Dr. Bill

SCAN

anarchy in the arts: '94 the techno-revolution

The 14th ANNUAL SYMPOSIUM ON SMALL COMPUTERS IN THE ARTS

November 4th - 6th, 1994
The Franklin Institute Science Museum
Philadelphia, Pennsylvania

SCAN BE:

Symposium:

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Mark Scott, Vice-President
Misako Scott, Secretary-Treasurer
Heather Collins, Misako Scott, Symposium Coordinators
Brian Souder, Chuck Lutz, Music Program, Performance Coordinators
Tom Porett, Leslie Cohen, Art Exhibition Curators
Leslie Cohen, Art Exhibition Designer

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SMALL COMPUTERS IN THE ARTS NETWORK

Presents

The 14th Annual Symposium on Small Computers in the Arts

The Franklin Institute Science Musem

November 4th - 6th 1994Philadelphia, Pennsylvania

anarchy in the arts:the techno-revolution

The traditional bureaucracies of the art world are being challenged by the decentralization of the toos of production, and the evolution of artist-controlled distribution systems. More people are able to get involved in more kinds of art than ever before.

Today, nearly everybody who buys a personal computer gets some kind of paint program free; most of them try it out and some of those will turn out to be artists. These people who may have had no exposure to traditional art instruction, and may not have been inclined to pick up a sketch pad or paint set.

Composers of multi-instrumental musical works are now able to hear their compositions performed on their own MIDI synthesizers, and no longer have to work within a large institution to gain access to a suitable group of performers.

Visual artists are establishing virtual galleries on the Internet. Could this be the beginning of a new distribution system for artists' art? Could this be the beginning of Anarchy in the Arts?

The 14th Annual Symposium on Small Computers in the Arts

is Sponsored by:

Small Computers in the Arts Network, Inc.

and

The Franklin Institute Science Museum

With Very Special Thanks to:

Ed Wagner, Joseph Moore, ZeeAnn Mason, Jeff Bechtle and the Franklin Institute Staff

Rick deCoyteand Michael at Silicon Gallery

Olde City Arts Association

Cati Laporte, Post Stamp Artist, NY NY

Hower Byer at CD Comix

Bill Kolomyjec from PIXAR

Ellen Reynolds, Annenberg School of Communications, University of Pennsylvania

Rosa Snare & Kathleen Allen , Bucks County Community College

Rebecca Mercuri, and the ownerof the flop-house for wayward musicians

Sylvia Pengilly and Tim Duffield for their kindnesses

Dock Street Restaurant & Brewery

and our volunteers William Montgomery, Martin Snyder, Gloria Buccini, Gretchen Trainor

Brian James and Kim Troup

Enjoy Your Stay

The Franklin Institute Science Museum

20th Street & Benjamin Franklin Parkway
Philadelphia, PA 19103
215 • 448 1200

Visit the Franklin Institute's Science Center and Mandell Futures Center, where hands-on science exhibits originated. Participate in everything! Stroll through a giant heart or learn about the environment while exploring a rain forest. Take a ride on a locomotive or climb abosrd a model space station. Watch as your face ages 25 years on a video monitor! Catch *Grand Canyon: The Hidden Secrets* in the Tuttleman Omniverse Theater, with a four story domed, wrap-around screen that puts you in the middle of all the action.
In the Fels Planetarium you can explore space and astronomical phenomena.

And don't forget STAR TREK: FEDERATION SCIENCE
Navigate from the Bridge, play Gravity Billiards, become a Klingon, Step into the Transporter and experience VR on another planet.

First Friday's in Olde City

"The most entertaining way to to 35 galleries and showrooms of Fine Art, Antiques Furniture and the Decorative Arts."
City Paper says,
"First Fridays in Olde City is the best way to show off Philadelphia,"
and it was voted one of the
"things about Philly you couldn't live without."

Maybe you'll need a cab to get back, although they're everywhere:
Olde City Cab 338 0838 ***Quaker City Cab 728 8000*** ***Yellow Cab 829 4222***

Local Restaurants:

Ben's
Downstairs at the Franklin Institute
Homemade soups and sandwiches, moderate prices

Onmi Café
Downstairs at the Franklin Institute
Sophisticated salads and pasta, modrate prices

Dock Street Restaurant and Brewery 496 0413
2 Logan Square, between 18th & Cherry Streets
Good, freshly brewed beer, innovative menu, medium prices

Cutter's Grand Café 851 6262
2005 Market Street
Very fresh seafood, well stocked bar, medium prices

The Fountain at the Four Seasons Hotel 963 1500
Logan Square, between 18th & the Parkway
Fancy Food, fancy desserts, fancy prices

Mace's Crossing 564 5203
1714 Cherry Street, 17th & the Parkway
Tavern with good burgers, medium prices

Mirabella's 981 5555
17th & the Parkway
Good, updated Italian, reasonably priced

Morton's of Chicago 557 0724
19th & Cherry Streets
Big, wonderful steaks, lobsters, lamb chops, tabs

Restaurant Callowhill Street 557 6922
19th & Callowhill Street
Upscale, French-American, ambience, medium-high

Rose Tattoo Café 569 8939
19th & Callowhill Street
Good international food, moderate prices, cute place

Swann Lounge & Café 963 1500
Four Seasons Hotel, between 18th & the Parkway
Elegant Lounge, creative menu, expensive

T G I Friday's 665 8443
18th & the Parkway
Friday's is Friday's

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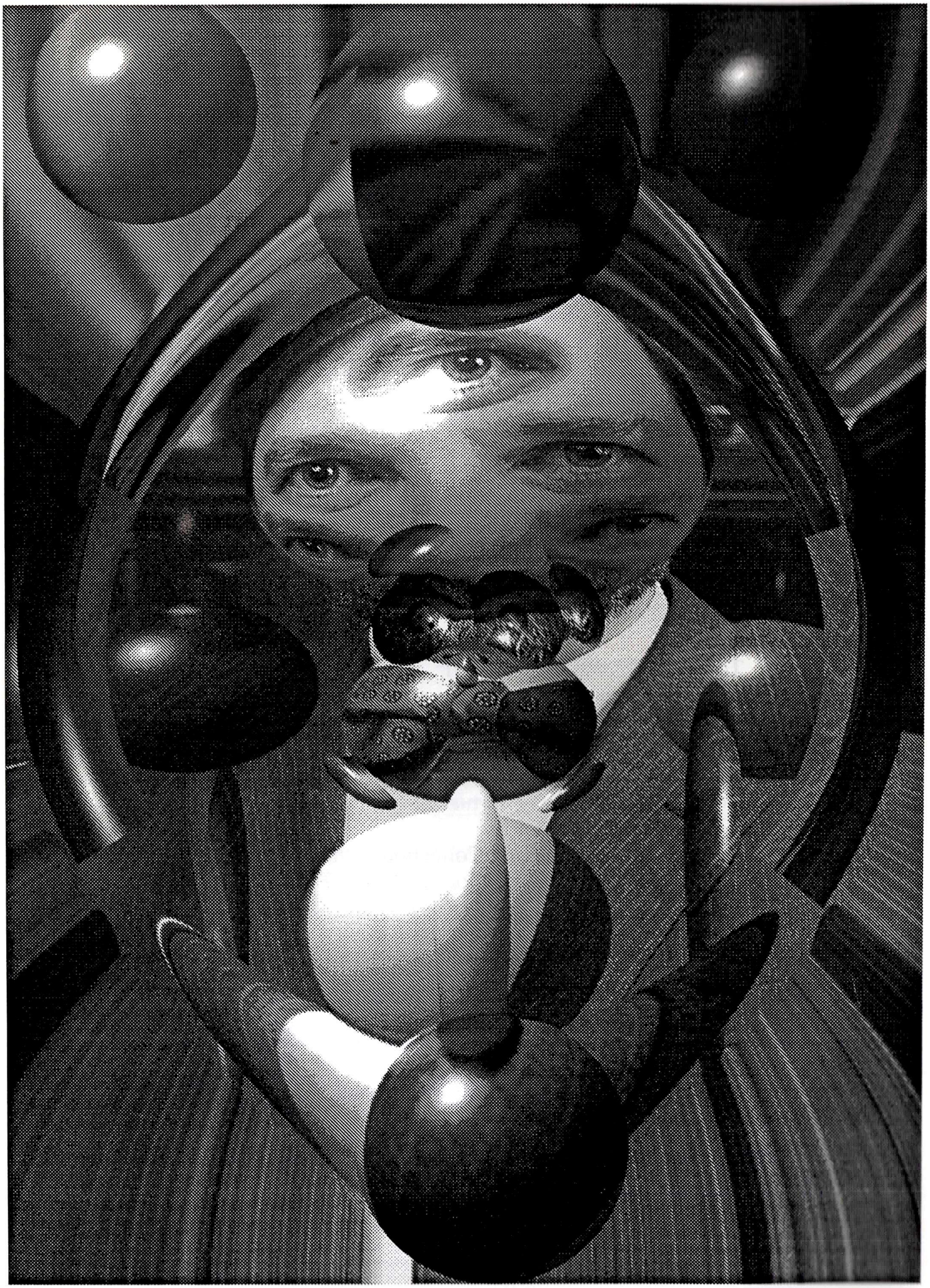

Friday, November 4th

audience participation alert - see Ethics & Copyright
book signing today 12:15

8:30-10
SPECULAR INTERNATIONAL
Andrei Herasimchuk and Matt Davey

Specular TextureScape 1.5 retail $195 conference price $99
Design the exact texture you want, or one you never imagined possible! TextureScape gives you the control to design detailed and rich textures, while freeing you to play with color, light and motion. TextureScape's files take up little disk space (under 30K each), yet textures can be rendered at any size or resolution needed. TextureScape can also morph between textures!

Specular Collage 2.0 retail $399 conference price $249
lets you manipulate and combine multiple hi-res files quickly and without a lot of RAM. Each image remains a separate object, even after its been blended and layered with others. Choose from a rich selection of effects like automatic drop shadows, feathering and selected Photoshop plug-ins.

Infini-D 2.6 retail $695 conference price $399
is a powerful and easy-to-use 3D modeling, rendering and animation tool that has won virtually every award in the industry. It also integrates seamlessly with programs like Adobe Premier, Photoshop, and Illustrator to provide the best in 3D graphics production. Infini-D lets you take full advantage of the Power Macintosh, boosting speed and performance by over 500%!

Specular LogoMotion retail $149 conference price $79
With LogoMotion, you can quickly and easily create dazzling QuickTime movies. Start by having LogoMotion transform your EPS logo (or any font) into 3D. Next, add backgrounds, animated props, lights and cameras from LogoMotion's built-in collection of StageHands. With LogoMotion, high-quality 3D animation is as easy as choosing items from a menu!

Andrei Herasimchuk is the Director of 2D Applications/ Collage Product Manager
Matt Davey is the TextureScape Product Manager for Specular International.

10-10:45
PROJECT RAPTURE: MILLENIAL REQUIEM
Tim Jackson

The term rapture has a number of connotations ranging from intense delight to the end of the world. The notion of art as a radical aim of democracy has only been given lip service by the powers that be in the art world, since the connoisseur and collector are by and large looking for rarefied objects rather than democratic transformation. PROJECT RAPTURE seeks to provide a forum for creative works that address these dichotomies. Tim will discuss the production of a major installation piece incorporating computer-generated video projection on an 8' x 8' mixed media construction. As long as space permits, all work submitted (in any visual or performing arts medium) will be included. There's more.

Tim Jackson is an independent artist and a PhD candidate in Art Education at Penn State University

10:45-11:15

THE ANARCHODIGITAL: Punk/Random/Collaborative/Accessible/Arboreal

Mike Mosher

Artist Mike Mosher will review and contextualize some aspects of his past work that may emobdy anarchist aesthetics. This includes influences of late 1970's Punk, the use of Garage Band collaborative art forms, the introduction of randomness to hypermedia narratives, public access television participation, and video selections from his autobiographical 1993 performance of @narchy a²rbor.

Mike Mosher, Visuals Consultant, Composer, Instructor Desktop Design at Cañada College, Redwood City, CA, Dir. Creative Arts, School of Computer Arts & Multimedia Arts, Interarts Program, San Francisco State, SF, CA.

11:15-12:15

ETHICS AND COPYRIGHT: RESPECTING THE RIGHTS OF OTHERS & PROTECTING YOUR OWN

Daniel & Sally Wiener Grotta, Frederick Wilf, Esq.

With the Advent of low-cost scanners and easy image alteration, several important questions are gaining importance and public recognition. Does the public have any responsibility regarding how their work is used? How can we protect our own images and music from being stolen? What are the contractual and legal rights and obligations of the artist? What are the moral issues that go beyond legal matters? These are important issues for artists to consider if we are to avoid the specter of even greater censorship in the arts. The panel will briefly discuss these, and then open the floor to your burning questions and comments.

The Grottas test equipment & software, lecture, conduct workshops, write books and produce art.
Frederic M. Wilf, Esq., ELMAN & WILF • Patent, Trademark, Copyright and Business Law • Media, PA

12:15-1:30

LUNCH BREAK

The Grottas will sign copies of their book Digital Imaging for Visual Artists on Sale at the Confrence Price of $45.00 + PA Sales Tax @ 7%

1:30-2:30

THE NEW ANALYSTS

Steve Bradley & John Hudak

Using contact mikes, sound sampling and homemade or found instruments, Steve Bradley and John Hudak will make the aurally and visually miniscule command attention with their demo/performance in an attempt to re-sensitize us to the more fragile members of our environment.

Steve Bradley is a Printmaker, Instructor at the College of New Rochelle, and now a Multimedia Artist
John Hudak is an Electronic Musician from Brooklyn, NY

2:30-3

THE DEATH OF PHOTOGRAPHY

David Glenn Rinehart

"From this day forward, photography is dead. Kaput. . .History. Digital Photography is supplanting the photography we've known, loved and used for a century and a half just as the camera usurped painting and drawing's utilitarian functions in the middle of the nineteenth century. Digital imaging is rapidly becoming the medium of choice in many professional applications. On the other end of the spectrum, Fuji Film's senior technical staff estimate amateur photographers will no longer use film by 2010. So what kind of future is there for good old-fashioned analog photography? The answer, in a word, is Art."

David Glen Rinehart is Director of Photography and a writer for European Photography. He is an Artist in Residence with a BEZZA grant at Prospect Place, Newcastle-Upon-Tyne, England.

3-3:30

SALT TO SILICON

Thomas A. Beuralt

"The technological evolution of photography from a chemical based medium to an electronic one becomes the main focus of this presentation. I will illustrate the necessary shift in photography to electronic imaging with the advent of the information age. I will conclude with the thesis that photography is alive and blossoming into an all-inclusive medium."

Thomas Beuralt is a Navy Photographer who considers the use of computers the natural evolution of photography. He's also an Adjunct Professor at Prince George's Community College, and teaches Computer Graphics.

3:30-4:15

STATE OF THE ART: ART IN NYC II

Rachel Gellman

Rachel will bring us up to speed with New York computer art scene.

Independent artist and a Computer Graphics instructor at the School of Visual Arts, NY. Look for her work at the Silicon Gallery

4:15-5

MULTIMEDIA PRODUCTION: A CASE HISTORY

Thomas Porett

Tom will detail the steps that were involved in the production of a multimedia presentation that is designed to communicate the varied academic programs of the University of the Arts in Philadelphia. This piece is currently being used by admissions personnel of the University to give prospective students a sense of the varied programs and learning opportunities at UARTS. Details of initial planning, program structure, image acquisition, editing, production, organization and testing will be covered.

Professor Thomas Porett is Director of Academic Computing at The University of the Arts, Philadelphia, PA

Friday, November 4th

5-6
MACROMEDIA DIRECTOR 4.0 retail $1195 conference price $599
John Thompson

Director 4.0 is the tool of choice for all your Multimedia needs. This popular program includes powerful features that let you easily combine text graphics, animation, sound, digital video, and interactivity to create dynamic Multimedia productions. Use Director to create corporate presentations, entertainment and educational CD ROMs, kiosks, software, demonstration disks, and more. Artists, creative directors, students, publishers - more than 100,000 users worldwide - choose Director for their Multimedia needs.

John Thompson wrote the Lingo scripting language for Director. JT also teaches at the Interactive Telecommunications Program, Tisch School of the Arts, NYU

6:30PM

Catch the SCAN Trolley on the Museum steps
going down to Philadelphia's Olde City "gallery row"
for First Friday.
the art galleries clustered in this part of town
all open their shows concurrently on the First Friday evening of each month, and you are invited to the incredible neighborhood party!

Be sure to pick up a map of the area galleries and restaurants
from Rick deCoyte, our host at Silicon Gallery

8PM

Meet the SCAN Crowd at the

GRAND OPENING!
SILICON GALLERY for Computer Art
139 N. 3rd Street • Philadelphia PA

and

OPENING!
SCAN '94 COMPUTER ART EXHIBITION
Silicon Gallery

Saturday, November 5th

book signing today - 12:15

8:30-9:30
PIXAR

BUY! BUY! **retail $299** **conference price $75****

*****PIXAR***
will donate $25 from the sale of each unit of Typestry 2 to your favorite charity - SCAN!

Dr. Bill Kolomyjec
Pixar Typestry 2

turns your Type I, TrueType, PostScript, and QuickDraw GX fonts along with your Adobe Illustrator and PPD (Portable Digital Document) files into dimensional text. You work in an easy, familiar 2D space but you get amazing 3D results. Pixar Typestry 2 includes Pixar's powerful RenderMan so your images have the same professional quality you have seen in some of your favorite movies, (Alladin, Beauty and the Beast, Jurassic Park, Terminator 2).
Files created with Typestry 2 can be imported into other applications such as Adobe Photoshop, Pixar Showplace, Aldus Pagemaker, QuarkXpress and any software that reads PICT, TIFF BMP, EPS or RIB files. With Pixar Typestry 2 you can even do a QuickTime or Video for Windows (AVI) animation to make your own flying logo!

Pixar Looks CD

includes 26 libraries, each containing approximately 20 unique appearances — over 580 terrific Looks to fit a desinger's every mood, whim and project. These beautiful libraries range from the practical to the magical and feature: •Practical - sponge, zolotone, wallpaper, paint, stone, clapboard, fabrics, woods • Whimsical - ripples, prisms, stars, gems, mist, webs, soapy film, smoke • Wild & Crazy - alien brain, mud lizard, iguana, paper dragon, puzzle bark • The amazing Metals & Glass

Dr. Bill - Renderman Marketing Manager, PIXAR, Richmond, CA

9:30-10:15
3D DIGITIZED SCULPTURE PROCESS
REVERSE ENGINEERING
Kevin Gallup

While many artists found themselves being slaves to the materials at hand, the materials are now endless. Conceptualization for commission competitions can be attempted in formats in which there are no limits to the imagination in providing true realism of a projected piece of work. Not to mention cost projection, physical analysis, ability to change according to problems that can be predicted such as shadows or space, and, most of all, the ability of the artist to have in hand a set of plans by which the piece can be successfully built by a third party without injection of unwanted interpretation.

Kevin Gallup is a Norfolk, VA Sculptor whose medium is mainly bronze.

10:15-11:30

COMPUTERS IN SCULPTURE: A TIMELY OVERVIEW

Tim Duffield and Rob Fisher

Rob and Tim will present the latest work of an international cast of sculptors who use computers in their work including: David Smalley and Alvin Sher • CT, David Morris • NY, Mark Mudge • CA, Chris Janney • MA, Masako Fujihata • Japan, Christian Lavigne • France, and Rob Knottenbelt • Australia. The presentation will divided into three themes: Computer Assisted Design and Fabrication of Sculpture, Computer Assisted Presentation of Sculpture, and Sculptures which Incorporate Computers.

Tim Duffield is an Independent Sculptor, Landscape Architect and Computer Sculpture ProActivist from West Chester, PA

Rob Fisher produces large-scale Environmental Sculpture, and is pre-eminent among computer sculptors, Bellefonte, PA

11:30-12:15

MATHEMATICS IN STONE & BRONZE

Claire & Helaman Ferguson

Discuss their recent work and their book, Mathematics in Stone and Bronze

"Helaman Ferguson is an impassioned sculptor and a PhD research mathematician who takes mathematical theorems and creatively applies them to physical materials." -Meridian Creative Group

Claire Ferguson's book *Mathematics in Stone and Bronze* is winner of the *Gold Ink Award.* The Fergusons are from Laurel, MD

12:15-1:30

LUNCH BREAK

The Fergusons will sign copies of their book, Mathematics in Stone and Bronze on Sale at the Conference price of $29.95 + PA Sales Tax @ 7%

1:30-2:30

INTERFACE

Sylvia Pengilly

Silvia will demonstrate some of the applications of the Interactive Brainwave Visual Analyzer, showing how to convert brainwaves into music, followed by a performance using the IBVA Headband.

Sylvia Pengilly, Multimedia Artist, Chair Theory/Composition, Loyola University, New Orleans, LA

2:30-3:15

THE INTERACTIVE PROPOSAL

Bill Bell

"Since my lightsticks are virtually impossible to describe with photos, and the effect cannot be conveyed through video means, I have had to devise trickier methods for making proposals and such. I use the MacIntosh, scanned photographs, and interactivity, mailing out discs instead of slides and videotape. Examples of these methods that resulted in successful commissions are the subject of my talk." And he'll bring a lightstick to show us what he means.

Bill Bell - Independent Artist, with an aero-space engineering background, has exhibited electro-optical sculptures since 1982. Look for his work here at the Museum and at the Silicon Gallery.

3:15-3:45

THE DAVE VAN KOEVERING COLLECTION

Bryan T. Schuler

"Anarchy? What I find is that the techno-revolution is leaving vast amounts of techno-junk in its vapor trails; out moded equipment faster than you can say "hit the save key." Early models are becoming Neanderthals; the ancestors of the digital age. Bryan Schuler will make a slide presentation of the Dave Van Koevering Collection of assorted acoustic and electronic instruments. Van Koevering created an electronic keyboard called the Vako Orchestron. He also convinced Bob Moog that his newly invented portable Mini-Moog was more than a toy, and became a major distributor for Moog." The rest, is . . .

