles)
Hotel Hankyu International
Logotype System, various dimensions, pp. 60-61
Michael Gericke, Donna Ching (designers)
Colin Forbes, Michael Gericke (art directors)
McRay Magleby (illustrator)
OUN Corporation (client)
Hardware: Apple Macintosh IIcx.
Software: Adobe Illustrator.
Notes: The concept behind the idea of a system of stylized flowers was to express luxury by differentiating every item in the hotel with special detail. Hand-drawn images were scanned into the computer, manipulated, and refined. Applications include signage, room folders, stationary, packaging, menus, and other amenities.

Pentagram
Afga Compugraphic Macintosh-Based Systems
Brochure, 8.5 x 11, p. 50
Harold Burch (designer)
Peter Harrison, Harold Burch (art directors)
David Ball, Martin Haggland, Harold Burch (illustrators)
Chip Simons, Roger Warner, Paul Avis, Bill Whitehurst (photographers)
Agfa/Compugraphic (client)
Hardware: Apple Macintosh IIx and IIcx, Agfa 9800 (output).
Software: Adobe Illustrator, Quark Xpress.
Notes: This brochure documents the development of a poster done for Agfa Compugraphic. The central device is a photograph of an apple which has been manipulated in a number of ways using Agfa systems' graphic technology.

Pentagram
NY Art Directors Club 1991 International Exhibition
Poster, 35.5 x 24, p. 47
Michael Gericke (designer and art director)
Donna Ching, Daniel Drennan (illustration assistants)
New York Art Directors Club (client)
Hardware: Apple Macintosh IIcx, Compugraphic 9000 PS Max and Crossfield Separation System (output).
Software: Adobe Illustrator, Quark Xpress.
Notes: The client submitted the text on an IBM disk, which was input in the Apple Macintosh system and manipulated with

the Quark Xpress program. In its final form, the "camera-ready" was contained in a floppy disk that was sent to the color separator and output as press-ready plates through a Crossfield separation system.

Pentagram
Design and Advertising into the 90s, 1989
Poster, 36 x 22, p. 46
Woody Pirtle, Penny Rowland (designer)
Woody Pirtle (art director)
Libby Carton, Jared Schneidman (illustrators)
Designers & Art Directors Club (client)
Hardware: Apple Macintosh IIx.
Software: Adobe Illustrator.
Notes: This poster promoted the Designers and Art Directors Club's first annual British/American design and advertising converence and awards presentations which were featured live in New York City via satellite from London.

Primo Angeli Inc.
(San Francisco, California)
Lipton 100th Anniversary Tea Tin
Package, 5.125 x 4.5 x 4.5, p. 67
Primo Angeli (designer)
Carlo Pagoda (art director)
Mark Jones, Mark Crumpacker (illustrators)
Thomas J. Lipton, Inc. (client)
Hardware: Apple Macintosh.
Software: SuperMac PixelPaint Professional, Adobe Illustrator.

R/Greenberg Associates
(New York City)
Sharpvision
Illustration, 11 x 8.5, p. 62
Bob Bowen (illustrator)
Ryszard Horowitz (designer)
Bert Blum, Griffin Bacal Advertising Inc. (art director)
Sharp Electronics, Inc. (client)
Hardware: Pixar, Silicon Graphics Iris, Sun 4, Apple Macintosh II, LTV drum film recorder.
Software: Meshwarp, IM Renderer (in-house), Electronic Dark Room (EDR), Adobe Photoshop.
Notes: The 2D warps were done with Meshwrap (on the Pixar), and the 3D warps were done with IM Renderer. The overall composite was done with EDR, a raster editor that runs on the Pixar.

R/Greenberg Associates
Cages
Illustration, 17.625 x 23.625, p. 63
Bob Bowen (illustrator)
Ryszard Horowitz (designer)
Deborah Yaffe, McCann Erickson Advertising, Inc. (art director)
AT&T, Inc. (client)
Hardware: Apple Macintosh IIfx, Silicon Graphics Iris, Sun 4.
Software: Adobe Photoshop, IM Renderer.
Notes: The 3D models were created with IM Renderer, and all images composited with Adobe Photoshop.

Reactor Art + Design
(Toronto, Canada)
Festival of Festivals 1990
Poster, 36 x 24.5, p. 44
Louis Fishauff (designer)
Toronto Film Festival (client)
Hardware: Apple Macintosh IIfx, Scitex (output).
Software: Adobe Illustrator 88, Letrastudio, VIP.