Bryan Schuler is currently pursuing a PhD in both Humanities and Ethnomusicology at Florida State University. He's a Composer in Electronic Media, performs on Piano, and accompanies the Tallahassee Ballet and FSU Dance Dept. Bryan served his Fullbright Fellowship in Ghana, West Africa as Composer in Residence to the National Dance Ensemble of Ghana.

3:45-4:30

IMPROVISING WITH A COMPUTER:

Visual Accompaniment of Sonic Resources

Nathaniel Bobbit

Assuming You Wish, composer Roger Dannenberg, Performing in the '60's, composer Mike Mosher and Buzz Portrait, composer Gregory Garvey, are energetic compositions for flute with visual accompaniment. Each composition introduces the activity of a composer with his use of visual accompaniment. As a group, these composers show how sound and vision can be fused according to: abstraction, portraiture, and narration. Nathaniel Bobbitt will discuss the performer's role in following visual cues and will give a demonstration of CMU Toolkit, a real time interactive audio graphic platform run on an Amiga.

Nathaniel Bobbitt has performed at various new music festivals, was an artist in residence at the Carnegie Mellon Studio for Creative Inquiry, and has performed as a soloist in Italy, Spain and at the National Food Association Annual Convention.

4:30-6

VIRTUS

Richard Boyd

Virtus WalkThrough Pro — retail $495 — conference price $240

Experience real-time 3D drawing and visualization with textures. The software's combination of object-oriented drawing and real time 3D graphics provides an interactive visual forum for prototyping designs of all types. The real-time texture mapping feature allows you to enhance your 3D environments by adding surface details such as doors, windows, bricks, landscapes or even corporate logos. Place any QuickTime movie into your model to add to the 3D multimedia sensation.

Alien Skin — retail $99 — conference price $49

An easy-to-use, seamless texture generator that creates unique, elegant 2D and 3D textures for both multimedia and print applications. Alien Skin sports both a stand-alone version and a plug-in version that may be used with Adobe Photoshop, Fauve, Matisse, Fractal Design Painter and other filter applications.

Virtus VR — retail $99 — conference price $49

Design your own worlds using the extensive sample object and surface VR Galleries provided with VR. Imagine building anything you can dream of—design your own spaceship, or just sit down and rest on your new front porch. You can use the many galleries provided with Virtus VR, or you can create your own objects with Virtus' "drag and drop" technology. And as you make changes to your worlds, the results are updated instantaneously!

Richard Boyd, Director of Sales, Virtus Software

PERFORMANCES

The 17th Annual Philadelphia Computer Music Concert

7:30-11:00
Choices Forum

Steve Berkowitz, Master of Ceremonies among other things

audience participation alert - see music through the ages

ASSUMING YOU WISH TO DOWNLOAD MODULAR 2

for Flute and Real-Time Electronics
Composer Roger Dannenberg
Performed by Nathaniel Bobbitt

The interaction between the audio and graphic imagery in "ASSUMING YOU WISH..." map a musical activity while also revealing instrumentalist sensorial and articulatory behavior. Thanks to the continuity of performer input through circular respiration and the CMU Toolkit system's captive transformative features "ASSUMING YOU WISH..." is an audiovisual survey human-machine interaction according to visual stimuli and beating spectra. This presentation will address the modeling of stamina and other time domain problems related with performer anticipation.

UNEXPECTED REFLECTION (1993)

Composer Emiliano del Cerro
Performed by Nathaniel Bobbitt
Spanish selection, UNESCO Tribunal for Composers

Nathaniel Bobbitt has performed at various new music festivals, was an artist in residence at the Carnegie Mellon Studio for Creative Inquiry, and has performed as a soloist in Italy, Spain and at the National Food Association Annual Convention.

MUSIC THROUGH THE AGES

Don Slepian

Don will make musicwith his foot-controlled, real-time MIDI instrument - no sequencing. The foot control allows Don to orchestrate on the fly, and he's ready to take requests in the interest of Anarchy!

Don Slepian is an internationally known electronic musician, recording artist, and concert performer. He's also been a consultant in computer music for Yamaha, Bell Labs, and Bell Communications Research.

SAMIA HALABY & WALTER WRIGHT

Samia A. Halaby and Walter Wright will be jammin' sound and painting. With a keyboard transformed into an instrument of visual output, Halaby will perform on the computer to create kinetic paintings in accompaniment to the electronic music of Walter Wright.

Samia Halaby is an independent multimedia artist living in New York
Walter Wright is a longtime Electronic Musician from Indianapolis, IN

AT THE CORNER OF ERROR & PERFECTION

The Visual Music of Avante Disregarde
Julius Vitali - Vocals, sampler, Amiga
Terry Niedzialek (appearing in video) - Vocals, hair sculpture, choreography

"This experimental music notation creates pictoral images formed by a series of musical notes that have been assigned instruments such as acoustic guitar, sax, piano and violin from a computer software program. There are four musical tracks, each with different notes which are simultaneously overlaid to create a line drawing." Can't picture it? Sit tight.

Julius Vitali and his ensemble Avante Disregarde frequently perform in NYC.

BUTT, IS IT ARTT?

The Electric Butt Bongo Orchestra
Ranjit Bhatnagar and Rebecca Mercuri, Directors

This outrageous production peeks behind art's end for an a posteriori synthesis of analog and digital rearings. An avant-garde celebration, a veritable sensory cornucopia of carminative rumpus combining the grand tradition of Le Petomane with a candid look at Voltaire. Audience participation is urged. SCAN attendees will remember Rebecca and Ranjit's collaborative effort in 1992 on the Cyberspace in Music Therapy exhibit at the Franklin Institute's Cutting Edge Gallery. Fears, their 3D work with Mike Mosher was also displayed at Montage '93. Butt, is it Artt? brings back this duo in a hip, off-beat setting, breaking the winds of traditional compositional practice. When not SCANning, Ranjit and Rebecca are often found surfing the Internet. Contact them at: ranjit@gradient.cis.upenn.edu or mercuri@gradient.cis.upenn.edu.

Sunday, November 6th

audience participation alert - see electronic toybox, 1pm

8:30-10

HSC Software

Susan Murphy

Kai's Power Tools

Graphic Design, Print, Animation, 3D Rendering, Multimedia, Video - No matter what kind of graphics or imaging you may want to produce, whether you are a power user of Photoshop or are just a beginner, Kai's Power Tools will immediately accelerate your ability to produce stunning imaging and graphics. Gradient Designer, Preview Windows with real-time feedback, Fractal Explorer and Texture Explorer will all be put through their paces.

KPT Bryce - 3D Ray-Tracing Environment Generator

Produce realistic 3D landscapes quickly and easily with this popular Mac program. User interface by Kai Krause, author of Kai's Power Tools (above). Landscape modeling/rendering program written by artist/programmer Eric Wenger. CD-ROM with 400MB of artwork and project files.

Live Picture

Susan Murphy is Eastern Regional Sales Manager for HSC Software

10-10:45

CARDS FROM THE EDGE

Richard Wright & Mark Scott

Using standard DTP software on the Macintosh, Mark Scott is creating a series of interconnecting, extensible playing cards that warp the mind. Adobe Photoshop is used to scan in and clean up original hand-drawn images as line art, then Aldus FreeHand is used to add the color or grayscale tones, a technique that preserves bitmap detail. Richard Wright brings imagesetting, production, and printing expertise to the project. In order to mass-produce these cards, EPS files must be positioned and imposed correctly for printing. Richard will share his experience with halftone and stochastic screening, trapping, bleed edges, and page imposition techniques.

Mark Scott, from Philadelphia, PA is an artist with 14 years of computer graphic life lessons. Richard Wright runs a high-volume imagesetting facility in Winston-Salem, NC.

10:45-11:30

COMPUTER ANARCHY á la NYC

FIRE - Cati Laporte

Rebecca Mercuri

Dorée Duncan Seligmann

individual electric - Vibeke Jensen & Norman Douglas

These guys just stormed in and took over. No one here has a clear idea of what they're up to, so hunker down, this could get bumpy.

Manhattan artist FIRE creates outlaw postage stamp art depicting images which she feels reflects contemporary American Culture. Dr. Kevorkian, Amy Fisher, Lorena Bobbitt, KILL/HATE Rose, !st Amendment (burning flag), Mike Tyson, L.A. Hell of a Town (in flames) and Ford Bronco & DNA are examples of her lik 'm, stik 'm art.

"The **individual electric** *strategy is to create public and secret situations. Digital interactive material will be used to introduce ideas about photoelectric communication as language; paradoxical croak for planned obsolescence."*

Rebecca Mercuri and Dorée Seligman will try to contain the situation so no one gets hurt.

11:30-12
TURNING ART INTO ATOM BOMBS
Loren Buchanan

"What sort of things does the science community need to learn from the art community to better understand the intricacies of whatever problem they are trying to solve," and more art related science issues.

Loren "Buck" Buchanan is a scientist at the Naval Research Lab in Colesville, MD. He's also a musician, sculptor, and videographer.

12-1
LUNCH BREAK

audience participation alert - see electronic toybox and real-time internet art collaboration

1-2
THE ELECTRONIC TOYBOX
Byron Grush

A Dual Site Hi-Res Image and Sound Transmission Performance Art Event å la Telecommunications Software! Byron will assist us in joining Devin Henkle and his audience at Northern Illinois University School of Art, DeKalb, IL, as we pull props from his "ElectronicToybox," paint, frame-grab windows, make sound and play with the audience doing the same across the way. Yes you*—come on down!*

Byron Grush is a Professor of Art at Northern Illilois University School of Art, DeKalb, IL. He's involved in Computer Graphics, Programming, Animation, and for at least three years, Transmission Art.

2-2:30
PRINTMAKING: A BLEND OF OLD AND NEW
Judith Oak Andraka

Judith Andraka will demonstrate her use of the computer to make fine art prints, "to draw the image, print it out by an ink-jet printer, work into the image with various media, scan it back into the computer and work more on it, and then print it onto Fine Art printmaking paper." But she's not finished yet. . .

Judith Oak Andraka - Art Department Chair at Prince George's Community College, Largo, MD., and founder of *Mezzanine Multiples*, a printmaking studio. Her work will be part of an exhibition of computer assisted art at Perdue University Feb 6- Mar 19, 1995.

2:30-3:15

THE VIRTUAL GALLERY ON THE WORLD WIDE WEBB

May Ann Kearns & Walter Wright

Mary Ann and Walter will demo their latest undertaking, the "on-line" gallery, accessible by any user of the Internet, the world-wide computer network. You'll tour the "virtual" gallery, viewing works by media artists who have exhibited or are currently exhibiting at the 911 Gallery. Most of the images may be obtained as prints by contacting the gallery directly. The 911 Gallery's e-mail address is etools@iquest.net.

Mary Ann Kearns is curator of the 911 Gallery in Indianapolis, IN. Walter Wright, a long time SCANner is co-owner of the 911 Gallery.

3:15-4

COMPUTER ARTISTS CANNOT LIVE ON ASCII BURGERS ALONE

Annette Loudin and Beth Cardier

"Taking the form of a performance/light and sound scape, our presentation combines personal experiences in computer art, and the real world of trying to stay alive. The purpose is to communicate some of our ideas about how we can survive and still make art."

Annette Loudin and Beth Cardier are both independent artists from Australia, presently living in California. Annette is involved in Media, Beth is a writer/dancer/computer artist.

THOSE WHO STAY

CAN PLAY

WITH ARTISTS FAR AWAY. . .

SO STAY AND PLAY!

4:00 . . . and beyond

REAL-TIME INTERNET ART COLLABORATION WITH AUDIENCE

Ranjit Bhatnagar

Since January 1994, OTIS artists have been "meeting" on the Internet almost every week for a collaboration reminiscent of the salon gatherings of the Surrealists in its playful informality and invention of collaborative "games." At times, hundreds of images, created, reworked and destroyed by up to a dozen artists around the world are made within a few hours. Sometimes a workstation is set up in a public place, (including a night club, a gallery opening, and SIGGRAPH '94) and the public is invited to watch the process in action, to be photographed and see what the collective creativity of the net does to their faces, or to join the collaboration. We expect the audience at SCAN '94 to be unusually active participants.

Ranjit Bhatnagar creates kinetic and interactive sculpture, soundscapes, realistic rendering,

SCAN '94 Art Exhibition

Silicon Gallery

139 North Third Street • Philadelphia, PA 19106
November 4th - 23rd, 1994

Kathleen Allen • *Holland, PA*	Warning! Nuclear Consequences	Topaz - 3D Model & Orig. Charcoal	11" x 14"
Judith Oak Andraka • *Laurel, MD*	The Lure	Ink-jet on Troya Paper	21.5" x 15"
	Boundaries II	Ink-jet on Unryu Paper	11" x 14"
Elaine Breiger • *NY NY*	Stilled Center	Cibachrome	
Gloria DeFilipps Brush • *Duluth, Minnesota*	5904	Dig. Photog./Laserprint	11" x 14"
	5804	Dig. Photog./Laserprint	11" x 14"
	5805	Dig. Photog./Laserprint	11" x 14"
Chris Butts • *Aldan, PA*	Winter	Cannon CLC 500 Print	15" x 15"
	Space	Cannon CLC 500 Print	16" x 20"
Mary Campbell • *Staten Island, NY*	Artery	Thermal transfer prints	4.5" x 6.5"
	Branch		7.5" x 3.5"
Leslie Nobler Farber • *Demarest, NJ*	Optical Language	Quilt	32" x 32"
Nancy J. Freeman • *Annandale, VA*	Bare Duet	Color Laser & Plastic Foil	50" x 40"
Rachel Gellman • *New York, NY*	Cheval d'Orsay	photo on metal	7" x 9"
	Police Horse	photo on metal	17.5" x 10"
Steve Gildea • *Downingtown, PA*	South Ray	IRIS Print	8" x 10"
	Plante	IRIS Print	8" x 10"
Sally Wiener Grotta • *Boyertown, PA*	Woman in Prism	Phaser III WaxThermal Print	13.5"w x 16"h
Richard Helmick • *Columbia, MO*	Kristen2	Digital Plotter Drawing	16.5" x 18.5"
Ken Kramer • *Philadelphia, PA*	Water and Rock I	Fuji Pictography Print	3" x 4"
	Water and Rock II	Fuji Pictography Print	3" x 4"
FIRE (Cati Laporte) • NY, NY	Collage	Postage Stamp	
Robin Lowenthal	Silk Scarf with Fractal	Fiber/Inkjet	18" x 18"
	Silk Scarf with Fractal	Fiber/Inkjet	8" x 64"
	Silk Scarf with Fractal	Fiber/Inkjet	16" x 64"
Walter Merrill • *Philadelphia, PA*	Tapestry of Figures	Print	13.75" x 24.25"

Ruane Miller • *Princeton, NJ*	Lost Myths . . .His Search	Dig. Photog.	40"h x 57"w
William Montgomery • *Phila., PA*	Intestinal Fortitude	Digital Image	34" x 46.75"
Lesley Mowat • *Camden, NJ*	Watching Nature Shudder Untitled (Giraffe)	Silver Print Silver Print	11" x 14" 11" x 14"
Jeannie Pierce	Fredricksonberg	Die Sublimation Print	7.5" x 10"
Jean Plough • *Philadelphia, PA*	Joyce's Party	Apple Canon Printer	44" x 22"
Tom Porett • *Ardmore, PA*	Voodoo #1 Dreamscape	Digitized Photograph Video-digitized image	16" x 11" 12" x 17"
Stephen Porter • *Bellefonte, PA*	Ribbon I, Curve 2 Column 5	Iris Prints; models for Sculpture	11" x 17"
Jan Provenzano • *Farmington, ME*	Untitled	Silkscreen on Paper	21" x 21"
Mark Scott • *Merion, PA*	Spiznet Comix	Pen & Ink, Aldus FreeHand	11"x 17"
Martin Snyder • *Philadelphia, PA*	Red Heads	Digital Photograph	8" x 9"
Kathleen Van Voorst • *Clairsville, OH*	Untitled	Cotton Fiber Appliquéd & quilted	48" x 48"
Walter Wright • *Indianapolis, IN*	ShivaDiva	Installation	144" x 96"

SCULPTURE BY:

Bill Bell • *Brookline, MA*	Painter	yellow LED lights embedded in clear lexan polyvinyl carbonate 9000 artist's palette	19.5 x 13.5 x 12
Sydney Cash • *Marlboro, NY*	Layers of Sky	Painted Glass	13.5 x 7.5 x 3
Kevin Daniel • *Gainesville, FL*	Letterbox	Steel & Computer Controlled Lighting	72h x 36w x 6
Helaman Ferguson • *Laurel, MD*	Costa II	Bronze	18" diameter
Kevin Gallup • *Norfolk, VA*	Fractal Tree	Bronze	72" x 40"

VIDEOS BY:

Sylvia Pengilly The Book of Kells	**Thomas Sacchi** Navane	**Ray Brooks**	**Steve Speers** Tesla's Lab	**SVA Student Work**

Papers

Towards a Computer Aesthetic:
Inside the Body of the Beast

we cascade toward a **future** on ecstatic

electronic signals gossamer

zeros ones

All **colors** are possible as long as they are only
light digital
vacuous weightless

An eye always watching for **freedom** on
our dollar bill of rights

always prepared for action if someone
uses **it**
then thumb presses back another mind

purchased in

this stock market of ideas

held commodities

a brush drying **hard**
mold covering stand oil

dry rotted canvas this is
the smell of progress

steady whir and hum of the **naked** computer

mantra cycles

Picasso wept--his fingers annointed with oil from
public keyboards

take, think, this is my blood
delete, this is my body

do this to forget me

Tim Jackson
1219A Old Boalsburg Rd
State College, PA 16801
(814) 861-6034

Macintosh-assisted performance by Mike Mosher & friends, Ann Arbor MI, 1993.

@narchy a²rbor

"@narchy a2rbor" was performed at the Performance Network in Ann Arbor, Michigan on August 21, 1993. It consisted of eighteen songs sung at the piano (seventeen originals plus a medley of Fats Waller's "Reefer Man" and our old highschool fight song "Push On Pioneers"), spoken word and computer graphic projections. The songs were laced together with commentary that contextualized them as explorations of "the uniquely Ann Arbor aesthetic" embodied in its artists of my generation, though many were written when I was living in California or New Hampshire.

The stage was set with an eight-foot hanging painted grape arbor, the town's namesake and centerpiece of the Ann Arbor City Seal I remember from my youth (now replaced with a spreading tree). Six small potted plants were arranged onstage, serving as an *aide-memoire* for musing upon, as well as to organize and introduce the topics that the songs were meant to illustrate.

A "reflecting pool" delineated with painted rocks the screen on which projected imagery appeared. An Apple Macintosh IIci computer was connected to a Dukane LCD panel and overhead projector. Cycling HyperCard stacks of bitmapped imagery, their timing and dissolves programmed in HyperTalk, were launched with a single mouse click, while another invisible onscreen button on each stack returned to a main menu. A continuously cycling "pond" stack to which the screen would always return was intended but not built in time for the performance. Some of the imagery projected was scanned photography (especially historic local news photos), some cartoons or drawings, some ephemera like school corridor passes or absence slips. Some had text or featured combinations of rich, resonant local images peculiarly juxtaposed.

Chrysanthe Mosher opened the performance by reading an introductory text. She later read again--halfway through the two-hour performance--a selection that she had chosen about a teenage girl's sexual initiation from *FUN*, my novel of midwestern youth and rock n' roll. For this she was accompanied by Ben Miller on solo saxophone. I also read from *FUN* a selection about a garage band's debut at the school Science Fair, for which Ben provided improvisation upon an effects-enhanced guitar. I'd never performed or played with Ben before, though bitmapped images of his bands and those of his brother Laurence appeared as onscreen buttons in my 1992 multimedia kiosk "Collaborationation: Garage Bands, Community Murals & Cyberspace".

My longtime musical confidante Jimm Juback accompanied all the songs on electric guitar, with the exception of "Pixel Love" which featured Mark McNally. Jim Rees and Orin Buck taped the event for broadcast on Ann Arbor Public Access Television; Jim and I had produced a broadcast of my twenty-minute rock opera "Twilight of the Gymnasty" on it in 1974.

"@narchy a2rbor" follows an earlier HyperCard-driven performance piece on American history "Christopher Cumulonimbus", performed at the Philadelphia's University of the Arts in 1991 and then at the San Francisco Exploratorium in 1992. I chose to work with my old hometown's themes and imagery as this visit to Michigan was in part timed for us to attend my Ann Arbor Pioneer High School Class of 1973 twentieth reunion banquet the night before the performance.

That traditional celebration of those early '70s got me pondering that which was unique and had stuck with my generation growing up in Ann Arbor, in a liberal era with its grand flowering counterculture, our sensibilities exposed to powerful utopian forces at an early age.

Meanwhile the seemingly appropriate technology of low-res computer-assembled, computer-driven imagery, projected as a backdrop to accompany live performers, lets its visuals provide a layer of contrapuntal commentary upon the live musical and vocal content, one that follows its own pre-programmed timing. In this medium I was able to reflect anecdotally, visually and musically upon specific issues of politics, race relations, sexuality and romance, art, pranks, technology, drugs and drug laws, parents, literacy, numeracy and education; a range worthy of Ann Arbor's rich balance for growing up between the Apollonian discipline of the arbor and a certain Dionysian anarchy of the times.

--Mike Mosher

6.ix.93

Illustration assembled from photographs taken by Susannah R. Juni.

Small Computers in the Arts Network Symposium
The Franklin Institute, Philadelphia, Pa.
November 4, 1994 11:15 a.m.

Ethics and Copyrights: Legal Issues

by Frederic M. Wilf
CompuServe 72300,2061

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Media, PA 19063
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Each profession and field of endeavor creates and uses its own terminology. To bridge across different fields of endeavor often requires the seeking of common ground in language. The same is true when connecting the fields of art, computers, law and ethics. For the purpose of this discussion, I'll use the following terms in the following ways:

Morality — A personal code of conduct.

Ethics — A code of conduct expressly created or implicitly accepted among a group of people. The code of ethics for lawyers may differ from the code of ethics generally accepted among artists.

Law — A code of conduct expressly imposed on particular geopolitical areas by statutes passed by legislative bodies, regulations, decrees, judges ("common law") or otherwise.

Copyright law is the primary method of protecting both art and software in the United States. The following terms are used in copyright law, and some are defined in the U.S. Copyright Act:

Copyright Exclusive Rights — The Copyright Act grants five exclusive rights to a copyright holder, who may: (1) Copy or reproduce the work, (2) prepare derivative works, (3) distribute copies, (4) perform the work, and (5) display the work.

Fixed in a Tangible Medium of Expression — The Copyright Act automatically protects all works — including computer programs — as soon as they are written on paper or stored on some other medium. Talking about a program is not enough.

Author and *Holder* — The "author" is the person who creates a work. The "holder" is the owner of the copyright at any given time. Initially, the author and the holder are the same person because the author is the initial holder of the copyright. Then, the author may transfer the copyright to another person, who becomes the holder.

Work Made for Hire — Two definitions: (1) An employer is deemed to be the "author" of all works created by an employee within the scope of employment of that employee. (2) An independent contractor relationship for one of nine specific types of works (e.g., movies) where every person signs a written agreement making one person the owner of the copyright. This term does <u>not</u> apply to independent contractor relationships for the creation of software because software is not one of the nine enumerated types of works.

License — A contract by which the copyright holder allows another person to exercise any one or more of the five exclusive rights. An "exclusive license" means that only the licensee can exercise the licensed right(s). A "non-exclusive license" means that the holder is free to allow people other than the licensee to exercise the licensed right(s).

Assignment — A document by which the copyright holder transfers all of the exclusive rights to another person or entity, who then becomes the copyright holder.

Publication — Distribution of a work by sale, rent or lending copies of the work.

Copyright Notice — Consists of three parts: (1) "Copyright", "Copr." or "©"; (2) if the work is "published" (see above), then include the year of first publication; and (3) the name of the copyright holder. Still strongly recommended, but no longer required for any work first created or first published after March 1, 1989.

Copyright Registration — Highly recommended for any work worth more than the $20 filing fee, but is required only when it is time to file suit. In a copyright infringement suit, the copyright holder may get attorney's fee and additional types of damages if the copyright application was filed prior to the start of the infringement, or shortly after publication. Registration requires sending a completed application (two sides of one piece of paper), $20 check, the documentation, and a copy of the first 25 pages and last 25 pages of source code. Call the Copyright Office at 202/707-3000 (human) or 202/707-9100 (answering machine) for free forms and information on how to fill them out.

Idea/Expression Dichotomy — Copyright law does not protect ideas, but only the expressions of ideas. If there are many ways to express an idea, then copyright law will protect one expression from being copied or incorporated into another expression without the permission of the copyright holder. If there is only one way, or just a handful of ways to express an idea, then the Copyright Act may not be used to protect that idea, and other people may use any expression of that idea.

Fair Use — A provision in the Copyright specifically allows uses that otherwise would be infringing. Fair use is limited to criticism, comment, news reporting, teaching, scholarship, research and similar uses. Each use is evaluated on a combination of four factors: (1) the purpose of the use; (2) the nature of the original work; (3) the amount and substantiality of the portion used in relation to the original; and (4) the effect of the use on the market for the original work. No one factor is determinative.

In the creation of new works based in some part on prior works, what uses are permitted under your personal morality? What uses are permitted under the express or implied codes of ethics of the art world and the computer world? How do these differ with the uses permitted under the law?

Recent court decisions involving 2 Live Crew's "Pretty Woman" parody of Roy Orbison's "Oh, Pretty Woman" raises all of these issues, and provides legal guidance, without necessarily answering the question. These are among the questions we will be exploring during our session.

Frederic M. Wilf practices intellectual property and business law. He represents many companies and individuals in the computer industry, and he writes and speaks regularly about topics involving computers and the law. A chapter he wrote on legal issues appears in "The McGraw-Hill Multimedia Handbook" edited by Jessica Keyes. Fred may be reached at CompuServe 72300,2061 and at his law firm, Elman & Wilf, 20 West Third Street, Media, PA 19063, (610) 892-9580.

Multimedia Production - A Case History

Professor Thomas Porett
Director of Academic Computing
The University of the Arts
Philadelphia, PA

This presentation will detail the steps that were involved in the production of a multimedia presentation that is designed to communicate the varied academic programs of The University of the Arts. This piece is currently being used by admissions personnel of the University to give prospective students a sense of the varied programs and learning opportunities at U/Arts. Details of initial planning, program structure, image acquisition, editing , production, organization and testing will be covered.

Concept Development

- Initial demonstration of MM Class Work
- Initial discussions
  - *Communication issue*
    - Complex issue of revealing the nature of the University of the Arts
- Proposal development
  - *Efficacy of using laptop systems*
    - Macintosh "Blackbird" models
  - *Updatable*
  - *Convertible to large presentation via video link*
  - *Program completion by the end of Sept. 1994*
- Outline
- Inspiration flow chart
- Project approval
  - *Proposal Feb. 14, 1994*
  - *Approval March 23, 1994*
- Future planning
  - *Potential for CDROM*

Initial image research

- University image files
- Need list
- Shooting schedule

Image editing and PhotoCD production

- Essential need for multimedia trained photographer
- Images batched into related groups
- PhotoCDs produced of edited images

Simultaneous video shooting schedule

Concentrated on performing arts events

General University shots acquired

Potential CDRom production

Quicktime movie production

Digitized sequences created and processed in Cinepak compression for potential CDROM usage

Adobe Premier used for effects

Used to convey animation and film clips

Production steps

Ongoing photographic editing

- *Transfer to PhotoCD*
- *Additional photographic assignments*
  - Coupled multimedia project with the viewbook photography.

Image editing from PhotoCDs

- *Created departmental folders*
- *Image size decision*
  - Based upon collage approach
  - Influenced by number of images vs file sizes
- *All images processed in Adobe Photoshop*
  - Film types and conditions varied casts
  - Low inherent image contrast
  - Sharpening helpful

Director 4.0 and SoundEdit 16

- *Modularity of program*
  - Kept file sizes reasonable
  - Permitted quick changes and updates
  - Change with as structure of institution evolves
  - Ease of sound changes
- *Departmental movies*
  - Import batches from image processed folders
  - Arranged initial sequences in Cast
  - Sprite sequences brought in as batches

Graphic Design

- Foundation of master screens with interactive elements
- Extensible structure to permit additional icons or labels for differing audiences
- Simple button controlled progressions
  - To be used by recruiting personnel primarily
  - Must be limited in complexity for use in presentations
  - Must be easily configured for distribution beyond the immediate admissions recruiting staff i.e. CDROM or kiosk

Animation

- *3D animation of campus for introduction*
- *Morphing of University logo with actual building*

Alpha testing

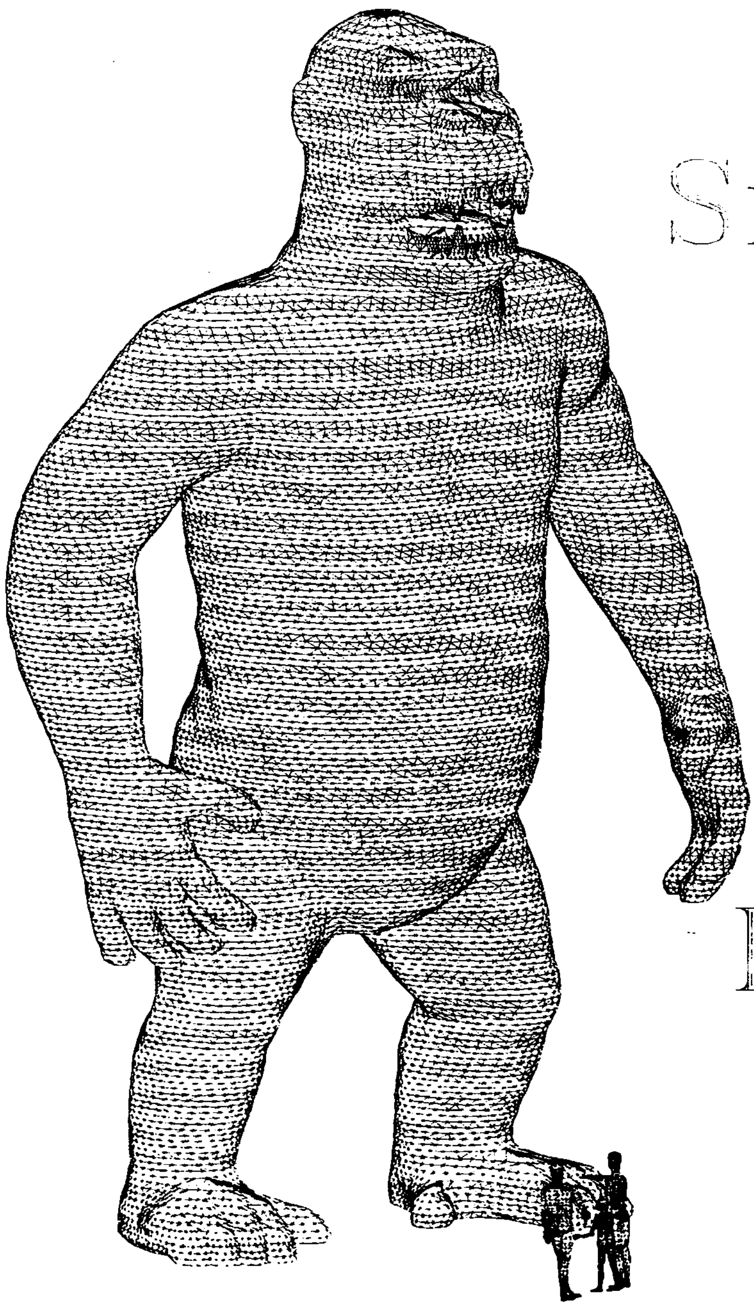
- Sample progressions shown in July
- Initial rough cut shown in August
- Approval for project to continue in this direction

Beta testing

- First "final cut" shown with some major changes to film and animation clips
- Sound track added
- Interaction molded for admissions usage
    - *Primary beta tester crucial*
        - Customized pauses
        - Pacing
        - Informational label updates created
- Final acceptance

Future development

- Voice track to be added
- Expansion of humanities to include writing program
- CD Rom production



Small Computers meet 3-D Digitizing

Today's Artist
By Kevin Gallup

Today's artist must become increasingly aware of the potential of the small computer in designing objects and providing direct access and interaction with clients through modems or networks. The small computer allows the artist to conceptualize without building cumbersome models, to use studio space more efficiently, and to make more effective presentations to clients. The artist has readily available, cost effective, intuitive tools for creating, presenting ideas, projecting costs and using fabrication techniques. Most importantly, the artist can do it all without requiring assistance from computer specialists.

What will become of the art world with these affordable powers? Increasingly, artists will find that their medium can be almost anything. While many artists once found themselves being slaves to the materials at hand, the materials are now endless. Conceptualization for commission competitions can be attempted in formats in which there are no limits to the imagination while providing true realism for a proposed piece of work. Cost estimating, physical analysis, the ability to revise a piece of work are capabilities of the small computer. It is also possible for the artist to have in hand a set of plans by which the piece can be successfully built by a third party without unwanted interpretation. The artist of today should be aware of the potential of these computers have, and whether they choose to use them or not, there will be no denying the growth of the influence and importance of the small computer in the artists lives.

At Old Dominion University, there is a unique fusion between technology and art. The mission of the art department at Old Dominion University is two-fold. First is the training of the art students in a holistic manner in which traditional skills are taught in such a way as to make the student capable of understanding the artistic experience. Secondly, students are made aware of the skills required in the world outside the school environment. Old Dominion University is fortunate in achieving cooperation across disciplines, allowing students exposure to a wide range of vocations for which they can utilize the skills obtained. This can be seen in a group called TECHNOART formed between the art, engineering, and technology education departments. This is a group which utilizes capabilities from each department to bring together abilities and equipment that would otherwise be too difficult for each individual department to operate. It has been show that there is much to be learned from each, and the joint technical services that each contributes certainly make the statement "the sum is greater than the parts" a true concept.

With this in mind, some of the current projects by the art department are especially in tune with the philosophy and nature of SCAN. There is a project underway which utilize 3-D digitizing techniques that clearly illustrates how an artist can move from conceptualization of a three dimensional form to a photorealistically rendered object, resulting in the ability to render the finished piece in any size. This process is especially important to sculptors, however many of the elements in the process are important to all artists.

3-D digitizing has made big advances lately in improving performance, being somewhat “user-friendly”, and lowering in cost. However, there are still many obstacles involved that still make this process something that is not suitable for the casually interested. The software still requires a good background in engineering drafting principles and takes many hours of work to gain competence. The equipment continues to drop in price, but is still more expensive than most are willing to spend. Artists however, are usually drawn to these leading technologies and will find a way to overcome the obstacles. The following is a overview of some of the equipment used and capabilities of the 3-D processes.

Equipment used for this presentation:

PC 486DX66 w/ 16 mb RAM
Polhemus 3-Draw digitizer
HP Plotter and HP Printer
Software: AutoCad w/ AutoSurf and AutoVision

CadKey
3-D Studio

Purpose of computer processes in the sculpture process-

A. Conceptualization
B. Manipulation
C. Presentation
D. Output

First and most important consideration of process: COST
Second : ease of use

Basic Reason for 3-D Digitizing - When there is an object to be made that is either very large or small, the advantages of this process is very clear, that is to render the object at a manageable size, bring it into the computer, and then deal with the object as necessary. This can be rendering, determining an internal structure, drawing a set of plans, growing a model via stereolithography, etc. There are also some good reasons for this process for non- large or small sculpture pieces, such as objects for use in animation or to come later, virtual gallery settings. Whatever the case, there are certain conditions in which the 3-D digitizing process is preferred over simply making the object with CAD alone. Attempting to create a sculptural composition such as a human figure using CAD alone, is very difficult. Often it is better for an artist to create the composition in clay or wax or whatever material, then digitize the object for manipulation in the computer. Animators also find this process very useful to initially arrive at a shape that can manipulated for animation use. 3-D sketching can lead to quick and interesting conceptualizing exercises compared to the normal practice of developing paths off of a computer screen. Once the artists begin to explore the possibilities of these system, there will no doubt be some exciting results.

A quick summary of digitizers will show a wide variety:

Contact:

Mechanical Arm
Electromagnetic Field

Sonic
Non-Contact:
Laser
Software:
Should support NURBS

Basic process for contact digitizer and AutoCad w/ AutoSurf:

A. Determine or map out control lines
B. Input control lines
C. Edit control lines
D. Apply surfaces
E. Apply meshed surface for rendering or sectioning

The digitizer used in this example is the Polhemus 3-Draw digitizing tablet which can act as a 2-D or 3-D digitizer with a stylus attached to a cable which acts as the input device. This cable attachment allows more freedom of movement than rigid arm type digitizers, but has the disadvantage of not being able to digitize conductive materials.

Objects are best digitized in formats utilizing NURBS. This results in the ability to create surface patches and a high degree of manipulation and editing compared to attempting to do the same with polygons. This process requires a good understanding of NURBS to systematically layout the object to be digitized. Once the mapped out nurbs have been digitized, the process of applying surfaces to the object begins. The surfaces need to result in a continuous mesh surface in order to render cross-sectional views.

Once the object has been created, it can be subjected to the processes that make CAD a powerful tool such as scaling, arraying, or other manipulations.

Major areas of manipulation and conceptualization offered by the computer process (AutoCad and 3-D Studio):

A. Lighting
   1. Ambient
   2. Spot
   3. Distant- Sun angle calculator

4. Ray Trace
5. Shadows

B. Material (Surface Rendering)
1. Solids
2. Textured mapped
3. Transparent

C. Movement Animation
1. Movement about space
2. Hierarchical movement

D. Physical Analysis
1. Determining centroid or mass
2. Measurements and locations
3. Placement of internal structure

E. Typical items associated w/ CAD (scale, arrays, stretch, etc.)

F. Placement of piece within an environment

Presentational capability- ability to work with the piece in a photo-realistic setting results in the ability to deal with many issues associated with winning a sculpture commission competition, dealing with a client, or just putting ideas in a format that is self explanatory.

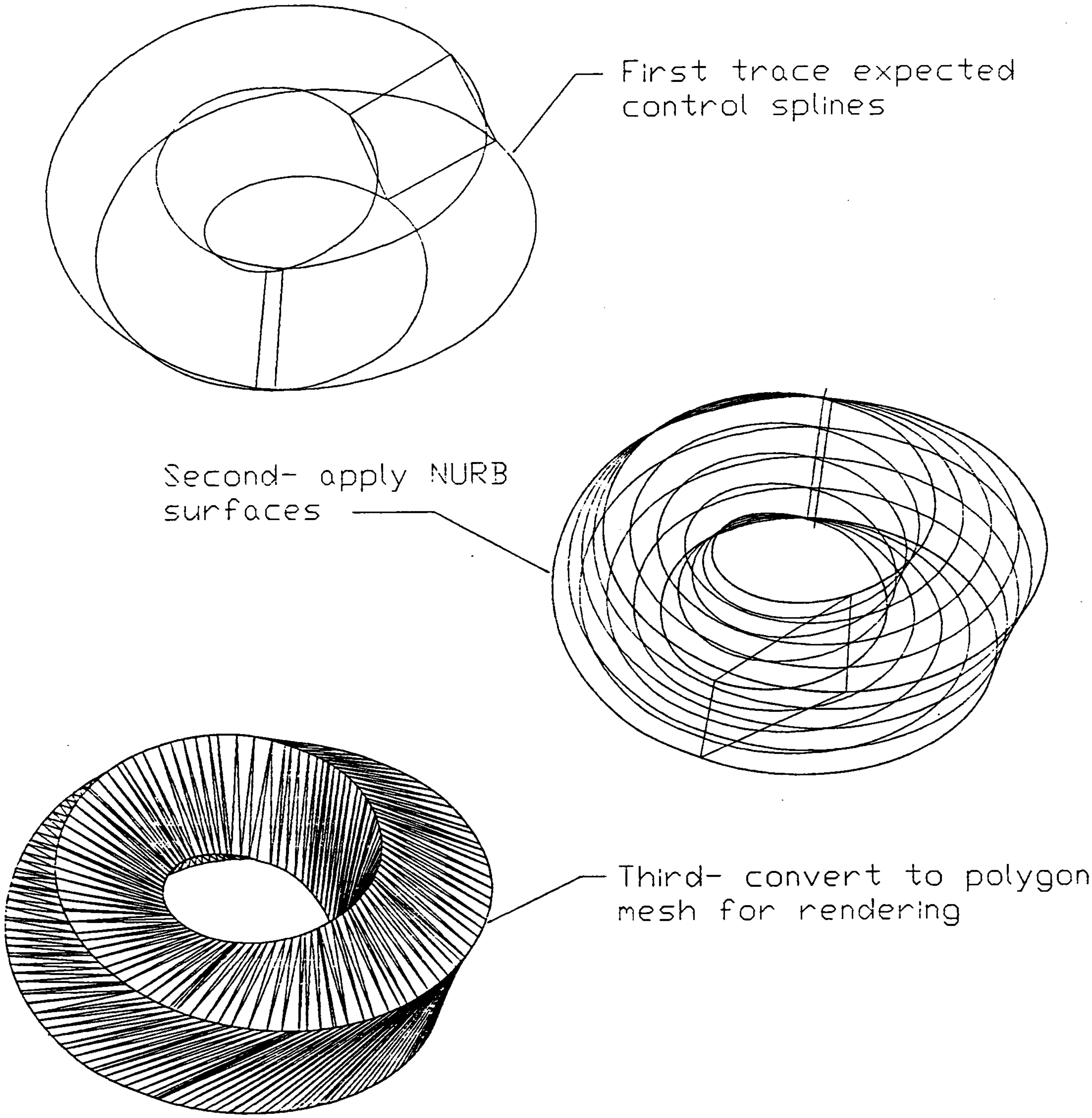
Output

A. Plotting for fabrication
B. Render for slide, print, video, animation
C. Cutting data- CNC machining and milling
D. Growing data- stereolithographic growth

For any further assistance I can be reached at:

Kevin Gallup (804-440-1216 hm. 683-5923 fax)
1532 W. 38th St.
Apt. 2
Norfolk, Va. 23508

Process of 3-D digitizing w/ contact digitizer



COSTA II: SCULPTURE BY VIRTUAL IMAGE PROJECTION

HELAMAN FERGUSON

0. Abstract. My recent sculptures involved with a computerized virtual image projection system and appropriate antecedents are summarized. The CRADA between NIST and my studio is described as a vehicle for developing new technological tools from an aesthetic application viewpoint. One current application of this avant garde technology is to create a ten foot diameter minimal surface (Costa IV) for the Maryland Science Center, Inner Harbor, Baltimore, Maryland. This quantitative sculpture will be installed for a permanent exhibition opening in June 1995. This paper includes a summary of techniques for creating the 16 inch diameter bronze and aluminum piece (Costa II) exhibited at the *SILICON GALLERY* in Philadelphia in connection with this year's SCAN conference.

1. Brief Sketch of My Previous Sculpture involving Computers. In the first place I am an artist with some very visual things to say. Sometimes computers or other technology can help me, sometimes computers and technology get in the way. It is important to know the difference, cf. [26,27]. I begin by listing a few sculptures that I have done in which tangent computer technology was helpful or even necessary. These sculptures are photographed and documented in [1]. By the way, if some things are expressible in a mathematical language it may be possible to express them naturally in a computer (graphical) context. On the other hand, there is nothing intrinsically sculptural about mathematics or computer science, any relationship is a creative act.