Reactor Art + Design
Fun With Computers, 1989
Poster, 27 x 19.5, p. 44
Louis Fishauf (designer)
Topix Computer Animation (client)
Hardware: Apple Macintosh IIfx, ScanMan Scanner, Scitex (output)
Software: Adobe Illustrator 88, Letrastudio, VIP

Reed Design
(Madison, Wisconsin)
Calendar Clock
Calendar, 4 x 9 (open), p. 58
Gail Bothum (designer)
Stan Reen (art director)
John Besmer (writer)
Reed Design (client)
Hardware: Apple Macintosh II, IIci, IIfx.
Software: Aldus Freehand, Aldus PageMaker.

Sackett Design
(San Francisco, California)
The *AART Group*
Stationary, various dimensions, p. 61
Mark Sackett (designer and art director)
Chris Yaryan (illustrator)
The AART Group (client)
Hardware: Apple Macintosh II.
Software: Adobe Illustrator.

Sackett Design
Marin Ballet Nutcracker
Poster, 22 x 22, p. 46
Mark Sackett (designer and art director)
Chris Yaryan (illustrator)
Marin Ballet (client)
Hardware: Apple Macintosh II.
Software: Adobe Illustrator.

More Design

SHR Design Communications
(Scottsdale, Arizona)
Audi 100/200
Brochure, 12 x 10.25, p. 54
Karin Burklein Arnold, Miles Abernethy (designers)
Barry Shepard, Karin Burklein Arnold, Steve Ditko (art directors)
Carol Hughes (illustrator)
Rick Rusing (photographer)
Audi of America, Inc. (client)
Hardware: Apple Macintosh II.
Software: Adobe Illustrator, Aldus PageMaker.
Notes: The design, layout, and the majority of the graphics in this piece were done on the computer. Camera-ready art was prepared conventionally.

SHR Design Communications
SHR Christmas Card, 1988
Card, 11 x 4.5
Douglas Reeder (designer and illustrator)
Douglas Reeder, Barry Shepard (art directors)
SHR Design Communications (client)
Hardware: Apple Macintosh II.
Software: Adobe Illustrator.

SOS
(Los Angeles, California)
All But the Obvious
Book, 5.5 x 9, p. 58
Susan Silton (designer)
Los Angeles Contemporary Exhibition (client)
Hardware: Apple Macintosh IIx.
Software: Aldus Freehand, Aldus PageMaker 4.0.

SOS
Symmetry
Book, 8 x 9, p. 57
Susan Silton (designer)
Los Angeles Contemporary Exhibition (client)
Hardware: Apple Macintosh IIx.
Software: Aldus Freehand, Aldus PageMaker 4.0.

Sullivan Perkins
(Dallas, Texas)
Intertrans Annual Report
Illustrations, 8.5 x 11, p. 64
Linda Helton, Lisa Johnson (illustrators)
Linda Helton (designer)
Ron Sullivan (art director)
Intertrans Corporation (client)
Hardware: Apple Macintosh IIx, Radius Gray Scale Dual Page Monitor, LaserWriter IINT, Microtek MSF 300G.
Software: SuperPaint 2.0, Adobe Illustrator 1.9.3, Quark Xpress.

Taylor & Browning Design Associates
(Toronto, Canada)
1990 Brazilian Ball Poster
Poster, 33 x 26.25, p. 43
Paul Campbell (designer)
Paul Browning, Paul Campbell (art directors)
Paul Campbell, David Drummond (illustrators)
Brazilian Ball Committee (client)
Hardware: Apple Macintosh IIci Linotronic L-300 (output).
Software: Adobe Illustrator, Quark Xpress, Adobe Separator.
Notes: The color was separated with Adobe Separator, and the film was generated on the L-300

Texas Instruments
(Dallas, Texas)
Sun Watch
Product rendering, 10 x 14, p. 70
Paul Leighton (designer and art director)
Hardware: Apple Macintosh IIci.
Software: Stratavision 3D 1.4.2, Adobe Photoshop 1.0.6.

The Design Work
(Los Angeles, California)
Radius Inc. 1990 Annual Report
Annual Report, 11 x 8.5, p. 59
Tony Hyun (designer and illustrator)
Tony Hyun, Toni Hollander (art directors)
Sollecito Photographer (photographer)
Radius, Inc. (client)
Hardware: Apple Macintosh II, Radius 19" monitor and DirectColor with PrecisionColor calibrator and QuickColor accelerator, Mass Micro drives and cartridges.
Software: Quark Xpress, Adobe Photoshop, Adobe Illustrator.
Notes: This annual report was designed and executed completely on a Radius Publishing System which consisted of a Radius 19" color display, the DirectColor/24 Interface, and the PrecisionColor Calibrator. The Apple Macintosh IIx computer was accelerated by a Radius QuickColor Graphic Engine. The photographs were scanned into a Scitex system and then converted to the Photoshop file format. Then they were retouched and enhanced with Photoshop, converted back to the Scitex format, placed in the Quark Xpress layout, and output to film via Gateway pre-press link.