Umbilic Torus NIST, Carrara Marble, and *Umbilic Torus SRC*, Serpentine are the duals to *Umbilic Torus NC*. I carved *Umbilic Torus NC* using a CNC milling machine with a surface filling curve tool path [2,3]. My mathematical design in the case of Umbilic Torus NIST/SRC included choosing the elliptic umbilics to be a neighborhood of infinity. This led to $w = 2e^{i\varphi} + e^{2i\phi}, 0 \leq \varphi < 2\pi$ as the cross-section. This locus of a point on a circle of radius 1 rolling outside a circle of radius 1, is known as an epicycloid of one cusp, or a cardioid, a heart shape. This outward curved form with internal cusps offers new sculptural challenges compared to the inward curved form of the NC piece so I used virtual image projection, [4,6], suitable for direct carving in natural stone. For this SP–1. the 'virtual image projector', a Mac-II computer monitored lengths of three cables under tension which met at a point. A key concept is that three distinct labelled points in general position on any block determine the block's position and location. The virtual image for this sculpture was in the form of specially designed parametric equations above [7]. The software included an algorithm which calculated from any given point on the block the nearest distance from that point to the virtual image. This allowed random drilling in any direction to that depth without touching the virtual image. In the *SRC* piece I left partially carved out maximal sphere cavities looking out of the base like microwave antennae revealing the origins of the polished stone they support.

Eight Fold Way, Marble and Serpentine. is permanently installed in the patio area of the Mathematical Sciences Research Institute, University of California at Berkeley (just up the hill from the Lawrence Hall of Science on Centennial Way). This sculpture involved computer controlled water-jet cutting for the hyperbolic tiling base disc and virtual image projec-

Typeset by $\mathcal{A}_{\mathcal{M}}\mathcal{S}$-TEX tion for the joint of the black serpentine and the white marble. Quantatitive serpentine geometry underlies the qualitative marble topology. The mathematical design language used here includes the symmetry of surfaces. A sphere with $g > 1$ handles cannot have infinite symmetry. Hurwitz Theorem [11,12] states that the group of automorphisms of a surface of genus $g > 1$ is bounded by $84(g-1)$. This marble surface has genus $g = 3$ and the automorphism group can have $84 \cdot 2 = 168$ elements. The literal automorphism group of the polished marble surface itself has only one element, but that surface is articulated in such a way that all 168 automorphisms can be read out of it. There is an infinite discrete group associated with this marble acting on the hyperbolic plane that has a fundamental domain of exactly the 23 darker heptagons grouped around the 1 prism of the same polished black stone. The discrete group in effect sews up the 24 heptagon domain into the marble surface of genus three. The white marble has its 24 heptagons articulated as ridges and as incisions. The ridges correspond to the geodesic arcs in the hyperbolic plane which lie inside the fundamental domain, the incisions or cuts correspond to those geodesic arcs on the boundary of the fundamental domain. Select an edge somewhere on the marble. Go along this edge to the next fork in the road, take the left fork, go to the next and take the right fork, then left fork, then right fork, left fork, right fork, left, right and this is back to the original selection. There were eight turns, hence the title 'Eight Fold Way'. These 21 cycles return after eight alternating turns whatever the inital choice. The 168 elements of this group are the 3×3 invertible and commutator matrices [9,10] with entries over the two element field. We have to visualize this full symmetry genus three surface with more than our eyes, we need our fingers touching through these eight fold paths, our haptic senses of around and through, in addition to seeing.

The next generation of the virtual image projector, SP–2, was used in the creation of *Eight Fold Way*. SP–2 has six instead of three cables with all six lengths monitored by sensors arranged in Stewart platform format, [6]. The operator interactively flies the triangle. Tool tip position (x, y, z) coordinates and tool orientation (pitch, roll, yaw) are computed from the six cable lengths. Carving the *Eight Fold Way* included matching two stone parts, a hand shaped heptagon in the serpentine with a matching rounded heptagon on the tetrahedral marble form. The SP–2 helped. First the concave heptagon was carved in the marble. This heptagon was then touched with the tip of the inactive air drill to input a 'cloud' of points in no particular order close enough together. The three registration points were relocated in reversed order to carve the convex hand in the serpentine to hold the marble at its concave heptagon.

Most have seen the natural sculptural forms of the Grand Canyon carved out of solid rock by the abrasive Colorado River. I mused about capturing that sort of power in my studio. Looking over the south rim at the tiny filament of water glistening in the sun far below was about the filament size I saw close up in a water jet. One significant difference was the noise; the water jet seems to compress millions of years of erosion into a few seconds of roaring tornado sound, churning the catch chamber below into white water. This violent roar comes from a filament of water issuing from a diamond orifice under 55,000 pounds per square inch pressure, cf. [8]. The precise serpentine geometry counterpoints the free marble topology.

Cosine Wild Sphere, Serpentine, is an incised torus wild sphere carved by virtual image projection with the SP–1 system as described in *Umbilic Torus NIST/SRC*. In this case I desired a torus that was decidedly not a torus of revolution, I had a technological point to prove with the SP-1, this torus could not be made on a stone lathe for example. The virtual image in this case came from design equations that gave the torus a cosine profile when seen from the side. This is an alternative to inversion and cyclide tori for making a torus larger on one side. I have been interested in quarter periods of the cosine curve for some time. The changing radius curve in the virtual envelope for this incised torus carving lies in one such quadrant. The surface of this incised wild sphere seems to be covered with a thousand glistening eyes, these are residues of the virtual image projection carving process. As one approaches the virtual image and touches a nearby point, the computed radius for the sphere to remove there will be smaller the nearer the point. I stopped about a centimeter or so away from the virtual image and left the spherical cups. On one side, lower center there is a deeper indentation, below the level of the virtual envelope. In using the SP–1 at that time one of my sons was calling off the millimeters from the computer screen while I was drilling to depth. Somehow on that hole I started thinking centimeters instead of millimeters. I caught my error before I came out the other side. Perhaps unfortunately this interesting sort of random element is less likely to occur with the more idiot proof SP–2, but then the SP–2 is in the hands of a especially creative idiot ····.

Five Fold Umbilical Cord Torus, shows clearly the importance of studio work in addition to the generation of maquettes as computer graphics images. The curve at the core of this piece is a torus knot type $(p,q) = (1,5)$, which is the trivial knot. This unknot can be drawn on the surface of a simple torus, which in effect I did in the final direct carving process. I charged up my system to do the direct carving by alternating between two activities: 1) generating equations for umbilical cord forms and then testing these by making stereo pairs of computer graphics output, 2) dissecting actual umbilical cords given to me by friends (not the first time I dissected). The three cord segments were quite interesting and I made a small number of clay models or maquettes about them or particular features. But I generated maybe a hundred computer stereo 3D images about them much faster than it would be possible to physically make them or things like them. The virtual studio of the computer screen need not be a sterile environment if coupled with actual studio experience. A topologically equivalent example of the five fold core space curve on the simple torus for this sculpture is given by the simple vector valued function of one variable $t \mapsto ((3+\cos 5t)\cos t, (3+\cos 5t)\sin t, \sin 5t)$ where the circle of minor radius 1 cycles five times for each single cycle around the circle of major radius 3. This space curve can be given cross-sections in various ways and built up into a torus in its own right. After all this preparative emotional and conceptual loading, the direct carving went quite rapidly.

Igusa Conjecture, Serpentine, reveals clearly the futility of simply copying mathematical equations somehow into sculpture, which may not be physically possible nor indeed desireable. Jun-Ichi Igusa of The Johns Hopkins University conjectures what a few mathematicians can somehow have in their heads, but which simply cannot exist physically let alone have a physical model of any sort [13,14]. He bases his conjectures on hard won but important examples that may take him years to compute. His examples are precious mathematical treasures by themselves. His local zeta function is a rational function

$$Z(s) = \int_{X(O_K)} |f(x)|_K^s dx, \qquad \Re(s) > 0,$$

where K is a p-adic field with absolute value $|.|_K$, ring of integers O_K, f a polynomial on an affine space X with O_K structure. For the present example, $f(x_1, x_2)$ is the discriminant of the binary cubic form $N(ux_1 + vx_2)$ in u, v where x_1, x_2 are from a simple K-split Jordan algebra A of degree 3 with generic norm N. The 'simple' in the last sentence is typical mathematical jargon of understatement.

The case enjoyed by this sculpture is $X = H_3(C(O_K)^2$ where C is a composition algebra of dimension $2n$ with an O_K-hyperbolic norm form. Then $Z(s)$ takes the form []

$$Z(x,y) =$$

$$\frac{(1-x)(1-x^2)(1-x^{n+1})(1-x^{2n+1})}{(1-x^2y^2)(1-x^5y^6)(1-x^{2n+1}y^2)(1-x^{2n+2}y^4)} \cdot$$

$$\frac{F(x,y)}{(1-x^{3n+3}y^6)(1-x^{6n+2}y^6)}$$

where the polynomial $F(x,y)$ has 140 terms, where $x = q^{-1}$, $y = q^{-s}$, $n = \dim C/2 \neq 1/2$, and q is relatively prime to 6. In spite of this complexity, the functional equation $Z(x^{-1}, y^{-1}) = y^{12} Z(x,y)$ is true []. On the other hand the eigenvalues of monodromy for the binary cubic form f *(quite independently of the local zeta function Z)* are $\exp 2\pi v\sqrt{-1}$ for a zero v of the Bernstein polynomial

$$B(s) = (s+1)^2(s+\frac{5}{6})(s+\frac{7}{6})(s+\frac{n+1}{2})^2 \cdot$$

$$(s+\frac{n+2}{2})^2(s+\frac{2n+1}{2})^2(s+\frac{3n+1}{3})(s+\frac{3n+2}{3})$$

Igusa's conjecture is that in general the poles of the local zeta function including multiplicity lay among the zeros of the Bernstein polynomial and thus correspond to the eigenvalues of monodromy. I divided the stone into two parts, that referring to the poles and that referring to the eigenvalues. One might think: well, $Z(x,y)$ is just a rational function, why not just graph it, or since it is complex valued with a complex argument, graph sections of it. I tried that just to develop some insight. That showed next to nothing, the dynamic range of this polynomial is such that there are not enough protons in the known universe to begin to draw a picture that shows more than a tiny bit. So I retained the idea of the absolute value idea as I did in *Essential Singularity* (these poles are removeable) and created spire-like forms over the relative positions of the poles. I kept in mind that if one could see much of the first the others would be invisible, so I cut more stone off as the poles got more distant. Between the poles and eigenvalues I carved sort of a water line as a ship has. it is the nature of conjectures that one thinks from time to time. will it float? will it sink? The eigenvalues on the other hand are abundantly visible. In this case they all fall on six points equally spaced around the unit circle as they are the three complex roots of 1 and the three complex roots of -1. For the example at hand. there are two eigenvalues not coming from poles. those I did not arch along radii from the center as I did the four eigenvalues that did come from the poles. The sculpture stands on its eigenvalues. I have carved this stone celebrating Igusa's conjecture. Isn't that risky? The conjecture may turn out to be false. Nature is risk. Might the stone have come apart during the carving process if the conjecture were false?

Essential Singularity, Aluminum, was actually created in the course of a vendor demonstration of the first small (desk-top) computer I ever saw in the early 1970's. My reaction was to do something with this new thing besides making a list of numbers that didn't go anywhere. The formal series expansion

$$e^{1/z} = \sum_{n\geq 0} \frac{1}{n!\ z^n}$$

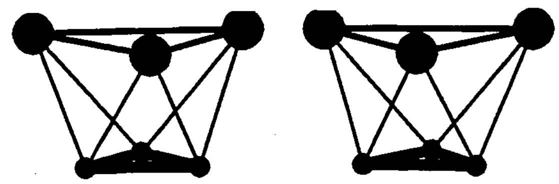
exhibits an infinite sum of terms each of which blows up for $z = 0$. Subtracting one leaves infinitely many still. For z a real variable $e^{1/z}$ is positive, the graph lies in two dimensions and is a piecewise one dimensional curve with a infinite break at $z = 0$. Too little for sculpture. For z a complex variable the three dimensional graph lies in four dimensions. Too much for sculpture. So I crush this by looking at the absolute value of the graph which is now two dimensions in three. This new function $|e^{1/z}|$ still has the infinite blow up feature at $z = 0$ although the infinitely many terms above are obscured a bit. If $z = x + y\sqrt{-1}$ then $|e^{1/z}| = e^{x/(x^2+y^2)}$. Level curves of this function are circles of the form $cx = x^2 + y^2$ tangent to the origin, centered on the real axis, on the right for $c > 0$ and $|e^{1/z}| > 1$ and on the left for $c < 0$ and $|e^{1/z}| < 1$ with radii as on the real positive curve above. I took a stack 40 steps above 1 and 10 steps below 1. This discretization destroys the mathematical model save at the edges, and introduces the human element of steps, stepping up the spire, stepping down into a pool. We can relate to steps, we have two feet and set them down discretely. We might relate to the pure model being infinitely smooth except at one point if we slithered as well as snakes. Would footless whales evaluate integrals of smooth functions as naturally as we evaluate discrete sums? This piece was completed a couple of decades ago and was a clear sculptural departure both in material and aesthetic choices from the literal and representational plaster mathematical models once visible in many mathematics departments around the world [16,17].

2. Virtual Image Projection. The last sculpture and reference provides a natural segue to modern replacements of plaster models, computer images to enhance and communicate understanding of mathematical structure. The book by Alfred Gray, [18], is filled with images which took many person years to create a century ago. But great was the desire to see these things then; now they appear on the computer screen in seconds with a few keystrokes by anyone who can type. Great is my desire to touch quantitative forms today. Sculpture has tended to be qualitative, just as I do life drawings or sculpture to learn new surfaces, so I can learn new surfaces by looking out of this mathematical window. Traditional sculpture has been implicitly quantitative, the quantitative only emerges after the fact of a physical creation if then. Explicit quantitative sculpture includes a quantitative creation (mathematical) prior to the physical creation. The physical artifact then partakes in various ways of the original quantitative proto creation, but tends to be convolved with geologically or physically interesting natural materials. Technology is just emerging to make them possible in person hours instead of months or years. But it should be kept in mind, *even possible at all*, due to the inhumanly huge numbers of calculations involved.

The images of Gray's book come from parametric equations. These parametric equations have been under design by mathematicians for hundreds of years. On the other hand, pointing machines for sculpture have been around for hundreds of years as well. Pointing machines, whatever their variety, always refer to an existing object, a solid model or maquette, which is to be copied or enlarged. These pointing machines are slow and laborious but quite effective. They are useless without an object to copy. Parametric equations represent things that are not physical but mathematical, figments in our heads if anywhere. Lately we have been drawing these things on glass, computer screens. The central problem is how to get these images out of the computer. Digitization is a process for getting physical image coordinates into a computer data base. Once in the computer we can do things to the image, but how to get the three dimensions back again.

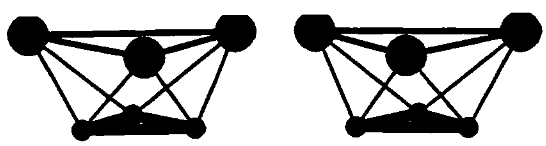
VIP or Virtual Image Projection refers to one *inverse digitization* process which I have developed jointly in a CRADA (Cooperative Research and Development Agreement) between my studio and NIST (National Institute of Standards and Technology). This inverse digitization, goes from either parametric equations or a data base in the computer, into physical materials. My aesthetic choice is direct carving in the final material, e.g., subtractive carving of natural stone. The present form of this computer instrument has been strongly influenced by that aesthetic choice. The concepts are simple and powerful and can be adapted to other forms, as was the case with COSTA II.

The VIP itself is a mathematical engineering based on a theorem of Cauchy from over a century ago. Cauchy was an exceedingly creative mathematical soul who discovered many theorems; this one states that a convex polyhedron is determined if the lengths of its edges are known. The application to the Stewart platform technology is the polyhedron being an octohedron of eight triangular faces, twelve edges and six vertices, the dual of a cube. The SP–2 which hangs in my studio includes two rigid equilateral triangles, on the ceiling 13 feet on a side, and suspended in midair 3 feet on a side. The other six edges are made of high tensile strength fine cable of variable length feeding under tension into six length sensors.



This stereo pair of the VIP octohedron shows the lower triangle translated downward with yaw.

A complex mathematical model (originally developed by NASA for the space shuttle) for this engineering setup. The software includes a C language implementation of this model which takes the six lengths imput and computes six coordinates which are three for the location of the tool tip and three for the orientation of the tool. This computation is done in real time on the Mac II. The Costa surfaces involve undercuts so the orientation of the tool in the undercut volumes is necessary.



This stereo pair shows a symmetric position of the VIP octohedron. The fat vertices in the top triangle indicate the sensors. The six fine lines between the top triangle and the bottom suspended triangle indicate the variable length cables measured by the sensors.

These six lengths are then available to the computer (MacII) through an analog to digital interface. Since the six edges of the two rigid triangles are known exactly, the other six variable lengths, when known at any instant completely determine the octohedron. They determine implicitly the position and orientation of the suspended and moveable triangle, in particular the position and orientation of any tool fixed to that triangle.

3. Costa Minimal Surface Design.

Minimal surfaces occurred when mathematicians two centuries ago, e.g., Euler and Lagrange, began thinking about mathematical language to describe stretched surfaces, surface tension, soap films, and such. The abstract mathematical surfaces were called minimal surfaces and were defined by certain differential equations, cf., Osserman [25]. Mercifully we will not write these differential equations here. Right off three surfaces were discovered, the plane, helicoid, and catenoid, which satisfied the differential equations for minimal surfaces. And there the matter lay two centuries, with various mathematicians wondering if there could be a minimal surface with a hole in it. Costa's thesis [20] in Brazil in 1983 led to a renaissance in the theory of complete embedded minimal surfaces of finite genus, a renaissance opportunity seized by Hoffman and Meeks [22,24].

One way to think about minimal surfaces geometrically is in terms of kissing spheres. A kissing sphere at a point on a surface is the largest sphere which is tangent at that point. The reciprocal of the radius of the kissing sphere at a point is called the Gaussian curvature. But there are two possible kissing spheres, one on each side of the point on the surface. The surface is minimal if the two spheres are the same size.

D_4 is the symmetry group of a square, there are eight elements which describe all the rotations and reflexions (flips). Costa's minimal surface has D_4 symmetry but this was not remotely known in 1983 when Costa wrote down the parametric equations [20]. As soon as an even rough computer graphical image was computed by James Hoffman and seen by Dave Hoffman and Bill Meeks, the symmetry was exposed. From there a proof was constructed [21]. Costa's original parametric equations involved the Weierstrass representation and integral of functions of the Weierstrass elliptic P function. Recently Gray [19] developed a new parametrization without the integrals by introducing the Weierstrass elliptic Z function. This breakthrough means the computation of a picture of the Costa surface takes now five minutes instead of ten hours. This renders the surface feasible in my virtual image studio context (which uses a vintage Mac-II). So a year ago this sculpture would have been much more troublesome to do. Doing the sculpture also motivated some new mathematics. When I developed the proofs of symmetry below, they actually gave a simplification in Alfred Gray's original parametrization.

The D_4 symmetry is crucial for the construction of the sculpture out of eight related parts, so I give this symmetry careful attention here.

The parametrization for the Costa minimal surface takes two variables (u, v) into three coordinates $(x, y, z) = (c_1, c_2, c_3)$. The three coordinates correspond to the following three functions of a complex variable $w = u + iv$ where i is a fixed choice of exactly one of the square roots of $-1 = i^2$.

$$c_1(w) = \frac{\pi^2}{4e_1} +$$

$$\frac{1}{2}\Re\Big(\pi w - Z(w) + \frac{\pi}{2e_1}(Z(w - 1/2) - Z(w - i/2))\Big)$$

$$c_2(w) = c_1(i\bar{w})$$

$$c_3(w) = \frac{\sqrt{2\pi}}{4} \log\left|\frac{P(w) - e_1}{P(w) + e_1}\right|.$$

The number

$$\pi = 3.14159265358979323846264338327 9\ldots$$

is the usual area of a circle of radius one. The number

$$e_1 = 6.87518581802037282749009577981 0\ldots$$

is actually a design choice. It is chosen so that there are absolutely no self-intersections in the surface. As a general rule, almost all choices of functions (e.g., Enneper, etc.) in a Weierstrass representation cf., [26 (Dickson on stereoplastigraphy)] have self-intersections and are therefore by definition not embedded. If e_1 were replaced by anything else, the result would be pretty awful. The new thing about the Costa surface was that it was embedded and at the same time a (triply punctured) torus. D_4 symmetry was recognized and the insight was developed into a proof that this torus was indeed embedded and had no self-intersections, [21,22].

The two functions P and Z are defined by

$$P(w) = \frac{1}{w^2} +$$

$$\sum_{(0,0)\neq(m,n)} \Big(\frac{1}{(w - m - ni)^2} - \frac{1}{(m + ni)^2}\Big)$$

and

$$Z(w) = \frac{1}{w} +$$

$$\sum_{(0,0)\neq(m,n)} \Big(\frac{1}{w - m - ni} + \frac{1}{m + ni} + \frac{w}{(m + ni)^2}\Big)$$

where these are both doubly infinite sums over all positive and negative integers m and n where both m and n are not simultaneously zero. It is important to emphasize here that these definitions are not suitable for actual numerical computation of P and Z. These functions have been much studied over the last century and their numerical analysis is well understood, indeed both P and Z appear in the special function packages of Mathematica 2.3, although Z is not in Mathematica 2.2, [23,24].

Because of the double periodicity of the triple (c_1, c_2, c_3) we can assume that $w = u + iv$ lives in the fundamental square defined by $0 < u < 1$ and $0 < v < 1$. Because of the D_4 symmetry we can only need to compute the vector (c_1, c_2, c_3) as a function of the two variables u, v in the fundamental triangle (bounded by East and Northeast) defined by the inequalities $0 < v < u < 1$. Including rotations *and* reflexions the surface is defined by its part in one single octant, but reflexions are not physical! Another problem is that the P and Z functions have poles; this leads to a natural pentagon as an eighth of a finite part of the surface.

The D_4 symmetry proof requires only the following properties of the P and Z functions.

$$(i) \qquad P(-w) = P(w)$$

$$(ii) \qquad P(iw) = -P(w)$$

$$(iii) \qquad P(\bar{w}) = \bar{P(w)}$$

$$(iv) \qquad P(w + m + in) = P(w)$$

Note that P is doubly periodic.

$$(j) \qquad Z(-w) = -Z(w)$$

$$(jj) \qquad Z(iw) = -iZ(w)$$

$$(jjj) \qquad Z(\bar{w}) = \bar{Z(w)}$$

$$(jv) \qquad Z(w + m + in) = Z(w) + m\pi - ni\pi$$

Note that Z is almost doubly periodic.

The equations $(i - iv, j - jv)$ are primitive in the sense that the proofs follow from the definitions of the Z and P as sums over the Gaussian lattice as given in equations (z) and (p).

For the proof, there are six transforms of the complex number $w = u + iv$, viz.,

t_0	w	(u, v)	(x, y, z)
t_1	$i\bar{w}$	(v, u)	$(y, x, -z)$
t_2	$1 + iw$	$(1 - v, u)$	$(-y, x, -z)$
t_3	$1 - \bar{w}$	$(1 - u, v)$	$(-x, y, z)$
t_4	$1 + i - w$	$(1 - u, 1 - v)$	$(-x, -y, z)$
t_5	$1 + i - i\bar{w}$	$(1 - v, 1 - u)$	$(-y, -x, -z)$
t_6	$i - iw$	$(v, 1 - u)$	$(y, -x, -z)$
t_7	$i + \bar{w}$	$(u, 1 - v)$	$(x, -y, z)$

where the right hand column with $x = c_1, y = c_2, z = c_3$ is what we want to prove. The group elements t_1 and t_3 generate the group,

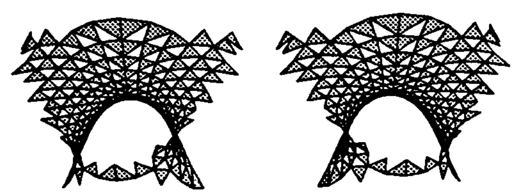
$$t_2 = t_1 t_3, \quad t_4 = t_1 t_3 t_1 t_3, \quad t_5 = t_3 t_1 t_3,$$

$$t_6 = t_3 t_1, \quad t_7 = t_1 t_3 t_1,$$

where t_0 = identity. (There are three interesting representations of D_4 here as 1×1, 2×2, 3×3 matrices. The 1×1 appears as the sign of w and is the product or quotient of the determinants of the 3×3 and 2×2's.)

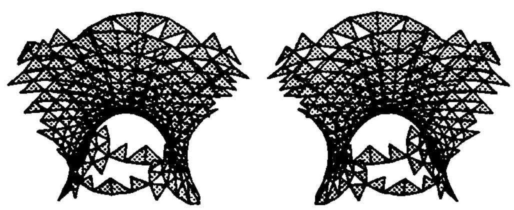
A stereo view of one eighth of a fragment of the Costa minimal surface, this is t_0 alone.

It suffices to check t_1 and t_3. The proof that $c_3(w \cdot t_j) = \pm c_3(w)$ for the right $\pm$ follows easily from the $(i - iv)$ because the quotient inverts every time $P(w)$ changes sign. The proof of $c_1(w \cdot t_3) = c_2(w)$ is a bit more involved with the $(j - jv)$ for the $Z(w)$ function. It is amazing how it works. It is very clear that one would not be particularly motivated to look for symmetry of this kind in these rather arcane coordinate functions without having seen a picture of the symmetry!



A stereo view of a fragment of the Costa minimal surface with t_0, t_1, t_6, t_7 showing how the surface in different octants fit together to make part of the punctured torus.

To complete the embedding argument from this one observes that the inner product of the gradient of the appropriate one eighth of the surface in a standard octant with the $y-$axis direction doesn't change sign, i.e., is always visible and therefore a function over the xz plane.



A stereo view of a fragment of the Costa minimal surface with the full group of D_4 symmetries $t_0, t_1, t_2, t_3, t_4, t_5, t_6, t_7$. This view is not particularly wonderful because of the paucity of pixels, but the doubled number of pixels is very nice on the computer screen. Postscript and its encapsulation freaked out on the better picture. Anyway the bronze and aluminum is vastly better.

4. Costa Minimal Surface Sculpture.

When it comes to comtemplating a sculpture postfiguring these ideas, there is some subtlety: this is D_4 symmetry not Z_2^3 symmetry. A tennis ball or baseball with the usual seam has Z_2^3 symmetry and can be physically constructed of one single eighth rotated and translated about the sphere. The Costa minimal surface is a triply punctured torus in which the seam represents one puncture and the other two punctures can be thought of as two symmetrical circles appropriately located one above and one below the seam. This marked tennis ball has now D_4 symmetry and *two* separate eighths are required to rotate and translate to fill the whole sphere. Thus we actually need two elemental forms, mirror images of each other, to construct the Costa minimal surface.

Furthermore, a sculpture has physical thickness whereas a mathematical surface has none. I choose to have one surface of a not very thick bronze be a reasonable approximation to the mathematical surface and the other somewhat parallel surface less approximate. I could have chosen to sandwich the surface between two parallel offset surfaces, but noticed that that would obscure the deliciousness of the actual tension in the soap film like minimal Costa. I also chose not to be obsessed with smooth surface and incorporated texture. These are strong ideas, and it is interesting to see how they survive visually without obsessing over them as if I were making a mathematical model of some kind, which is impossible anyway.

Another non-physical feature of the surface is its infinite extent. I addressed this issue by cutting the surface off at some fixed radius from its natural center. Hence a pentagon as an eighth. But what radius. This involved the generation of many computer maquettes of different radii until I found one I liked. The Hoffmans' pictures were published at radius three or more. Here the embedded ends tend closely to circular and sculpturally unexciting. I pulled the radius in to two to activate the curves to a central hyperbola potato chip flower basket sort of boundary and two caps not so obviously circular. The central curves tend to a plane and the caps tend to a catenoid for increasing radii.

The purpose in part for doing a small version, Costa II, was to develop the process with an eye to the three foot version, by then one should be prepared to do the ten foot version. For the sixteen inch version, being indolent, I simply computed a file of coordinate points for a single orthant. Referring to this file by real time interpolation within the VIP software. I pointed off these three dimensional coordinates in a thermosetting clay material set in a orthant corner of plexiglas. That done and the clay cooked a negative plaster image of that was made. I now had a sandwich mold of a single orthant element. I then went back to the coordinate file in the computer and mathematically reflected that file with a mirror image transformation. (The plaster image is the same at the surface and not a mirror image.) With this new file in the VIP I built up mirror image in its orthant and made a negative plaster image of that. I then produced two sets of four spatial pentagons, eight altogether, which when properly connected made my fragment of the Costa minimal surface. I coated this with wax and cast the result in bronze. Some of the aluminum boiled in with the bronze giving the interesting surface texture. One of the surfaces was made smoother in the wax stage than the other and that received an antique verde patina, the other a darker patina.

The resulting Costa II amounts to some degree of approximation (millimeters) to a capturing of a soap film which can now be felt and rung like a bell! The ten foot version will be big enough to slide down and through. Haven't you always wanted a seat of the pants understanding of minimal surfaces?

REFERENCES

1. Claire Ferguson, *HELAMAN FERGUSON: Mathematics in Stone and Bronze*, Meridian Creative Group, Erie, Pennsylvania, 1994.
2. Helaman Ferguson, *Two Theorems, Two Sculptures, Two Posters*, Invited paper for the 75th Anniversary Issue of the Mathematical Association of America, Cover and Sixteen Figures, American Mathematical Monthly **97** (August-September 1990), no. 7, 589-610.
3. Helaman Ferguson, *Space-Filling Curves in Tool Path Applications*, with Jordan Cox, et al., Special issue on NC Machining and Cutter Path Generation, Byoung K. Choi/guest editor, Computer Aided Design (CAD) **26** (March 1994), no. 3, 215-224.
4. James Albus, Roger Bostleman, Helaman Ferguson, Samuel Ferguson, et al, *Functional Description of a String-Pot Measurement System, SP-1*, National Institute of Standards and Technology, NIST Draft Document (6 April 1990), 1-76.
5. Helaman Ferguson, *Multiperiodic functions for surface design*, with Alyn Rockwood, Computer Aided Geometric Design **10** (1993), 315-328.
6. James Albus, Roger Bostleman, Helaman Ferguson, Samuel Ferguson, et al.,, *String-Pot Measurement System SP-2, hardware/software*, National Institute of Standards and Technology, NIST Draft Document (3 March 1993), 1-197.
7. Helaman Ferguson, *Computer Interactive Sculpture*, April 1992 Symposium on Interactive 3D Graphics, Computer Graphics, ACM SIGGRAPH Special Issue, 109-116, reprinted in The Visual Mind: Art and Mathematics (Michele Emmer, ed.), LEONARDO International Society for the Arts, Sciences and Technology and MIT Press, Cambridge, Massachusetts, 1993 Chapter 10., pp. 49-55.
8. Helaman Ferguson, *Computers and Sculpture: Water Jets*, Invited paper for series in MAQUETTE, a publication of the International Sculpture Center, David Furchgott/Director, 1050 17th Street, N.W., Suite 250 Washington, D.C (March 1993), 11-12.
9. John H. Conway, R. T. Curtis, S. P. Norton, R. A. Parker, R. A. Wilson, with computational assistance from J. G. Thackray, *ATLAS of Finite Groups*, Maximal Subgroups and Ordinary Characters for Simple Groups, Clarendon Press, Oxford University Press, New York, 1985.
10. Murray Gell-Mann and Yval Ne'eman, *The Eightfold Way*, reprint Chapter: The Eightfold Way: A theory of Strong Interaction Symmetry, California Institute of Technology Laboratory Report CTSL-20 (1961), W. A. Benjamin, New York, 1964.
11. Adolf Hurwitz, *Mathematische Werke*, Band I Funktionentheorie, Band II Zahlentheorie, Algebra und Geometrie, E. Birkhauser & Cie, Basel, 1932-33.
12. Jonathan L. Gross & Thomas W. Tucker, *Topological Graph Theory*, Wiley Interscience Series in Discrete Mathematics and Optimization, John Wiley & Sons, New York, 1987.
13. Jun-Ichi Igusa, *Local Zeta Functions of certain Prehomogeneous Vector Spaces*, American Journal of Mathematics **114** (1992), 251-296.
14. T. Kimura, F. Sato and X.-W. Zhu, *On the poles of p-adic complex powers and the b-functions of prehomogeneous vector spaces*, American Journal of Mathematics **112** (1990), 423-437.
15. Diane Mae Meuser and J. Denef, *A Functional Equation of Igusa's Local Zeta Function*, American Journal of Mathematics **113** (1991), 1135-1152.
16. Eugene Jahnke and Fritz Emde, *Addenda, VI, The exponential function $e^{1/z}$*, Tables of Functions, Dover, 1945, p. 39.
17. Gerd Fischer, Mathematische Modelle / Mathematical Models, Friedr. Vieweg & Sohn, Braunschweig/Wiesbaden, 1986, pp. volumes I: i-xii, 1-129, II: i-viii, 1-83.
18. Alfred Gray, Modern Differential Geometry of Curves and Surfaces, CRC Press, Ann Arbor, 1993 First Edition, pp. i-xviii, 1-664..
19. Helaman Ferguson, Alfred Gray, S. Markvorsen, *Costa's Minimal Surface via Mathematica*, (to appear) (1994), 1-14.
20. Celso J. Costa, *Example of a complete minimal immersion in R^3 of genus one and three embedded ends*, Bol. Soc. Brasil Math. **15** (1984), 47-54.
21. David Hoffman and William Meeks, *A complete minimal surface in R^3 with genus one and three ends*, J. Differential Geometry **21** (1985), 109-127.
22. David Hoffman, *The Computer-Aided Discovery of New Embedded Minimal Surfaces*, The Mathematical Intelligencer **9** (1987), no. 3, 8-21.
23. Milton Abramowitz and Irene A. Stegun, *Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables*, Chapter 18: Weierstrass Elliptic and Related Functions, pp. 629-683; especially 18.14: Lemniscatic Case, pp. 658-663, Dover Publications, Inc., New York, 1977.
24. Stephen Wolfram, *Mathematica*, A System for Doing Mathematics by Computer, Addison-Wesley Publishing Company, Inc. The Advanced Book Program, Redwood City, California, 1991, Second Edition.
25. Robert Osserman, *A Survey of Minimal Surfaces*, Dover Publications, Inc., New York, 1986.
26. Stewart Dickson, Chair, *The Third Dimension: It's not a Virtual One*, A Panel of Sculptors: Helaman Ferguson, Frank McGuire, Bruce Beasley, Rob Fisher, Stewart Dickson, Published in Proceedings of ACM SIGGRAPH '91: Panels, Las Vegas, Nevada. 28 July - 2 August 1991.
27. Rob Fisher, Chair, *The Computer: A Tool For Sculptors*, A Panel: Stewart Dickson, Timothy Duffield, Helaman Ferguson, Frank McGuire, David Morris, David Smalley, FISEA 93 – The Fourth International Symposium on Electronic Art, 3-7 November 1993, Roman Verostko, Program Director, Minneapolis College of Art and Design, Minneapolis, Minnesota.

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THE DAVE VAN KOEVERING COLLECTION AT THE MUSEUM OF SCIENCE AND INDUSTRY TAMPA, FLORIDA

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The Dave Van Koevering's instrument collection currently housed at the Museum of Science and Industry, Tampa, Florida, is one that has evolved as a result of the creator's most diverse life. Originally a traveling evangelist, Dave Van Koevering and his family performed gospel tunes on many of the unusual instruments he collected over the years. Of particular interest was a recording the family produced of a traditional hymn, with its melody performed on a set of gears spinning on a marble surface. Van Koevering's evangelism through these unusual instruments lead him to seek out new innovations, in particular, electronic music.

Van Koevering first met Robert Moog in the late nineteen sixties when Moog was manufacturing the large suitcase models of his synthesizer. Known as models I, II, or III (depending upon the size), these early models were monophonic and operated by external patch cords. The use of external patch cords were rather cumbersome to operate during live performances. However, Van Koevering did purchase one of these early models and used it in his evangelistic meetings.

During one of his subsequent meetings with Moog, Van Koevering discovered a smaller version of the synthesizer at Moog's home. This model had internal patching and was able to create polyphonic sounds. The unit contained five oscillators; one as a controller for the tone wheel, three tone oscillators, and one for pink noise (read <u>Electroacoustic Music: The First Century</u> by Herbert A. Deutsch for more detail). This unit was an advancement in the technology yet Moog stated that it was merely a toy that he was making for some of his friends for Christmas. According to Van Koevering, he disagreed with Moog over its usefulness and claimed that it had the capability for being the first live performance synthesizer and went further to offer a challenge to Moog to build one thousand of them and Van Koevering would sell them all. Thus began a relationship that would last well into the seventies. Van Koevering began traveling through-out the country introducing the keyboard to performing musicians. Among the early users of the instrument was Keith Emerson of "Emerson, Lake, and Palmer" who also used the earlier patch cord model for the "Lucky Man" album.

In the 1970's, Robert Moog sold the R.A. Moog Company whose new owner renamed it Moog Music, Inc. It was sold again in 1973 to Norlin, Inc. It was during this time that Van Koevering left Moog and moved to Seminole, Florida opening Vako Sound House. The title Vako is a shortened version of Van Koevering's name. There he sold professional concert equipment including "Fender" and "Gibson" guitars, "Melotron," "Moog," "Arp," and "Hohner" keyboards, as well as "Phase Linear" and "Crown" Amplifiers, the first two major concert amplifier manufacturers. Also included were products by Bob Heil out of St. Louis. Heil built heavy-duty touring equipment for concert sound reinforcement for major bands such as The Who. Heil's line included snakes, mixers, horns, P.A.s, and guitar stacks. Heil developed wire grills on the speakers rather than the cloth covers to protect the horns from touring abuse and from aggressive performers such as Pete Townsend.

Vako was involved in the repair of electronics for the touring bands that performed in the Tampa Bay area including "Emerson, Lake, and Palmer," "Rick Derringer," and Ruth Underwood's (Frank Zappa's Percussionist) Xylo-Marimba, equipped with an individual "Barkus Barry" electronic pick-up on each note. Vako also rented concert gear to such bands as the "Righteous Brothers."

Among the less professional keyboards Vako carried was a Japanese "Optigon." This instrument was originally developed as a competitor to the "Magnus" chord organs. Underneath the keyboard was a slot for a sheet of acetate fourteen inches in diameter with black and white bands following a circular pattern. These bands were optical sound tracks, much like the kind found on the sides of motion picture film. Each band contained a separate track relative to a particular pitch on the keyboard. The acetate sheets were removable and could be exchanged for other sound sheets. Although the audio was not of high quality, the advantage of the "Optigon" over other keyboards such as the "Melotron" was that the tone could be sustained indefinitely as compared to five or six seconds on the "Melotron." Unfortunately, the manufacturer was never able to match up the place in the circle where the sound began and ended thus creating a blip or click in the sound every revolution. This sound would occur often in the tracks closer to the center of the sheet causing considerable interference with the desired sound.

Around 1974, Van Koevering decided to create a keyboard instrument using the optical discs of the "Optigon" but improving upon the track loops and the electronic technology in the area of coupling the sounds to the keyboard. Under the Licensing of the Japanese company and with the expertise of engineer-musician Lee Schugel, Van Koevering had new instrument discs recorded in Japan and Schugel attempted to marry the wave patterns together in a more uniform order as well as improved the disc-reading ability of the keyboard. The new instrument was given the name of "Vako Polyphonic Orchestron" having the unique features of being a polyphonic instrument that could hold an authentic tone for an unlimited amount of time. One of the drawbacks though was the inability of the instrument to create an attack for the sound envelope. Initially the instrument drew great attention in the music world as Van Koevering took out full page ads in major music magazines and displayed the instrument at the trade shows. In the end, a limited amount were made, perhaps as few as thirty, and the "Orchestron" fell into oblivion.

The most famous of the "Orchestrons" built was one that was commissioned by Pat Moraz, the keyboardist for "Yes" after Rick Wakeman left the band. Lee Schugel spent several weeks building the instrument in Zurich, Switzerland where Moraz was recording a solo album. The instrument contained two manuals rather then the standard single manual and an "Arp Pro Soloist" installed into the cabinet. Connected to the Two "Orchestron" keyboards by an electrical umbilical cord were ten disc readers housed in a separate cabinet from the keyboards. Each reader contained a separate orchestral instrument sound allowing the performer to immediately change from one sound to another without physically changing the discs. This coupling capacity was developed by Schugel. Other than perhaps one "Yes" Album, the special "Orchestron" was never used again for any major recording.

Prior to relocating to Florida, Van Koevering, along with Moog Music, Inc. Vice President for Education, Dr. Thomas Rhea, had established the Electronic Music Foundation, a not-for-profit organization. Rhea's responsibilities at Moog Music, Inc. was to write all of the owner's manuals and documentation for the various equipment. He also wrote a column for a number of years in "Contemporary Keyboard."

According to former Foundation board member Daniel Hevia, the purpose of the foundation was to collect musical instruments that demonstrated the development of amplified sound. The collection was housed in Van Koevering's home and garage until he was able to find a place to publicly display it. Much of the collection had come from his own collection of instruments during his evangelistic days.

Some of the more important instruments in the collection included Clown Emmet Kelly's Trick Violin, an Edison Stro-Violin (of limited production), "Arp Odyssey Synthesizer" number 1 Prototype with a clear plastic housing, "Orchestron Model A" number 1, "Mini Moog" number 1016, "Moog Theremin Flushing Model", and an early "Ondes Martenot," the original "Ring Modulator." This rare instrument was developed in the early part of the twentieth century and was the focus of many composers of the time. According to The LaRousse Encyclopedia of Music, 1974, this instrument invented by Frenchman Maurice Martenot generated tones "by means of the interference affect produced between a fixed and a variable oscillator," or, in other words, by the sum and the difference of two separate pitches. Herbert A. Deutsch states in his book, Electroacoustic Music: The First Century that the Martenot was produced in various forms between 1928 and 1977. Unfortunately, of all the above mentioned instruments, the "Ondes Martenot" was never accounted for in the Foundation's inventory when it was handed over to the Museum of Science and Industry. Deutsch also states that the early Minimoogs are "truly collector's items."

In September of 1978, the C.P.A. firm of Hevia, Kenny, and Beagles, P.A. wrote to the Music Department of the University of South Florida informing them of a recent business foreclosure action resulting in the acquisition of the Electronic Music Foundation collection. The firm desired to give this collection to a not-for-profit organization, preferably a museum. Dr. Vance Jennings, Chairman of the Music Department, suggested that the collection be handed over to the Hillsborough County Museum, the fore-runner to the Museum of Science and Industry. Finally, in 1980, the collection was handed over to the newly founded Museum of Science and Industry where it has resided in its storage room since.

In April of 1991, I was introduced to Wit Ostrenko, Director of the Museum of Science and Industry. Mr. Ostrenko informed me that there were some old electronic instruments in the museum's storage area and that perhaps I would like to investigate them at a later time.

It was not until the fall of 1991 that I began my research on the instruments. The Museum discovered the original collection acquisition paperwork and I was given two different inventories to study. I called the C.P.A. firm that handled the transfer and interviewed Daniel Hevia. Mr. Hevia informed me that he had been on the foundation board years ago and would research the files to find any additional information on the collection or how I could contact Van Koevering. Unfortunately, I have been unable to make contact with him.