The Office of Reginald Wade Richey
(Denver, Colorado)
Santa Monica Place Design Criteria Eatz
Brochure, 12.5 x 21.875, p. 55
Karl Hirschmann (designer and illustrator)
Reginald Wade Richey (art director)
The Rouse Company (client)
Santa Monica Place Design Criteria
Hardware: Apple Macintosh II.
Software: Adobe Illustrator 88, Aldus PageMaker 3.01.

The Office of Reginald Wade Richey
Santa Monica Place Design Criteria
Brochure, 12.5 x 36.5
Karl Hirschmann (designer and illustrator)
Reginald Wade Richey (art director)
The Rouse Company (client)

THIRST
(Chicago, Illinois)
ESSE by Gilbert
Promotional Book, 14 x 10.5, p. 53
Rick Valicenti, Michael Giammanco (designers)
Rick Valicenti (art director)
Todd Leif (writer)
Corinne Pfister (photographer)
Gilbert Paper (client)
Hardware: Apple Macintosh IIcx
Software: Aldus Freehand 2.0
Notes: This piece was printed by 29 different commercial printers across the U.S.A.

TW Design
(Atlanta, Georgia)
TW Self-Promo
Brochure, 6.25 x 6.25, p. 50
Andi Counts, Gregg Heard, DJ Teeslink (designers and illustrators)
TW Design (client)
Hardware: Apple Macintosh II, Linotronic 300 (output).
Software: Aldus PageMaker, Aldus Freehand, Adobe Photoshop, Adobe Illustrator.

TW Design
TW Stationary Package
Stationary, various dimensions
Gregg Heard (designer)
DJ Teeslink (art director)
TW Design (client)
Hardware: Apple Macintosh II, Linotronic 300 (output).
Software: Aldus Freehand.

TW Design
Corporate Presentations Promo
Brochure, 9 x 4, p. 56
Gregg Heard, DJ Teeslink (designers and illustrators)
Corporate Presentations (client)
Hardware: Apple Macintosh II, Linotronic 300 (output).
Software: Aldus PageMaker, Aldus Freehand, Computer Eyes.

TW Design
Tommy Nobis Annual Report
Annual Report, 11 x 8.5, p. 53
Andi Counts (designer and illustrator)
Tommy Nobis Center (client)
Hardware: Apple Macintosh II, Itek.
Software: Aldus PageMaker, Adobe Illustrator.

Uro Designs
(San Jose, California)
APO Knife
Product design, 10.5 x 1 x .5, 12.5 oz. (weight), p. 66
Greg Hicks, Jeff Hanna (designers)
Bill Stumpf of Circle Studios, Santa Clara, Calif. (photographer)
Uro Designs (client)
Hardware: IBM RT/PC.
Software: IBM Architecture & Engineering Series (AES).
Notes: The objective of this project was to produce an ergonomically correct and aesthetically pleasing multipurpose outdoor knife. The design had to prove extremely durable and function equally as well underwater as it would on land. Additionally, only minimal grip strength would be required for it's effective use. The extra thickness of the blade lends this design to a multitude of cutting tasks, including heavy duty chores. The grip design has proved to be of substantial benefit to individuals wearing gloves while working. Grip and pinch strength data were collected from fifteen individuals. Additional observations were made with computer designed prototypes of this knife, while they were used to perform a variety of underwater cutting tasks. Each APO knife is entirely handmade by Pat Crawford.

Waters Design Assoc. Inc.
(New York City)
Graphika
Book, 12 x 18.5, p. 52
Carol Bouyoucos (designer)
John Waters, Dana Gonsalves (illustrators)
David Arky (photographer)
James River Corp. (client)
Hardware: Apple Macintosh IIcx, Lightspeed Design 10.
Software: Quark Xpress, Adobe Illustrator.

More Design

Wiggin Design Inc.
(Darien, Connecticut)
Downtown Manhattan Map
Poster, 33.75 x 22, p. 47
Gail Wiggin (designer)
Martin Haggland (illustrator)
Jeff Kellner (photographer)
Jones Lang Woootton (client)
Hardware: Apple Macintosh II, Agfa Compugraphic SelectSet 5000.
Software: Adobe Illustrator.
Notes: This project was completely produced with Adobe Illustrator and output to 9-color film on Agfa's new SelectSet 5000. First time ever [according to entrant] that 9 color film was output, enlarged 160%, and still registered.

Zero One
(Glendale, California)
Loft Design
Architectural rendering, 13 x 16.5, p. 68
Robert Hennigar, Troy Viss (designers)
Zero One (client)
Hardware: Silicon Graphics Personal Iris 4D 25 TG.
Software: Alias Studio 3.0.

Animation

List of Works

Works are listed in alphabetical order by artist's name; length is in minutes and seconds; all cities in the U.S.A. except where noted. All notes are based on information supplied by the entrants; all efforts were made to double check technical information.

Seton Coggeshall
(University of Illinois; Chicago, Illinois)
End, 1991
3/4" videotape, 2'59"
Hardware: AT&T 386 WSG, TrueVision Targa 16.

Susan Alexis Collins
(Chicago, Illinois)
Going For Goldfish, 1991
3/4" videotape, 2'00"
Hardware: Amiga 2000.
Software: Deluxe Paint III.
Notes: A commission for the Manchester Olympic Festival Exhibition.

Gene Cooper
(Kansas City Art Institute; Kansas City, Missouri)
Passage, 1991
VHS videotape, 4'51"
Hardware: PC compatible, Targa board.
Software: Digital Arts.
Notes: This piece deals with spatial relationships in a person's journey through space.

Cyberdada
(Melbourne, Australia)
Cyberdada Manifesto Video, 1991
3/4" videotape, 5'50"
Hardware/Software: Spaceward SuperNova System using Art 8 and Art 24, Image generation on Quantel Paintbox.
Notes: A man jacks into the global matrix and moves through a number of Cyberdada virtual worlds. After something close to a religious experience in cyberspace he digitizes and lives in the matrix.

Tessa Elliott
(Middlesex Polytechnic; Herts, England)
Configuration, 1991
3/4" videotape, 8'20"
Hardware: Silicon Graphics Iris.
Software: Written in C by artist.
Notes: The work is an inquiry into the imaging of eternity through the use of Euclidean geometry. The "seed motif" of the animation is a traditional Celtic curvilinear interlacing form. The rate of change in the configuration is intended to raise questions about perception, illusion, and Western philosophy. At the very end the computer is calculating curves. The fixed viewpoint tells of another reality.

Masa Inakage
(The Media Studio, Inc.; Tokyo, Japan)
Spirals, 1991
VHS videotape, 1'10"
Hardware: NEC PC 9801 VX2 with transputer.
Software: SUPER TREK ray tracing renderer.
Notes: Music by the artist.

Jeff Jaffers
(Melbourne, Australia)
Meltdown, 1991
3/4" videotape, 30'00"
Hardware: Mirage, Abacus A64, ACO, SuperNova, Amiga, Silicon Graphics Personal Iris, Paint Box.
Software: Various.

Nancy Kato
(The School of Visual Arts; New York City)
Visions From The Amazon, 1991
3/4" videotape, 2'38"
Hardware: Silicon Graphics 4D 25 TG.
Software: Alias 3.0.

More Animation

Stephan Meyers
(Illinois Institute of Technology; Chicago, Illinois)
Tie the Knot, 1991
3/4" videotape, 4'14"
Tie the Knot
Hardware: AT&T Pixel Machine 964d.
Software: Piclib, custom.

Mark Neumann
(Hi-Res; New York City)
Breathing Room, 1991
3/4" videotape, 1'30"
Hardware: Amiga 500, Symbolics 3650.
Software: S-Paint.
Notes: MTV commissioned the artist to do two V.J. background environments using 10 second loops. This one is slotted for a new late night show to be airing soon. Artist uses an Amiga 500 to rough out ideas before getting on the Symbolics, and also to compose the soundtrack. S-Paint was used for creating the images and maps.