By December of 1991, I had amassed enough data to propose to the Museum that the collection should be brought out of storage and displayed in their permanent collections. By 1993, the Museum was able to envision a permanent space for the collection in their new 20,000 square foot addition to be open in 1995.

The focus of the collection will be to demonstrate the evolution of sound production from mechanical to analog to digital and show the relationship of the collection and its creator with the Tampa Bay area. It will also demonstrate the application of technology with regards to the general public. Visitors will be able to hear recorded examples of the instruments as well as interact with some of the later models.

The permanent display of this collection further demonstrates the Museum of Science and Industry's foresight in perceiving these instruments as the foundation, not only of tomorrow's music technology, but today's. It is important that our society, in it's race to improve and develop new ideas, continue to keep track of and recognize our past achievements. Otherwise many stages in the process will disappear and our descendants will be left with many of the same questions we ask when attempting to understand the evolution of achievement which has brought us thus far.

I wish to thank Mr. Wit Ostrenko, Director, MOSI, Cynthia Haffey, Collections, Mosi, Cindy Ciurro, MOSI, Keith Arsenault & Associates, and Lee Schugel for their support and assistance in this research.

Painting With Digital Light

Several years ago, when I was getting my Photography certification, one of our lecturers (a working commercial photographer) made the statement that his reply to the question "What do you do for a living" was "I paint with light." That phrase stuck out in my mind like few others have either before or sense, and not just because of the vivid imagery it uses. It was, in actuality, a statement of absolute truth relative to his profession which not only encompassed scientific fact but also implied the greater artistic skill inseperable from the trade. I have often wished that I was more inclined to plagarism when people ask me what I do for work, as I think that a paraphrasing of his original statement would aptly describe my present vocation.

Digital imaging, by and large, relies heavily on existing printing technologies for its transference to a more or less permanent substrate. While creative process itself has been made more efficient by the desktop systems we see in such abundance, the interperetation of digital art to an intelligible print format requires a good deal of highly technical knowledge and theories peculiar to traditional offset prepress trades. These trades, in turn, have more often than not viewed desktop systems as faddish, erratic interlopers in direct competition for their livelihoods. Not the best basis for a budding relationship.

Meanwhile the artist,who can see his creative effort onscreen, is in a quandary as to how to transfer this work to some form of hard copy and at an acceptable resolution. Whatever output device he/she may have is okay for rough proofing purposes (generally speaking) but probably (1) will not hold up for very long , (2) cannot be mass produced (over 5-10 copies), (3) is not of sufficient resolution/quality for a serious artist, or (4) has that intrinsic "computer art" look. Items 1-3 can be overcome with a little outside study as to printing/prepress requirements and item 4 requires imaginative use of an input device (such as a scanner or digital camera). As the technologies involved (on the desktop end) are not only relatively new but constantly evolving (on exponential scale), this presents quite a challenge.

It is here that the concept of "painting with digital light" must be brought into the discussion. Like traditional film, digital film output relies on areas of unexposed film to be exposed to a light source (laser) in precise amounts. These exposed areas in turn will translate into areas of color on a printed piece. It is also here that the very exacting and regular output of an internally generated computer image begins to lose that "fast and loose" look of hand-rendered reflective work. Yet a completely hand-rendered work is at best difficult and costly to translate to film for reproduction purposes. And a totally digital piece loses the very qualities that make art unique and exciting. What then the answer?

The best compromise is a combination of digitized hand work taken into a system and manipulated electronically, then composited into an electronic file. The result can then be "painted " onto a negative utilizing the output of a high quality imagesetter. At this stage is the point where the differences between the Laser or Dot Matrix printer and the high end output become painfully evident.If the hand work input was at a low resolution, it will be output at that same resolution, or "painted" with a crude brush. Woven into an otherwise high end file, the final product is totally unsatisfactory to all. If, however, one can input at a reasonable resolution, and then combine with similar quality electronic manipulation, then the finished product is not only acceptable but often times impossible to achieve through traditional methods.

The major stumbling block in all of this for most budding creative talents is knowing what kind of brushes they need to use. The majority of desktop scanners (CCD scanners, not the much more expensive PMT scanners used by color houses) work in an additive color RGB mode. Existing printing technology is based on subtractive CMYK color. While there are conversion utilities in most all digital image manipulation programs, these are often referred to in the complex terminology of color reproduction and may be hard to follow.

Even a simple B&W image can pose a series of hard choices with regards to resolution, file format and file conversion, not to mention all of the collateral problems of file size and enlargements/reductions. One must always ask "How detailed a brush must I use to get what I want?". The primary cosideration should always be to keep consistency foremost in your composition. This is to say, if you are planning to use a 300-800 dpi scan in a 2540 dpi output document, then there must be a conversion to a higher resolution format, such as redrawing the image using the scan as a guide, or converting the scan via a vector graphic conversion program such as Adobe Steamline or Corel Trace. With consistent output resolutions, the finished work will possess a unified image quality, or be "painted from the same digital light".

As with any palette, be it electronic or paintboard, general rules and conventions govern use. Issues such as color trap, color fit, color shifts and line screen angles are of the utmost importance as are knockouts, overprints. and moire when preparing for printing. In fact, it may be impossible to simulate a particular color in CMYK or mixed spot color. My only suggestion here is to learn all about whatever reproductive process you plan to use before composing. Knowing what brushes are available will help you paint a much clearer picture.

The most essential fact one must remember is that you are composing in a broader color base (additive color RGB) than you will be able to reproduce with conventional printing. If you do manage to "balance" your viewing system for CMYK (there are several good utilities out there for this purpose) you are still going to be making color judgement from a back-illuminated viewing surface, which will carry none of its luminance over to offset printing substrate. Indeed, it will actually tend to darken (w/dot gain) and appear "muddy" in comparison to the work image that the artist has become so used to seeing.

You must also consider all of the other attendant difficulties that professional printers and lithographers deal with in the normal course of image reproduction. Dot gain aside, there is still the possibility of unwanted patterns caused by screen interaction (moire) with each other (cyan and magenta for example) or even with a pattern contained within the image itself (woven rugs and tweeds are notorious, as are some geometric patterns). In fact, you may actually run into the consideration that your work may be non-transferrable to reflective media. Or the flip side which is that if you throw enough money at it, it can eventually done (albeit at premium rates).

On the subject of screen angles/moire/etc., there is now a newer technology on the digital imaging horizon. Stochastic screening is offered by several competing imagesetter manufacturers as an alternative method to reproduce color without problems peculiar to regularized haltone screens. While this "screenless" technology will indeed never produce a moire, its color reproduction is as unpredictable as the San Andreas fault. When proofing systems catch up to Stochastic screening, it will soon be accurately gauged and calibrated to a useful pre press output. Until then, it is more or less a curiosity that will require re-inventuion of several fundamental printing/color reproduction concepts.

Even with all of this it is still an attainable goal to produce high quality electronic imagery that can carry equal impact as reflective copy. The key lies in maintaining several basic concepts throughout the execution of your piece (if it is to be printed later, even hypothetically). A nice start is CMYK basis for all colors in the original file, barring this, a sure-fire conversion utility for the image format to a CMYK file type. Pantone libraries in apps are nice but make sure that there is a process color "build" for this in your document. A single or two color job will not need any sort of CMYK definition, but "continous tone" imagery will have to have it. If you are using a conversion utility to process the image to a CMYK base, be aware of the importance of saving with highest possible resolution. If, for example, you plan to "capture " a shot of an RGB screen and convert, use a format /method with better than screen resolution.

Understand as well that printed work is usually reproduced in an imposition which will have an inescapable tendency to misregister slightly due the effects of the printing process on the paper/board being run through the machine. Hence the need for trap color on all printed pieces.

If you are working with images of photographic/continuous tone origin, then small amounts of the same process color throughout the piece (known as "bridge color") will be needed. Bridge color serves the same purpose as trap color, but without the “outlined” effect that a trapped color produces. A spot color (added to the 4/c image) will also need trap, as it will contain no true “bridge” to any process color.A good rule of thumb is .003 inches-.004 inches for trap and 3% dot in the highlights for bridge.

Also an important consideration will be the final sheet size in relation to the actual stock size upon which the frouped job is printed. Your printer can give you an idea of standard stock cuts that correspond to press sizes in house. The less blank paper on your final printed imposition, and the lower the cost per finished piece.

But above all be sure and always be aware that you are never going to get the exact image on your monitor (speaking in perceived color terms) to a reflective substrate with 100% image fidelity.You may come very close, but the limitations of print technology will effectively make perfect color matches to RGB screen values an impossibility.

Your chances for completely accurate rendering most likely lie in the pursuit of reproducible grayscale images. With Krazy Kards our only real limitation lay in the fact that the type of paper on which it was printed would not hold the detail that it could be given in film format. Without going too much inb depth on Krazy Kards (a task I shall leave to Mr. Scott), our only obstacles were designing bleed (overprinted trim edge) into each card, and arriving at a final trim size that made an efficient use of paper. The blends created in FreeHand were small enough to maintain excellent transitional tones and the overlaid Tiff images lent a hand-rendered effect. The photo-print proofs showed not only good detail but consistent tonal values, which are easily reproduced on a single color press (keeping production costs low). More on this later from Mark Scott. Suffice it to say that color is not always the only way to go with your concept.

So before committing yourself to thousands of dollars in printing costs and prep time, try to bear in mind the acuity and definition of your digital brush, along with the few simple rules covered here regarding printed reproductions.

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CONCEPTION

I have been working on the idea of interlocking playing cards for several years. In years past I had worked on large charcoal and pastel murals at nightclubs as well as comic book pages, most recently Bible Comix - see SCAN '89 Proceedings. As a recent 9-5 job/family guy, however, I was beginning to lose my sense of creative urgency. Months pass by months, bills are paid, but the time and space for my art always seemed around the next corner, not "tonight", or "this weekend."

To get around this, I had to come up with a way to produce creative work while a) continuing to interact as a family member, and b) be able to finish works relatively quickly. Enter the 5x7 and 3x5 Index Card! Easy to get ahold of, easy to find room to draw on them, easy to put down on paper quick layouts and thumbnail sketches. And I could do it all while in the living room listening to the TV!

I started making these little sketches and stuff just started to appear. Felt like "automatic drawing". I was back in the flow. Maybe I was synthesizing all the stuff from the TV into my own mini-universe. Or maybe my concious mind was being distracted by the TV noise adequately so that my subconcious could really cook...

This went on for about 6 months, and I drew many separate scenes of a cast of mysterious characters interacting. Later, I became interested in drawing one character on each card, then in relating the drawings on the cards to each other somehow. Allowing them to be positioned in any sequence appealed to the game designer/puzzle maker in me.

So off I went in this direction, drawing one card after another, pencil on index card, with a loose idea of how walls, rocks, ceilings, open sky cards, dungeons, doors, and holes could all link up together. Well, after getting about 200 of these originals completed, and after getting some play-testing feedback, I realized I had to make things alot simpler if the cards were actually going to link up easily. (Actually only one or two of these cards would link up with any other card's side...too frustrating!)

Stop. Start over. Just think simple. Do one card with just a floor, then one with just a left wall, then one with just a right wall, and one with a ceiling. Then, do one with a floor and a left wall. One with a floor and a ceiling, and one with a floor and a right wall. . .

Hey, I was on a roll. And these cards **would** fit together with each other easily! So off I went, creating a card at a time, each one with a unique geometric wall/hole combination. I finished up late one night with Card #64, then spread them all out on the living room floor to see what would happen. To many strings and webs, not enough ground and mountain areas. Too much white space, but I could live with it. (Actually Cards #65-80 compensate for this if I ever get them completed.)

PRODUCTION

I needed a way to colorize and mass produce these images. Enter the Macintosh, CCD scanner, Adobe PhotoShop, and Aldus FreeHand. I had an original idea as to how to do this from colorizing comix several years ago.

I didn't want to lose my pencil/pen line quality, so Adobe Streamline or any other raster-to-vector conversion was not an option. I had hundreds of little lines and crosshatching, and I wanted the highest possible reproduction of this. Luckily, I could scan the images as black and white bitmaps instead of Grayscale or RGB, and achieve 5"x7" 400 dpi resolution at 400K memory! Even better, since its just black and white, it compressed to an amazing 40K as a LZW-compressed TIFFs!

To get shading I did not want to use Photoshop. Not only would I have to increase my bitmap image size by 24 times for RGB (from 1 bit to 24 bit), but, once you put color into a bitmap, it's pretty much a permanent thing. So I knew I wanted vector, resolution independent, shading.

Aldus FreeHand is the greatest little program! I FILE, Place'd my 400dpi B/W bitmap into it as a TIFF. Then I used ELEMENT, Element Info to change the bitmap's white to "Transparent". Then I put it on a layer and locked it in place. On lower layers, I then could create bezier curve objects (with no strokes) behind all the areas I wanted to be shaded. Instant colorized production-quality image!

This approach solved this part of my production problem. Any time I wanted to modify a color, or change a gradient, it was only a fill color pick away. This would have been impossible in PhotoShop. Also, I was never working on a file larger than 100K, yet my shading and gradients would always print at the highest possible resolution on imagesetter output, and the 50% reduced 400dpi would be very adequate for the line work!

I thought I was the only one using this technique, and for years was going to sell it for big bucks to the comic book companies, but it has been talked about several times by artists in recent issues of Step-by-Step Electronic Design. I think that the comic companies color houses are still working with 15MB per page RGB Photoshop images, though! No wonder comics cost $1.75 now a days...

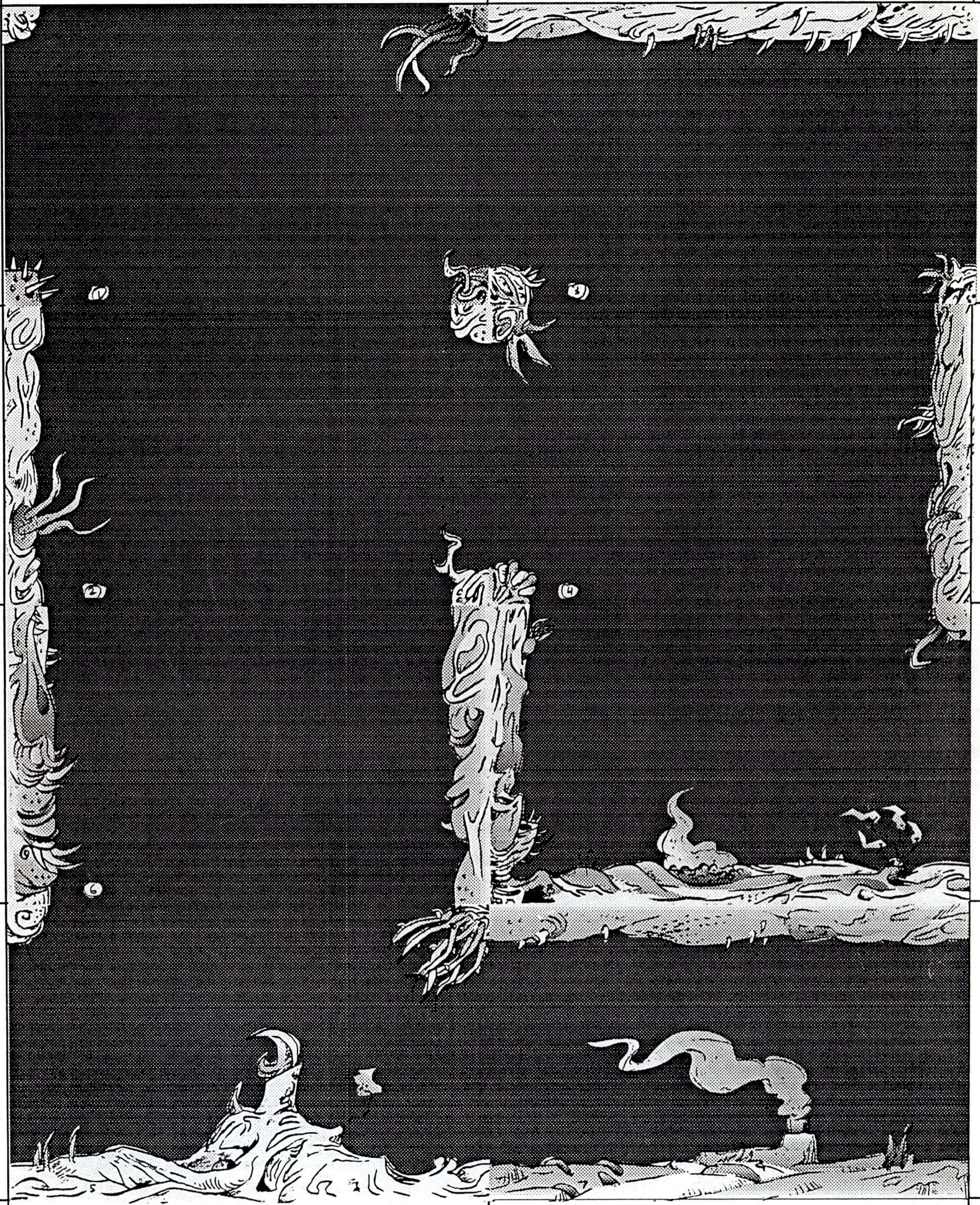
Once I had all the 64 cards as colored FreeHand files, I reduced them in size and copied them all onto 8 pages that could hold 8 cards each. I made sure that each page contained legal combinations of cards so that would interlock.

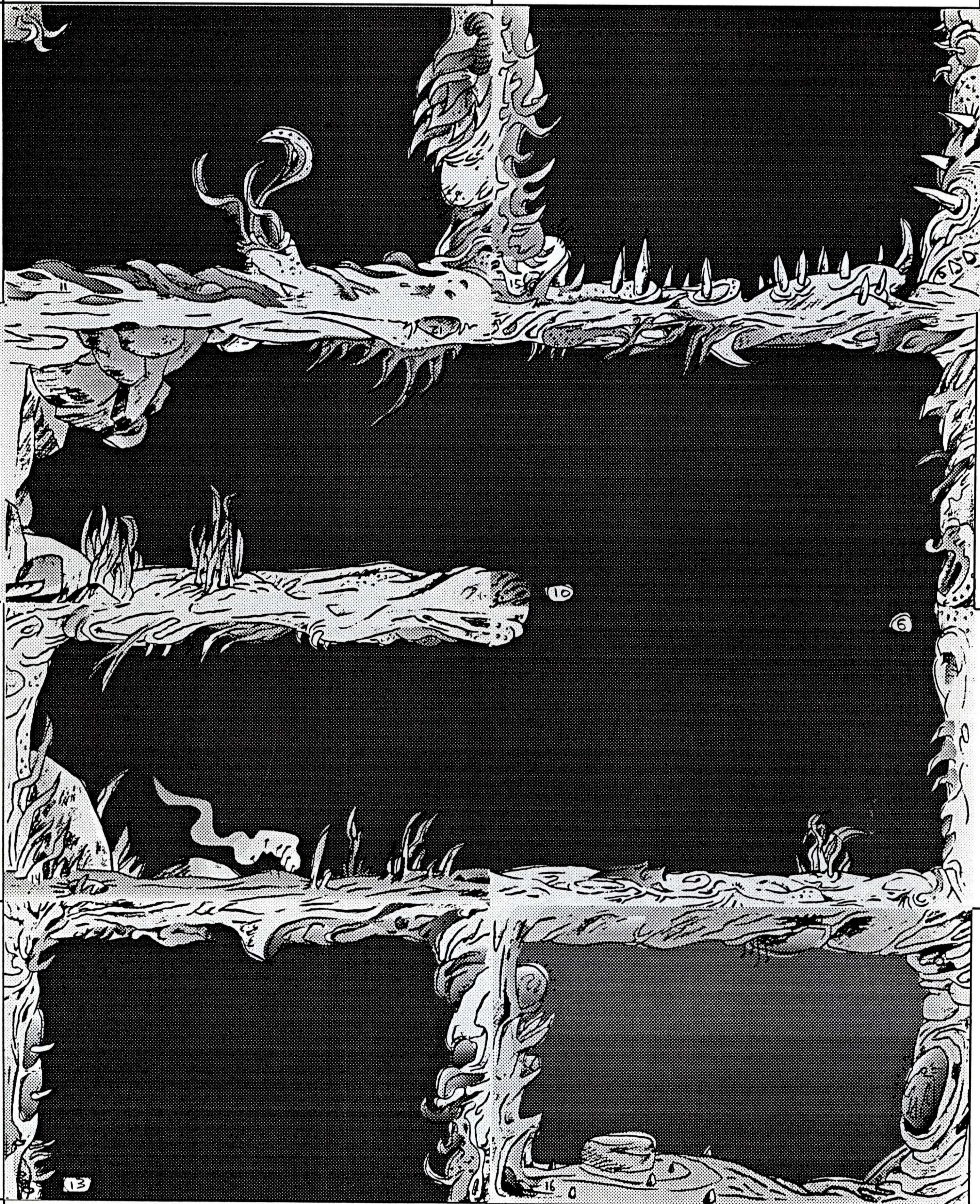
I am working with Richard Wright on a production version of these cards. I will have to re-arrange the final pages but most of the work I did on the original images is ok. Since they are in an object-oriented drawing program changing little things is fairly painless.