Thomas Porrett
(Ardmore, Pennsylvania)
Mystery Street, 1991
3/4" videotape, 16'00"
Hardware: Macintosh II fx, RasterOps 364 board, Microtek 300Z Scanner, MacRecorder, NuVista+ Board, Yamaha DX-7s, Yamaha TX16W (synthesizers), Alesis Quadraverb (sound processor) and Casio RZ-1 (drum machine).
Software: PhotoShop, MacroMind Director, RasterOps videocapture software, and Vision MIDI sequencer.
Notes: This piece is a 16-minute long sequence of images derived from digitized video and still photographs that have been edited in MacroMind Director to create a flow of visual imagery with what might be termed visual counterpoint. This has been achieved by using overlapping matrices of pictures to amplify and extend meaning. Visual complexities have been woven in with varied cultural references to create an allegorical Mystery Street, that symbolizes aspects of contemporary life in these times. A variety of events, circumstances, relationships are encountered to evoke the sense of celebration, excess, desperation, and mystery. The sound track was created with digitized sound from video and original music created on digital instruments using MIDI devices. The entire piece has been placed on an 80-megabyte hard drive that operates the piece in real time. Mystery Street, was exhibited at the Institute of Contemporary Art in Philidelphia for the Artists Choose Artists exhibition, and ran continuously for six weeks. The videotape is a direct realtime recording utilizing a NuVista+ card.

Dan Sandin
(University of Illinois; Chicago, Illinois)
A Volume of Two-Dimensional Julia Sets, 1991
3/4" videotape, 2'00"
Hardware: AT&T Pixel Machine.
Software: Custom written in the RT/1 and C programming languages.
Notes: The visualization of 3D fractal objects is very difficult because they are not made up of polygons and normals are not defined. John Hart developed the raytracer which uses distance estimation to intersect the ray with the object and approximate the normals. My intention with the animation controlling software that I wrote, is to produce a dramatic and dynamic exploration of this particular fractal. Original music and audio effects by Laurie Spiegel. Mathematical research by Lou Kauffman. Visual Leadership by Tom DeFanti.

Ellen Sandor
(Illinois Institute of Technology; Chicago, Illinois)
The Politics of Pleasure (extended remix), 1991
3/4" videotape, 3'30"
Hardware: AT&T Pixel Machine 964d, ECHO Scanner.
Software: Piclib, custom.
Notes: The marriage of art and science meets desktop music in this piece, exploring three basic themes of our time. First, the face of sexuality in the nineties; second, the issue of censorship; third, the thrust of pop culture as represented in remixing and sampling.

Suponwich Somsaman
(The School of Visual Arts; New York City)
inside, 1991
3/4" videotape, 2'50"
Hardware: SUN3, SGI Iris 4D 25 TG.
Software: Alias 3.0.

Peter Voci
(New York Institute of Technology; Old Westbury, New York)
Random Face Generator, 1991
VHS videotape, 3'00"
Hardware: DEC Micro PDP-11.
Software: Images II+.
Notes: Final version contains millions of combinations which cross-dissolve at various time patterns. Music is by Frank Military.

Richard Wright, Jason White
(Middlesex Polytechnic; Herts, England)
Superanimism, 1991
VHS videotape, 3'00"
Hardware: VAX 8530, IKON Framestore, SpaceWard, SuperNova, Sony BVU Recorder.
Software: Artist's 'Rayscan' 3D animation software, SpaceWard SuperNova Paint System.
Notes: This animation is primarily about the problem of reconciling a sense of what it means to be human and alive with the intrusion of the technology or artificial life. This is achieved not just by the presentation of objects as organic entities but by using the also semantically relevant technology of computer animation to shift this arena to the symbolic world of computer simulation, where tight control of modelling, animation, and photo-realistic effects can probe this boundary on several levels and with greater visual breadth. The structure of the animation is based around a 3D modelled surface of the video screen itself, which functions as an interface (window/barrier/mirror/ surface) between the artificial world of the machine and the external world of natural organisms. This surface incorporates aspects of the physicality of the human body and contrasts them with the artificiality of mechanical motion, alternating between the two, from scenes of body painting and "invasive" surgery reflected in a metallic plane, to whirling rivers of stone revealing a latent organic power, coagulating into sheets of the fossilized remains of dead life.

Z Communication
(New York City)
Organic Building Corp. Promotion
Videotape, 1' 56"
Jennifer Nelson (designer)
Nicolae Zeletineanu (art director)
Jay Goodman (illustrator)
Organic, Inc. (client)
Hardware: Apple Macintosh IIci, VTR.
Software: MacroMind Director.
Notes: This program sets the guidelines for the corporate identity manual and presents the company's capabilities to investors.

Jurors

Fine Arts and Design

Timothy Binkley
Fine Arts Juror
Timothy Binkley is chair of the M.F.A. Program in Computer Art and Director of the Institute for Computers in the Arts at the School of Visual Arts in New York. Having received a Ph.D. in philosophy from the University of Texas, one of Dr. Binkley's primary philosophical concerns centers around the questions raised by the use of computers in making art, and he has written numerous papers on this subject. Dr. Binkley is in the process of completing a book/software package titled "Symmetry Studio" to be published in December 1991 by Van Nostrand Reinhold. He is also working on a book about virtual reality. Dr. Binkley has created a number of interactive computer art installations, and has also created several software packages that put powerful mathematical tools in the hands of those with little or no technical training. Through the InterComm project at the Institute for Computers in the Arts, he has also worked on the development of real-time interactive telecommunications art projects that connect artists in different locations who work together to produce collaborative works.
Dr. Binkley is currently the chair of the New York City chapter of ACM/SIGGRAPH.

Eleanor Flomenhaft
Fine Arts Juror
As Executive Director and Chief Curator of Contemporary Art at The Fine Arts Museum of Long Island, Eleanor Flomenhaft has coordinated

More Jurors

over 200 exhibits and catalogs. Ms. Flomenhaft is also developer of new programs, writer of grants, and organizer of fund raising events at the museum. Her exhibits have been seen in many museums throughout the United States and the world. Ms. Flomenhaft is the leading expert on Cobra art in the United States, and is the author of *The Roots and Development of COBRA Art*, published in 1985, which is the first book in the English language on that important Abstract Expressionist European group. She has also developed the first museum-centered computer imaging showcase in America providing computer assisted art exhibits and computer hardware and software for visitors' use. Ms. Flomenhaft received the Presidential Award for outstanding contributions to the arts in the Long Island community in 1984.

Cynthia Goodman
Fine Arts Juror
Cynthia Goodman is an independent art critic and curator in New York City. Dr. Goodman received a Ph.D. in Art History from the University of Pennsylvania, and also specializes in Art and Technology. She authored the book *Digital Visions: Computers and Art*, which was published in conjunction with the Computers and Art exhibit at the Everson Museum in Syracuse in 1987. She has worked at the IBM Gallery of Science and Art since 1988 as program director and, more recently, on a consulting basis. Before that, Dr. Goodman was working on a Prototype Computer Project for the Solomon R. Guggenheim Museum in New York. Dr. Goodman has participated in numerous lectures and panels addressing the history of computer art and its aesthetics, and has acted as director for the Arttransition '90 conference at the Massachusetts Institute of Technology.

Kent Hunter
Design Juror
As creative director of Frankfurt Gips Balkind, an integrated communications agency based in New York and Los Angeles, Kent Hunter directs a team of designers on assignments that include annual reports, corporate magazines and newsletters, book projects, posters, and multi-media presentations. Mr. Hunter oversees the execution of design from concept to finish on a company-wide Apple

Macintosh computer network. Designers create print publications, video storyboards, 3D visuals, and advertising layouts at their electronic work stations. The mechanicals are then finalized and output by an in-house electronic production department. Mr. Hunter's work has been recognized by the AIGA, Mead Show, AR 100, Communication Arts, STA 100, Graphis, The Society of Publication Designers, and the New York Art Directors Club. Among his most recent honors are award-winning annual reports for Time Warner, Associated Press, and The Limited.

Isaac Victor Kerlow

Fine Arts and Design Juror, Chairman

Isaac Victor Kerlow is an artist and designer who has worked with computer graphics technology since 1980. Mr. Kerlow is also Associate Professor of Computer Graphics and founding Chairman of the Computer Graphics Department at Pratt Institute, where he developed a B.F.A. and an M.F.A. Programs in Computer Graphics for the School of Art and Design. Mr. Kerlow has lectured and written books and articles on computer-based visual creation in several languages, including *The Student Edition of PageMaker 4.0*, published this year by Addison-Wesley, and *Computer Graphics for Designers and Artists*, a reference and textbook he co-authored in 1986. His computer-generated artwork, including his work with 3D computer graphics, printmaking and painting, has been exhibited at international museums. Mr. Kerlow is currently working on a new project that examines the influence of electronic technology on the creation, distribution and consumption of artistic imagery and visual information.

David Peters

Design Juror

David Peters is an Associate of Two Twelve Associates, Inc. in New York City, where he is the designer of interactive and electronic media projects. As consultant to Citicorp/Citibank, he has been developing the interface for the next generation of touch-screen banking machines. His interest in design culture led him to Düsseldorf, Germany where he spent two years learning European design firsthand: He created the corporate identities and packaging that launched several hardware and software companies. Previously, Mr.