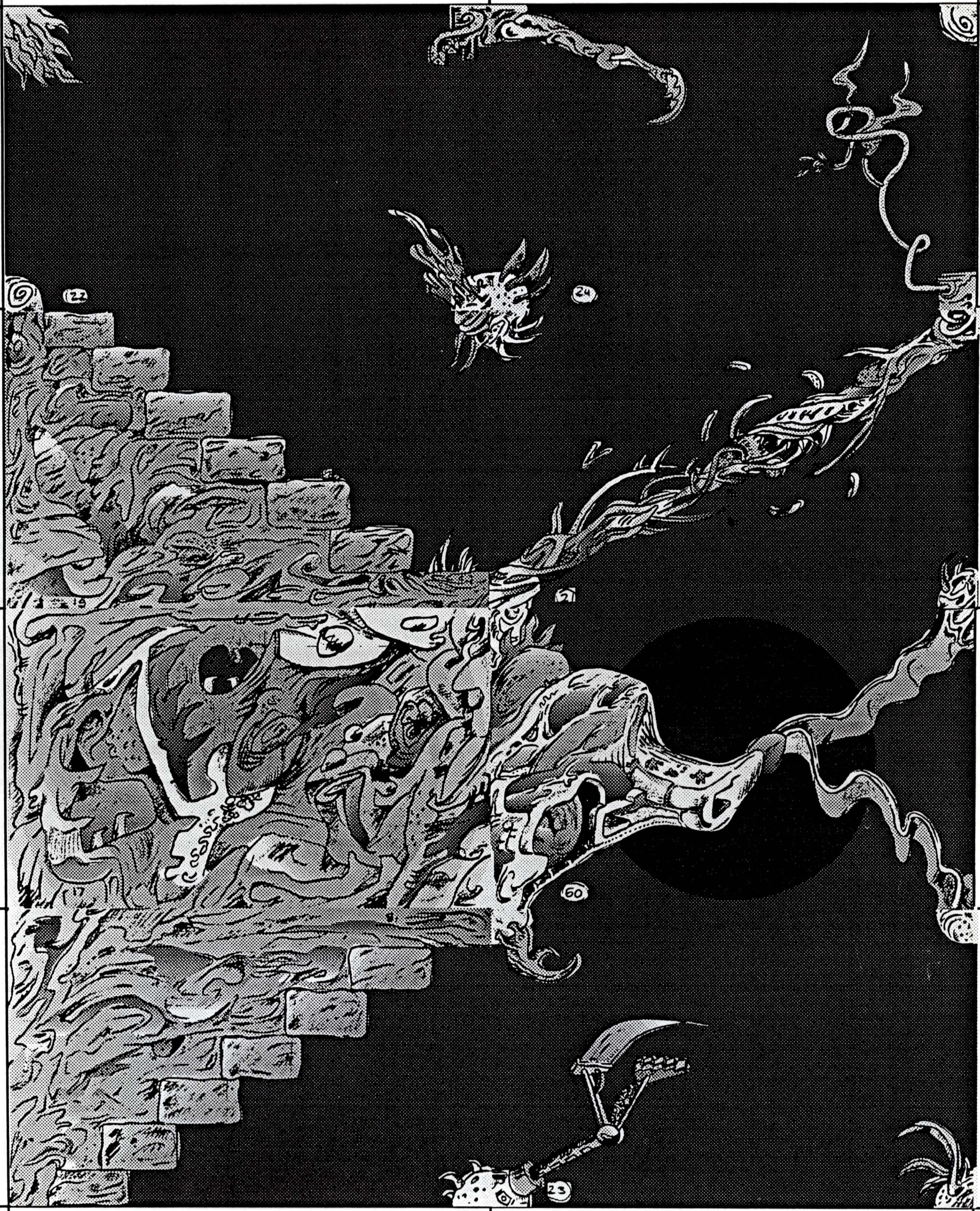
One final note: I really like the new version of Adobe Illustrator (5). However, these cards could never have been considered in Illustrator 3 (no gradients) and even with the new version are infeasible. High res TIFF bitmaps are not supported, so I'd have to bring the card graphics in as EPS, a notoriously inefficient file format for bit-maps. Their size jumps to 400K+. Also, there is no easy way to make the images "transparent" in Illustrator (Creating a clipping path from Photoshop is not "easy").

But a solid link from Adobe Illustrator back to PhotoShop is very alluring, especially since in the long run I want to be able to generate pure bitmap versions of these cards at any size: as PICTs for Macromind Director, for instance. Unfortunately, this link is just not in place. Illustrator 5 doesn't convert to PhotoShop except through Illustrator 3 format, so you lose all smooth gradient fills. Also, you lose any linked EPS file when you rasterize into PhotoShop. Back to square zero.

But its the kind of stuff that keeps the creative juices flowing.







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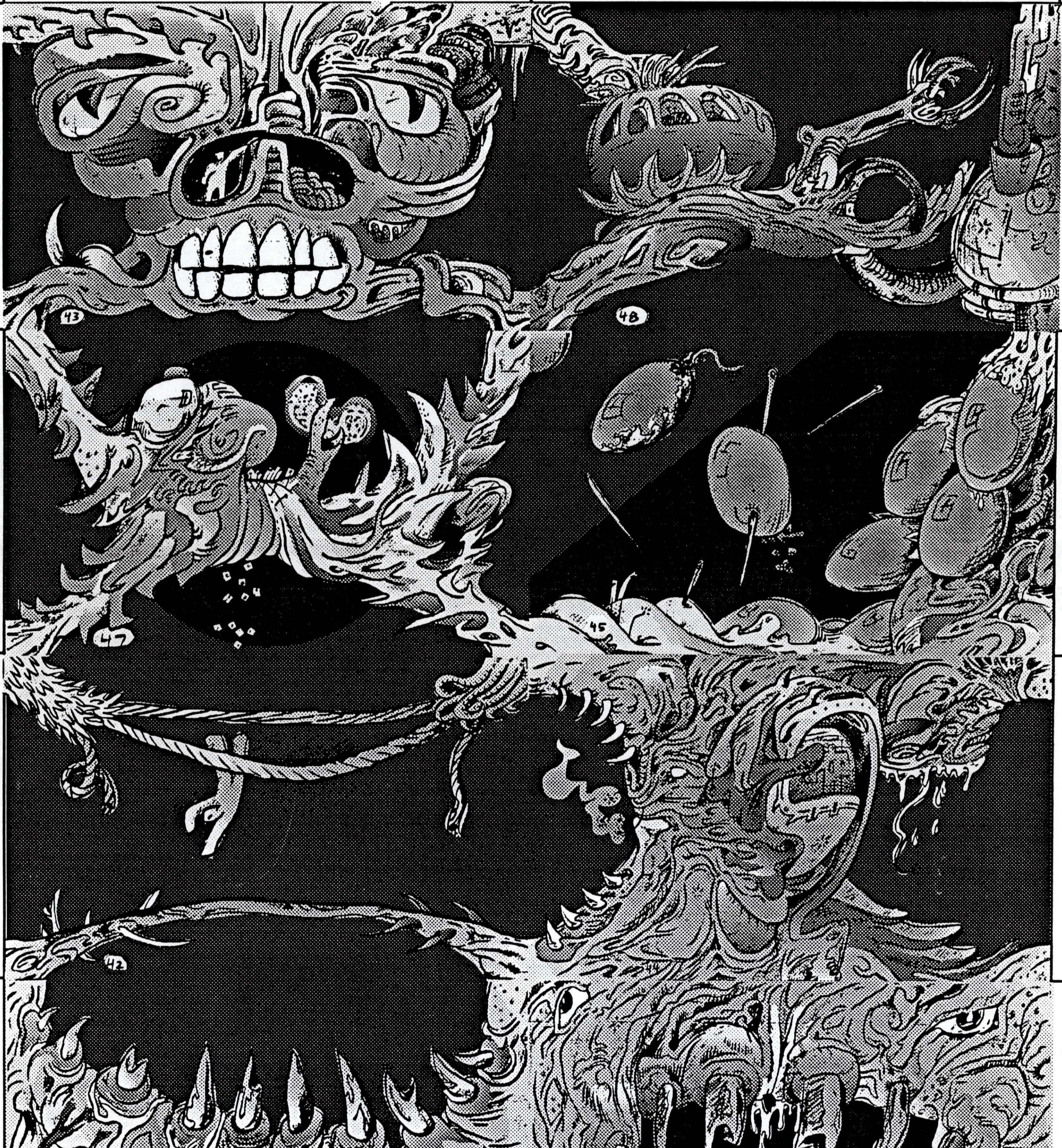

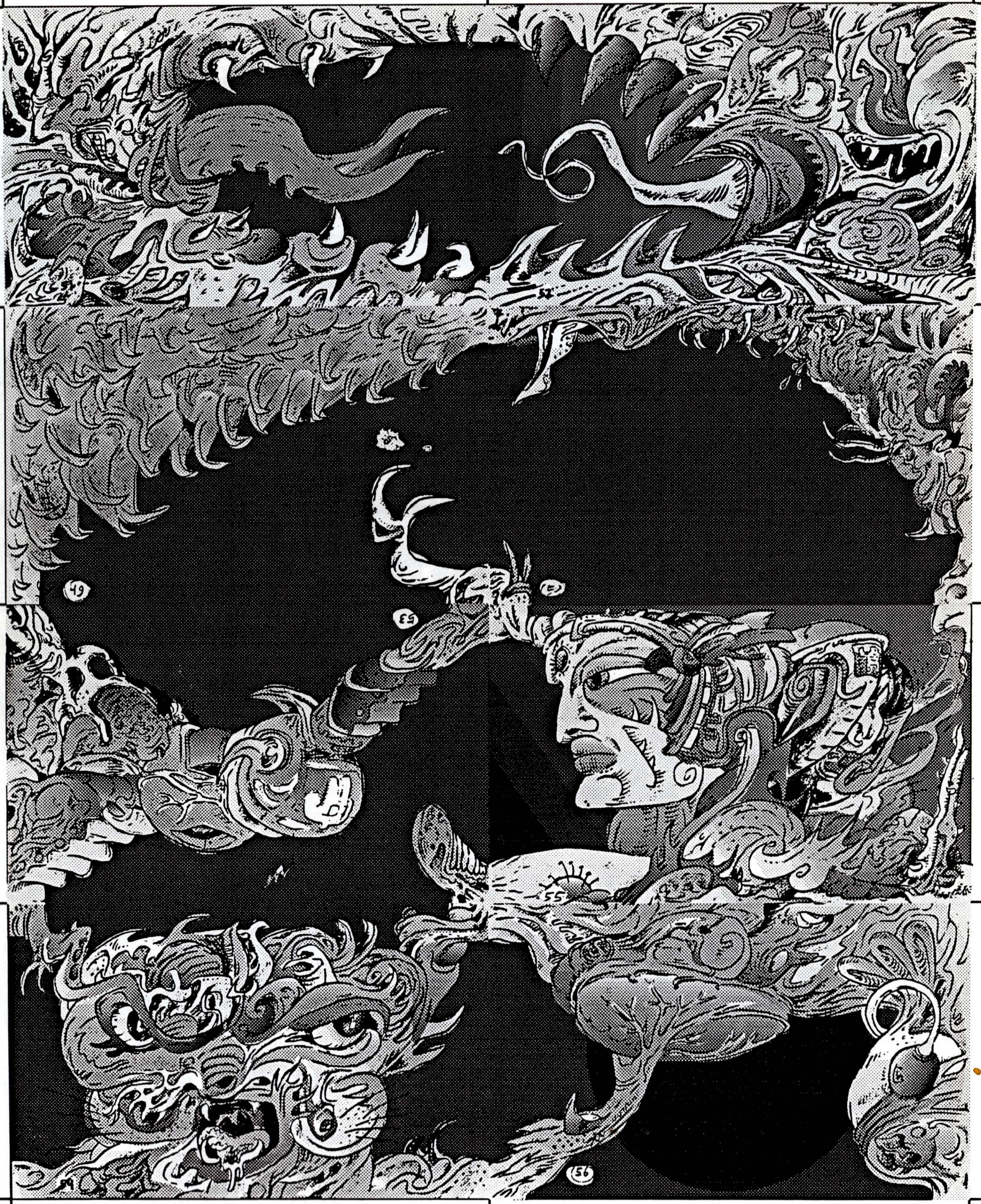

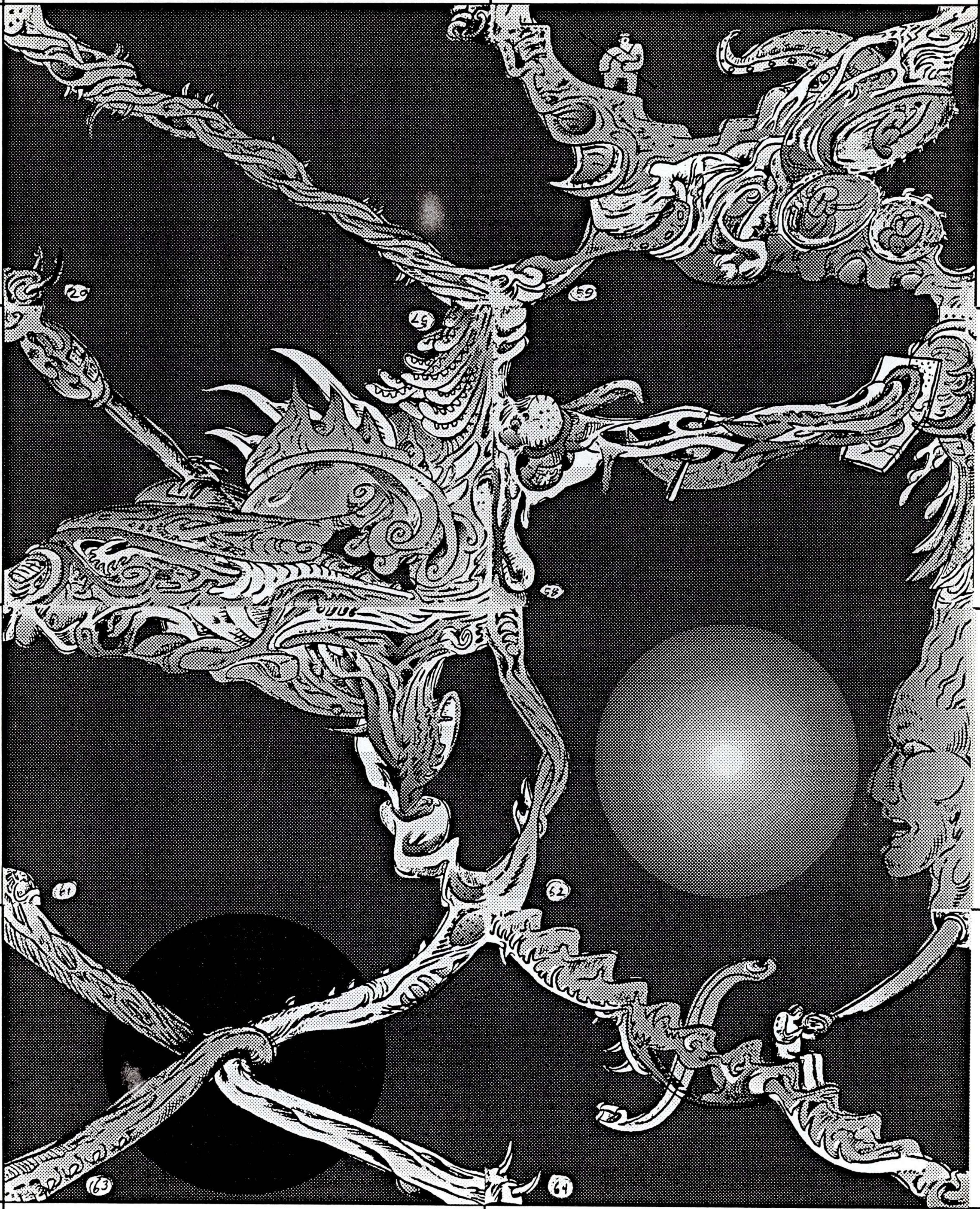

Turning Art Into Atom Bombs

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Artists routinely "borrow" from the science community. The Scan symposium is a good example of this. Computers were developed by mathematicians and electrical engineers to help solve a wide variety of problems. Now computers are used as a tool for artists to explore possibilities.

It is now time for the art community to return the favor. For a number of years the term "scientific visualization" has been used to describe the application of computer graphics to solving scientific research problems. As a member of the Center for Computational Science's Visualization Lab staff at the Naval Research Lab my job is to help the scientists turn their numbers into pictures and this paper is about some of the issues related to art and scientific visualization. This paper really has nothing to do with atom bombs.

One way the art community can return the favor is for professors to develop "Visualization for the Sciences" courses. These courses would teach at a minimum: color theory, presentation, and lighting.

Color theory is particularly important. Invariably, a scientist will pick out colors that look reasonable on a computers monitor, and they wonder why it looks so bad when printed or recorded to video tape. This is one area where I am not afraid to admit I need help. Mostly I know enough to provide general guidance like avoid fully saturated colors if going to video tape and to gamma correct before printing.

Presentation issues involve such things as layout and scripting. Again scientists need to be aware that even though things look real nice on their high resolution monitor, the translation to final form (video in particular) leaves something to be desired. Layout issues include such things as where and how big to make titles, legends, scales, color choices, line widths, and to make things as simple as possible (with out of course throwing out necessary detail).

Scripting an animation is something that should be premeditated. I prefer to use the voice over as the controlling aspect in determining how long a particular segment of an animation should be. I do know that others who record their animation and then add the voice over. Regardless of which method is used it pays to write a script of what needs to be shown, in what order, and rough timings.

Background music adds a nice touch, but be sure not to violate artists copyrights. Do not record the voice over and background music on the same track. Classical, light jazz, and easy listening instrumentals is the sort of music typically used.

Lighting is only important if there are three dimensional shapes that are being displayed. Unfortunately lighting is not something that is controllable in many of the tools that are currently popular. We currently use Wavefront's Advanced Visualizer to do 3D lighted renderings, but freely available ray tracers or image rendering packages would also get the job done. The big problem to solve here is getting what ever format the scientist is using to store his data translated into something that the rending software can use (this is not a art problem, but a programming problem).

Hopefully this paper will encourage the development of courses that will give future scientists additional tools to solve complicated problems in such fields as medicine and agriculture. An appendix is included here as additional information on creating animations of scientific data.

Disclaimer: The opinions expressed in this paper are those of the author and may or may not be the same as Kestrel Associates, Inc. nor the Naval Research Lab where the author is a contractor.

Acknowledgement: The work presented here was supported by NRL contract N00014-90-D-2184.

Appendix A: Animating Scientific Data

To create an animation of computed data is essentially a five step process.

These are:

- Decide what to animate
- Compute the data
- Transfer the data to an animation package
- Compute images
- Record images

This article will briefly describe various aspects of these steps, and conclude with a brief discussion of issues and concerns relating to animating data.

1. Define the problem

The very first step in creating an animation of data is to determine what the animation is to show. Talk with coworkers and if possible a visualization expert or artist about what is to be shown and how it should be presented. Good decisions made at this step will reduce the difficulties in the later steps. Some of the things to think about at this step include how long should the animation be, which animation program to use and/or which computer will the animation be rendered on, what quality is needed or will can be settled for, what will it cost, what media must the animation be recorded on, etc.

Simple problems can be presented in less than one second, but it is better to have the presentation last at least as long as a voice over describing what is happening in the animation. Typical animations will therefore be 5 seconds to a few minutes long. Video has 30 frames per second (25 if you need to record in a European format) and film is 24 frames per second.

2. Generate the data

In generating the data, the first concern is of course to generate data that is correct and accurate, but this is not in the domain of this article. The primary data generation concerns are data format, objects, motion control and consistency.

The format that the data is saved in is either a human readable ASCII file or a binary file. The ASCII file, while it requires extra storage space, is the easy way to save data in a transportable format. This is most suitable for small data sets or for testing of different animation packages. For very large data sets or for production data sets binary formats are a must. The binary format to use should either be one that is directly understood by the animation package, or should be translatable with a minimum of computer resources. One popular binary format is the Hierarchical Data Format (HDF) from the National Center for Supercomputing Applications. A number of the animation packages either support this format, or translators are available to convert to an appropriate format.

The objects to be animated must have some sort of description. The object types that are easy to deal with are raster images, vectors, polygons, spheres and 3D volumetric data sets. Raster images are two dimensional arrays of point samples. Vectors are pairs of 3D points, or more generally it can be a set of 3D points that are all connected. Polygons may have any number of sides, but should be planar (or mostly planar). To ensure that polygons are planar use triangles. Spheres only need a location and radius specified. 3D volumetric data sets are essentially a stack of raster images.

Each cell in a raster image or 3D volumetric data set typically has only a single value, but multiple values are possible (particularly 3 values for a raster image representing red, green, and blue). Each vector, polygon (or each point in a vector or polygon) or each sphere may have zero or more values associated with it. New rendering techniques may have to be developed to support complicated data sets. An animation may combine two or more different kinds of objects.

The specification of position and attitude is called motion control. For each frame in the animation each movable object needs to fully specified. Movable objects would typically be vectors, polygons and spheres. Raster images and 3D volumetric data sets usually are not relocated from one frame to the next. For most animations objects should not move any faster than half their diameter or length from one frame to the next. Not only can objects move, but the view point can move as well. Discussion of the view point follows in Section 4.

Consistency is crucial. Objects should not radically and arbitrarily change from one frame to the next. Colors, sizes, shapes, etc. of each object should typically remain the same or have gradual evolutionary changes during the course of the animation.

3. Import data to animation package

This step is trivial if the data is generated in the format native to the animation package. If it is not the same format, a translator will have to be used. Translators are typically short AWK, PERL or C programs.

The single biggest problem here is not likely to be the translation, but data set size. Disk space is one of those resources where there is never enough. To create an animation of a Computational Fluid Dynamics problem where each frame is computed from a 256x256x256 32bit floating point cube requires 64Mb, and the rendered frame will typically be 256Kb to 4Mb depending on the resolution it was computed at and the format it is stored. Assuming 256Kb per image, an animation will use 7.5Mb per second.

4. Compute Images

This is the step where art comes into play. This is where camera angles are determined, color choices are finalized, and composition issues are put to rest. For raster images that are self contained (no post processing needed) this step is not needed, and formats of data will need to rendered into a raster image. Some of the things that can be done during rendering (and this is animation package dependent) is labeling of objects, light source shading, ray tracing, and interpolating between data sets.
Some examples of labeling that could be added include titles, scales, legends, and pointers. Three dimensional objects can be rendered with the appearance of having one or more light sources illuminating it, and with ray tracing objects can be made transparent or reflective (lenses and mirrors). If the objects are moving in

relatively straight lines, interpolating frames can be computed. Interpolations can also be done to raster images or 3D volumetric data sets in some cases.