More Jurors

Peters co-founded Graphic Design Associates, one of the first design consultancies in Atlantic Canada. As principal he directed design programs for numerous institutions of the arts, commerce, and government. He taught at the Nova Scotia College of Art and Design and served as president of the Graphic Designers of Canada/Atlantic Chapter. In Manhattan, he occasionally lectures at The New School for Social Research and is currently co-chair of the MacUsers group of the American Institute of Graphic Arts/New York Chapter.

Donald M. Rorke
Design Juror (3D category)
Donald M. Rorke, Executive Vice President of Design (Worldwide) for The Knoll Group, has over thirty years experience in professional design, management, and teaching. His unique career with both private industry and the U.S. government has included senior positions in operational, administrative, and design management. These positions have covered new product design and development, graphic design, interior design and space planning, architecture, facilities planning and management. Mr. Rorke earned Bachelor of Fine Arts and Masters of Industrial Design degrees from Syracuse University, and has recently taken part in special programs at the Harvard Graduate School of Design. He has served also as a panel member and lecturer on design at seminars and colleges throughout North America. Mr. Rorke was Chairman of WORLDESIGN 88/NEWYORK, a quadrennial international conference and exhibition hosted by the Industrial Designers Society of America (IDSA) involving the most visionary designers in the world who represent 52 societies of industrial design in 37 countries and who influence over $100 billion worth of annual sales in world markets.

Judson Rosebush
Fine Arts Juror (animation category)
Judson Rosebush is a producer and director of computer animation, an author, and media theorist. He graduated from the College of Wooster in 1969 and received a Ph.D. from Syracuse University. He has worked in radio and television broadcasting, sound and video production, print, and hypermedia. He completed his first computer animations in 1970 and

founded Digital Effects Inc. in New York (1978-1985), one of the companies that introduced computer animation to the commercial marketplace. Dr. Rosebush is the co-author of *Computer Graphics for Designers and Artists*, published in 1986 by Van Nostrand Reinhold Co. He is currently completing a book on computer animation, and he is also the author of the serialized *Pixel Handbook*. He currently produces and directs a wide variety of special effects work for film and video, during the past year he co-authored and directed one-hour television programs on *Volume Visualization and HDTV* and *The Quest for Virtual Reality*. Dr. Rosebush also consults and lectures on animation, aids in software and facility planning, and writes–text as well as software.

Wendy Richmond

Design Juror

Wendy Richmond is co-director of the WGBH Design Lab, in Boston. The Design Lab produces computer-based multimedia projects and develops design guidelines for interactive multimedia. Ms. Richmond started designing with and for computers in 1979 as a graduate student at the Massachusetts Institute of Technology. She has led teams to develop computer-based tools for the graphic arts, and was a participant in the formation of Bitstream and Lightspeed. She is a recipient of many design awards, a National Endowment for the Arts grant, and has served as an NEA panelist. Ms. Richmond taught design at the School of the Museum of Fine Arts, Boston, and is a member of the Professional Council for the New School of Design, Boston. She is on the National Board of Directors of AIGA. Her column "Design Technology" has appeared in *Communication Arts* since 1984, and she is the author of *Design & Technology: Erasing the Boundaries*, published by Van Nostrand Reinhold.

The quotes presented here are representative of the varied–sometimes contradictory–feelings that artists, designers, programmers and engineers have towards using computer graphics technology in art and design. This is the framework in which many of the works shown here were produced.

For the Record

Artists who can grasp the new technology may have a much more direct opportunity to redefine our idea of nature than they did when their media were limited to painting and sculpture. [...] The natural world was never before overrun with the kind of artificiality that now permeates it, but one's conception of it has always been a man-made construct.

Jeffrey Deitch and D. Friedman, ed., *Artificial Nature*, Deste Foundation for Contemporary Art, Athens, 1990.

Women use computers at work **more than men** (41% versus 30%). 46% of all American children **are using** computers at school or at home. In *1984*, 30% of kids between 3 and 17 years old used **computers**.

Census Bureau Data, *Newsweek*, April 8, 1991, p. 8.

Technological *splendor did not always bring graphic* **progress.**

Estelle Jussim, "Changing Technology Changes Design," *Graphic Design in America*, Harry Abrams, Inc., New York, 1989, p. 113.

I have a fine arts background and I enjoy putting my hand to a piece of paper. I don't believe the computer will ever replace an original rough sketch. I cannot see myself just sitting at a computer and punching numbers.

Luckily we have reached a point where almost all media are computer processed in some way or another–if not by electronic pre-press system then by a time base corrector. Now everybody is a computer artist whether ***he or she wants***

to be one or not.

Joann Tansman, in "BBDO: Art Directing Crosses Tech Threshold," *Art Direction*, August 1990, p. 43.

Judson Rosebush, "The Proceduralist Manifesto," *Leonardo 1989 Supplemental Issue*, p. 55.

For us, the computer **is** a design tool.

It is really an extension of how we see and think, and of the traditional tools, such as pen, pencil, brush, grid and T-square, which we use to express and communicate our ideas. I'm not interested in the digital imagery of computers that has come to be associated with 'computer graphics.' It is not a look, or a style, or a trend that we're involved with here, but **an engaging**

mental

e x e r c i s e

as we solve communication problems.

John Waters, "A Computer for All Reasons," by Susan Braybrooke, *PRINT*.

One of the products of personal-computer design is the birth of a dense, furiously active look, the antithesis of the cool simplicity that has been considered model design in recent years. And all this visual cacophony is now acceptable because it is not the product of primitive cut and paste but the output of a sophisticated laser printer.

Karrie Jacobs, "Prototype," *Metropolis*, July/August 1988, p. 94.

I have my hands and my mind

I don't need any equipment

Distressed artist (identity witheld at artist's request), 1991.

In the new computer age the proliferation of typefaces and type manipulations represents a new level of visual pollution ***threatening*** our culture. Out of thousands of typefaces, all we need are a few basic ones, and **trash the rest.**

Massimo Vignelli, invitation for a lecture in New York City, February 1991.

No one understands the consequences of how computers are going to produce change. They are extremely clumsy instruments. As a tool-quite contrary to what people think of their flexibility and their aptitude-they are v e r y p o o r s u b s t i t u t e s for the archaic, old-time methodology. But they tend to dominate people's abilities and imaginations, so that in response to that particular tool, they do things they would not do normally for any other reason. And as a result of that, there really is going to be a different aesthetic in the Nineties because of the computer. What the aesthetic will be I have no idea.

Milton Glaser, in "Goodbye to the Eighties, Quotes by Designers," *Metropolis*, October 1989, p. 80.

I am sorry, our computer is down. We have to use the print out.

Overheard telephone conversation between designer and client, 1991.

The important point

is to recognize ***where***

handwork ends and

Frederic W. Goudy, prolific American type designer (1865-1947).

machine work begins.

People who work here have to know computers. Our working pace has changed now, so I can't bring in a designer who uses a drawing table–we don't even have a drawing table.

Javier Romero, in "At Home With High Tech Designing," *Art Direction*, August 1990, p. 46.

`ERROR: stackoverflow OFFENDING COMMAND:`

Upset laser printer, 1991
(serial number witheld
at the laser printer's request).

I don't under-stand the technique but I know what I want.

Manhattan Art Director
(identity witheld at art director's request).

The level of work done today with microcomputers is quite

amazing if you

compare it to what could be done three or four years ago.

Optimistic Art and Design Show Chair, 1991.

Without
new design
principles and
concepts we will
be faced with a
multimedia
Tower of
Babel

Muriel Cooper, in an interview by Steven Heller, *Graphic Design in America*, Harry Abrams, Inc., 1989, p. 99.

I know very little about how this stuff actually works. And one **probably** doesn't need to know anymore than most of us really have to understand our automobiles or our television sets. We get by **all right**, so long as there is someone readily available to put them right when they go wrong. It may be partly this fear of having to **really** understand the technology that makes computers appear so hostile to the uninitiated.

John Waters, "A Computer for All Reasons," by Susan Braybrooke, *PRINT*.

Computers are like another country. People who design computers and write software are like foreigners. They live there, in the computer country, and speak the language fluently. The rest of us visit, incorporating words from their language into ours, the way we incorporate words and phrases from French. *C'est la vie,* **we say.** *Load that onto the hard drive,* **we say.**

Karrie Jacobs, "Design for the Unreal World," *Metropolis*, September, 1990, pp 43-45.

To produce books, ads or magazines with desktop technology often means that electronic files from designers, illustrators, photographers and writers are merged into one huge cauldron of digital data. There is ample opportunity for plagiarism-witting or unwitting-and the near certainty of going undetected.

Catherine Farley, "Electronic Revelations," *Applied Arts Quarterly*, p. 29.

(Thenthereistheeleme ntofsurpriseacomput-erbrings)Itopensupth eideaofchance.Youhit *thewrongbuttonan*-d**allofasudden**you've gotdotsalloveryourl-ogo.Accidentsareusu allythebestthingsto-happentomywork.

April Greiman in *New American Design*, by Hugh Aldersey Williams, Rizzoli International Publications, New York, 1988, pp 182-189.

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