One major problem that needs to solved at this step is images that look good on the console, don't always look so good when translated to video tape. Some tips to be aware of are:

- Avoid fully saturated colors, particularly red.
- Preview your color choices on a normal TV monitor.
- Use san serif fonts or fonts with heavy serifs, and use a large point size.
- Do not push important information to the edges of the display.

5. Lay Images to video tape

This step is largely mechanical. If the animation package you are using is capable of generating the images fast enough, you can simply hit the record button of the VCR. Otherwise the animation will have to be recorded in single frame mode. Single frame recording will require a editing video tape recorder that is zero frame accurate and an edit controller. The edit controller is hardware and/or software that can switch the video tape recorder from play back to record and back at specified edit points.

6. Issues and concerns

One major issue is artifacts that are created during the various steps. One major source of these artifacts is the conversion to National Television Standards Committee (NTSC) video for recording by a VCR. Another source is the conversion from the original object description to a raster image.

By using a scan converter to convert the raster image (or one quarter of it) to NTSC video, colors are altered and high frequency detail is lost. There is nothing that can be done to prevent this as the problem lies in the NTSC coding. NTSC resolution is on the order of 700x485 pixels assuming an optimal set of equipment, but reality is more likely to be 454x485 or even 380x242 on home grade equipment. The human eye is more sensitive to intensity changes than it is to color changes, and the NTSC coding takes advantage of this. Color resolution is limited to 190x485 for half the color signal and to 63x485 for the rest of the signal. Color fidelity also suffers in the translation to video. Many of the more than 16 million colors that are specifiable for a source image are not legal NTSC colors.

In converting to a raster image, the objects are drawn to a rectangular array of pixels. With the exception of vertical and horizontal lines (or edges) lines will appear to be constructed of small boxes. This effect is commonly referred to as "jaggies".

Another aliasing problem has to do with very thin objects being displayed in some frames, not displayed in others, and partially displayed in the rest.

Picking colors to use is an something of an art. Annotations should have high contrast in relation to its back ground. One good way of ensuring that annotations have this is to use drop shadows. A drop shadow is a duplicate of the annotation in a contrasting color (usually black) and is usually drawn below and to the right of the annotation.

The scientific accuracy of the animation cannot be any better than the accuracy of the original data, it can only get worse. For this reason it is strongly advisable that any animation be viewed with a healthy amount of suspicion.

Another way of looking at the accuracy issue is to view the issue using computer terminology. The original data may have been computed using double precision, but the end result is going to have on the order of 8 bits of accuracy in terms of spatial and spectral resolution. If more spatial accuracy is needed 16mm film is on the order of 10bits, and 35mm film is on the order of 11bits. The color accuracy of the film recorder at TID is limited to 8bits, but this should not be a problem for most applications.

This article has only briefly touched on the various aspects in creating an animation. For further research into making scientific animations you can read the Usenet newsgroup comp.graphics.visualization, attend meetings such as SIGGRAPH or Visualization, or visit your nearest technical library and look up any of the numerous books on the subject of scientific visualization.

Creating Virtual Reality in Multi-site Transmission Art Performances

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Abstract
This paper outlines the strategies developed for recent performance art events which have used transmission art technology to create multi-site, virtual spaces. Specifically, it explores the use of a low-cost software and hardware system and the way in which the performances were influenced by it. It further suggests that advances in image and sound transmission technology for the future will be useful to individual artists only in direct proportion to the amount of access we will have to that technology.

Introduction
Time and space are interdependent elements of many forms of art. Lately, terms such as "virtual reality" and "cyberspace" have become popular to describe the experience of near-real time/space which is achievable through computer-based technology. It is possible with a computer to create the illusion that three-dimensional space exists in which a participant can enter, move around, affect simulated objects, and even communicate with other real or virtually real participants. Much of this technology is not really new but has improved in its efficiency to the extent that the viewer crosses the threshold of believability when virtual reality images are displayed.

Transmission art, telecommunication art and networking art have made possible multi-site, multi-cultural collaborations among artists for over a decade. The range of technologies used has included costly and esoteric equipment such as satellite downlinks, dedicated data lines as well as inexpensive and readily accessible equipment such as FAX machines, video telephones and modems. My current investigation focuses on inexpensive and accessible forms of technology.
As yet there is no actual genre of this form of artistic activity, nor is there a specific medium with which transmission artists can identify themselves the way videomakers or filmmakers do. Usually, artists come to transmission art from another discipline and bring with them ideas, attitudes and even content previously explored in some other medium. Transmission art shares this hybrid genealogy with another recent art form, performance art. In both types of art there is a potential basis in more traditional forms such as theater, poetry, music, painting , etc. This basis can enhance the performance by rooting the work in familiar ground, or it can be ignored.

Evolution

It seemed to me to be a natural evolution to move from my inaugurated art form of filmmaking (literally a "canned" medium) to live or semi-live performance art using telecommunication technology. Film and video have unique ways of creating visual and aural illusionary space yet both are linear in temporal structure and "frozen" as participatory experiences. Theater and musical performances, although scripted, have the dynamics that chance variations bring to them (this is exploited in improvisational theater.) Yet the spatial aspects of theater are limited to the setting, and like film, the audience (usually) views the action from a specific perspective. The addition of a telecommunication element to performance art expands the spatial design possibilities into what is now called "cyberspace."

My evolution from filmmaking led me to computer aided animation and coincidentally to networking art. I became involved in a number of projects, all collaborative, which used network communications to orchestrate, assemble or disseminate art works. I discovered a group of artists who were using an image transmission system called Send-It! to facilitate "virtual galleries" and interactive multi-site events. After using the system for several transmission events I became intrigued with the quality of "telepresence" it created. Using one phone line for image transmission and another for voice, Send-It! allows the virtual presence of a remote presenter to be felt by an audience.

Dreaming up a Performance

Tom Baggs and I decided to design a multi-site performance which we called "Dreaming in Color." It was planned to be given in November of 1993 at the Northern Illinois University Art Museum in DeKalb, Illinois and the Cincinnati, Ohio studio of Tom Baggs. Ironically, because of time and space problems, the performance had to be postponed. Production is again underway this year, and hopefully the piece will be performed as planned. Some of the thinking that went into the initial creation of "Dreaming in Color" may be important to future cyberspatial performance strategies, and I outline it here.

The performance was designed around the computer-based image transmission system called Send-It!, capable of sending high-resolution computer images over standard phone lines. Unlike typical "virtual reality" software, the images are not limited to a single viewer. They are also not three-dimensional nor do they exist as full motion. Instead, Send-it! resembles a slide show of very high resolution images displayed on Targa frame buffers. There is a slight indeterminate interval during transmission and display that seems to alter the time frame for the viewer. In contrast, live audio coming over a second phone line is real-time and can provide a source of tension between image and sound.

The use of the system gave rise to various technical and theoretical issues relating to the juxtaposition of remote space in simultaneous events. It is significant that this technology, developed as a teleconferencing system, is not expensive and does not require special phone lines. It is easy to set up using a DOS based computer and modem at each site. As we approach the era of "video on demand" it will be crucial to hold on to technologies that individuals can own and control. Someday soon Ameritech will be sending Disney movies over your telephone, but it is doubtful that artists will have much access to this technology. Instead, I look to internet personal computing for the next generation of transmission art technology.

In my many discussions about the nature of transmission art with Tom Baggs, we often commented on the importance of "telepresence." Since both of us had a background in media art, it was only a matter of time before the idea of a performance using Send-It! began to take shape. What if, we asked, two performers interacted with images and sound in a shared virtual space, yet neither was in the same actual space as the other? The performance would occur in two different locations with two different audiences experiencing nearly identical spectacles. Each performer would occupy the virtual reality of the other.

The design of our extra-spatial performance would have to begin by defining what we meant by cyberspace. Metaphorically, it was like poking a window through some imaginary dimensional wall so that two remote spaces seemed to intersect. Mechanically, the link was physical: numerous connections of copper wire stretching from DeKalb, Illinois to Cincinnati, Ohio, a couple of high-speed modems and the image transmission software. To fortify the illusion that each remote space opened into the other, we decided to use video projection as part of the set. The surface of the video screen became the window into cyberspace at each site.
The staging needed to accommodate the computer, yet not emphasize its importance. We decided to use a chair and table pushed against the virtual window (the video screen surface) to suggest that it extended through the window, into the cyberspace (Cincinnati for me, DeKalb for Tom.) A camera at each site could then send a picture of the chair and table from the point of view of the screen to the other location. The computer, modem and camera would be hidden or disguised. The only discernible hardware would be a standard telephone, connected to an amplifier.

In order to coordinate the performance at both sites we decided to use a pair of video tapes. Visual or aural cues could be placed on the tapes as well as supporting image material. Each performer would start his tape at precisely the same moment and could switch the video display back and forth between the tape and the transmitted output from the computer coming through the modem. Sound would be mixed between telephone and video tape. This would give us a variety of live, taped, or transmitted sounds and images to work with and a way to cue switches. Rehearsals began on the piece.

Students and Transmission Art

Early in Spring of 1994, I was asked to do a workshop on Transmission Art for the Center for New TV in Chicago. "Dreaming in Color" was still a work in progress at that time so I asked a colleague at Northern Illinois University, performance artist Mary Zerkle, if she would involve her students in a the project. We demonstrated the system and suggested a few ways the technology might be used in performance art. The audience would consist of the students at NIU and the workshop attendees at CNTV, thus performance pieces would need to be designed as "interactive." Some of the solutions the students evolved used the transmission technology to their advantage.

In this case, only one phone line was used, so when sound was needed a tape recording was used. The first group of students produced a story, acted through a series of tableaus complete with comic strip-like word balloons for dialogue. The software was set for continuous frame-grab and send, a repeating cycle which took 15 to 20 seconds. Each frame of the story was set up and posed by the group during transmission of the previous frame. This resulted in an energetic shuffle to regroup, and an intriguing accidental quality to the transmissions. Continuity was maintained as the story unfolded.

The second group's piece utilized a prerecorded video tape shot around a simple theme at various locations. The piece alternated between live setups and sequences from the tape. The audience at the receiving end experienced a series of stills from both sources, mixed in a way which didn't immediately reveal what was live and what was "Memorex." The live camera and the video deck had to be repatched to switch between inputs, so the performance at the sending end had the added element of production manipulation tension: will he make the patch in time for transmission?

The third group used the interactive possibilities of the system to produce a series of questions and answers. A still picture or an object was photographed and transmitted along with a question which had to be answered by the audience. Perhaps the answers suggested a rearrangement of the objects or pictures or a comment was returned. At least, a dialogue was struck between the performers and the audience which became the focus of the work while retaining the continuity of the central theme.

Future Reality

A lot of art, sometimes folk art or guerrilla art, develops out of the misuse of tools intended for non-art activities. By using teleconferencing software for performance art, we are working in the folk and guerrilla art traditions. As the world of personal computing continuous to expand, we are beginning to see the inclusion of so-called multi-media capabilities. We are on the verge of reasonable quality full-motion video and synchronized sound. Wonderful. But we have to understand that the process of this development is directed by purely economic concerns: not artistic, educational, politically correct, or egalitarian ones. It will be our task as artists to subvert this new technology to our own needs.

PRINTMAKING: A BLEND OF OLD AND NEW

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Abstract:
This paper is concerned with a comparison of traditional and electronic methods of printmaking and their interaction as perceived by the author. I will attempt to convince the reader that the personal computer used as a printmaking medium is a natural extension to the historic processes of printmaking.

A comparison of mediums and processes:
In speaking of printmaking I am referring to the making of an original print, a fine art process that is capable of producing unique impressions by a process or a combination of processes that may be repeated to form multiples. At the risk of oversimplifying, I will define Printmaking as: The artist putting an image on one surface and transferring (printing) it to another surface.

The making of the matrix
For the purists who declaim the use of computers in Printmaking, it is important to note that the four major traditional processes of printmaking all began as utilitarian enterprises of some sort.

Relief printing can be seen in the prehistoric lines drawn in a cave, but the earliest identified relief impression was Sumerian from around 4000 BC; while Western relief printing can be dated from the Middle Ages when the printing of the religious Block Prints, playing cards and later Block Books became commercially viable.

Intaglio printmaking includes etching, embossing, drypoint, mezzotint, aquatint, soft ground, lift ground, and the Collograph. The earliest examples date to 15th century Europe and may have evolved from recording a goldsmith's design.

The image in Lithography depends on a chemical reaction instead of the physical separators seen in Relief blocks and Intaglio plates. Lithography is also the most autographic of the methods. Invented in 1798-99 by Alois Senefelder, when he was trying to develop a commercial method for printing music and theatre support materials, the image is drawn or recorded in reverse on stone or plate.

Serigraphy, a stencil process which permits the ink to pass through certain areas of a screen, is one of the newest printmaking processes; but as a stencil process, it is also very ancient. Stencils are found from the ancient French Pyrenees and Fiji Islands to the more modern applications beginning in Japan around 500 AD. Screen printing appeared in its present form in the US in 1914 and had major updates in the stencil materials for the next 10-15 years. In 1930, the WPA artists began to experiment with the process. To differentiate it from commercial screen printing, the Fine Art use was named Serigraphy prior to a 1940 museum show in Philadelphia.

The Collograph, a combination of Relief and intaglio printing is the only printmaking method which was developed as an artist's medium rather than as a commercial vehicle. Glen Alps of the University of Washington gave it the name Collograph, meaning a printed collage.

Two other forms of printmaking are Monotypes and Monoprints. These painted pictures which are transferred to paper are known for their single images. Famous artists experimenting with this method included William Blake and Degas, as well as Matisse, Chagall and others. These methods have become very visible in recent years and are now accepted into many printmaking shows.

Comparison and Correlation of Methods

First let us look at the image creation. I have divided the creation of images into three categories: Drawing methods, Photo Methods, and Computer Generation. Direct Drawing or Painting and Photo Imaging can be incorporated into any of the printmaking methods, while Computer Generation is unique to computers.

1. Drawing Methods

Serigraphy involves drawing on the screen with glue or as a reversal process-drawing with crayons or other greasy materials, applying a blockout glue over the area and later removing the crayon to leave open areas for the ink to pass through (known as the Tusche & Glue Method).

In Intaglio platemaking, the printmaker paints directly on the metal with an acid resist blockout - such as asphaltum or in the reversal process paints a sugar-lift mixture in strokes on the plate, covers it with a liquid ground, and then washes the lift ground off. The artist then etches the plate so that the acid attacks the now open areas where the lift ground had been.

In Lithography direct washes, brush strokes or crayon may be drawn directly on stone or plate, processed and printed.

Relief printmaking involves cutting a line or shape into wood, linoleum or other material. This corresponds to the drawing line in other mediums.

In Collagraphs, all manner of blockouts and buildups can be used from wood glue to polymer medium. These can be built up in layers in a very free, painterly manner.

On the computer, paint or drawing programs can be used to directly draw on the screen and create the image.

2. Photo Methods

Another method of image making entails the use of photographic materials. The image matrix may range from darkroom-prepared positive or negative images that are linear (non-tonal) photos of images on lith film (Kodalith film is one brand) to drawings on acetate or glass that are used as photo positives for transferring the image photographically to plate, stone, block or screen. Each printmaking process has its own method of accepting photographic images, but all are capable of doing so and artists have exploited the use of photography for their images. The method consists of creating or transferring the image to a transparent film that either blocks the light or allows it to pass through. At this step by means of exposure and development, the artist can control the amount of the image that is captured and its appearance. These images are what is known as line images because either the black is there on the film or it is not. By this very method, it is not possible to get a continuous tone because the film image consists of solid areas of emulsion or open areas of non-emulsion. If the artist wishes to register continuous tone, then he must either use a different type film or developer that registers continuous tone or resort to the use of half-tone screens which break the image into dots. (This can be seen in commercially printed newspaper and magazine images.) The half-tone screens used different size dots to give the appearance of tonality when in reality they are various sizes of solid dots blended by the eye to give the appearance of continuous tone - the finer the dots, the smoother the tone. Given the nature of the artist's printmaking materials and the aesthetic, the artist usually opts to use line type lith film and achieve a freer, more "arty" appearance. The film is able to be pieced together, drawn on, and otherwise altered to form the final image that will be put on the plate, stone, block or screen. In this way many disparate parts can be assembled to create the artist's intent. Once the finished matrix is ready, it is applied to the stone, plate, block or screen by exposing an ultra-violet sensitive medium to an actinic light source. (Actinic = a chemically active light that hardens light sensitive solutions. ex.Sunlight). The sensitive base will be either positive or negative acting, depending on the type of emulsion used.

Another, more direct application is the application of photo transfers directly to the print surface. A photo-copy is made of the image and is then moistened with a solvent and applied to the receiving surface. By nature this is a direction reversal of the image.

Computer Printmaking has become the "darling" of photo image printmaking. The computer has been both the bane and the glory of the process, since photo images are easily accumulated into the computer by scanning, Photo-CD, still , video, video digitizing and video capture. However, the very ease of the imput also creates a moral question on the use of non-personal images. (Meaning those images not created or personally photographed by the artist). Image processing programs open all kinds of possibilities for manipulating, comparing, and compositing images. What used to take hours and hours of repeat trips to the darkroom can now be accomplished with the click and drag of a mouse. Sizes can be altered as they can in the darkroom; but also they can be warped, morphed and interwoven. They can be made to look like other media, accented, and rubbed through. The possibilities are endless. Unfortunately some of these techniques or filters if they are used indiscriminately can create a very "packaged and sterile art". They are both overused and under-explored. But in the hands of an artist wishing to explore, invent and create they open up a virtual Pandora's Box of possibilities. (The term Pandora's Box is used in all its connotations, because that is exactly what these techniques have the possibility of being - a Janus of Art.) But, oooh! - the printmaker now has so many possibilities in so many ways in much less time. In the end, the enquiring printmaker spends more time than he ever did in his image making; exploring the many possibilities of the image which were neither apparent or attainable in the past.

3. Computer Generated Images

A third area of computer input or creativity is the use of mathematical formulae to create images of many types which are largely grouped under the title of "fractals." Based reiterative mathematical equations, these images are virtually unattainable except through the computer.

The output

Of course as any Printmaker will tell you, making the plate, screen or block is only part of the "creative" process of printmaking. Regardless of the method, there is always that moment when the final proof of the print is pulled and the printmaker sees the joy or horror of his labors. In traditional printmaking, once the artist has approached the "printing", there is usually one way to do it for that medium - with minor variations in some. For example in Intaglio, the ink can be applied on a warm or cold plate; it can be hand or paper wiped (leaving various amounts of plate tone); the press pressure can be adjusted; the ink can be applied by hand, card, a la poupee, by viscosity or surface rolled. But it still is inked into the grooves or recesses of the plate with perhaps an additional surface roll. These types of variations are also found in the other processes. The ink may be rolled or dabbed or painted with a brush onto a Block. It can then be printed with a press, a wooden spoon, a baren or even rolled over with a car.

But for the computer printmaker, the printing is another entire part of the creative process. Perhaps because of both the dearth and at the same time the abundance of output choices, the printmaker is able to extend creativity into the actual printing process. The Computer Printmaker may do direct printing, make stencils for another printmaking process, transfer the print, output for collage, create monoprints or even make photographs and slides. And each of these choices has many variations in addition to many combinations and convolutions of the process.

Today the most common choices for direct printing are inkjet, laser, Iris, dye sublimation, thermal transfer and dot matrix printers. For affordability and versatility, many artists use ink-jet printers. There are many variables in printing from an inkjet printer - the paper, inks and image can all affect the final print. The image can look totally different on two different papers-depending on weight, sizing and color or the paper and how they absorb the inks. Through printing programs the artist is able to size and proportion the image as well as change ink balances, intensity, dither options, contrast, number of colors, brightness and saturation just to name a few of the variables. Inkjet prints may be printed on any number of papers. It appears that paper with less sizing is better for this printing and Japanese type papers such as Unryu, Masa, Moriki, Sekishu, Hosho and Sumie all impart their own characteristics to the print.

Larger prints than the printer is able to produce may be made by utilizing either a "tiling" or a "jigsaw" method. The tiling method uses a printer determined size of paper (such as 8 x 10 inches) for separate parts of the image. Each part of the image is printed on a sheet of paper which is then assembled into a tile-like pattern - often with the backing showing through - like mullions in a window. In the "jigsaw" method, the printmaker splits the computer image into overlapping sections - each into its own separate file. Each of the areas is then printed separately, making sure to keep the integrity of the proportion and size. (The Sharp JX-730 /JX-735 prints thirteen and one-half inches wide by as long a length as the artist wishes). The printed pieces are then overlapped, glued onto a backing sheet, and trimmed through the overlap for a perfect butt of edges, creating almost invisible seams. A third method is to use the images as collage pieces that go over and next to each other as do traditional collage pieces.

Printers may be used for edition printing outputs or for Monoprints. The term direct can be misleading for the printmaker may decide to run the same paper through the printer two or more times, building up an image with subtle overlays. Yes, it could be composited in the computer, but the richness of the inter-layers is not the same as that achieved by two or more printings. Some printmakers use old printed materials such as maps and books and overlay their images unto these sheets. Other printmakers first work on a plate and scan the image from that plate into the computer for reworking. Others will put the computer image unto a plate by using photo emulsions, print the image, re-scan that print and work on it in the computer, then print it out again, work on it with other media and finally output it on a color laser or IRIS printer. I have found that each printmaker who has gone into computer printmaking has evolved his own method of working an image and printing it.

In my own work: I print the image, work into it with Prismacolor pencils and other art media, scan it back into the computer, paint on it more, changing colors or areas, and then reprint it. It may go through one to five of these rebirth cycles. In doing so, the print incorporates a richness of layering that contributes to the overall image. The subsequent scannings pick up the Prismacolor strokes and retain them in the computer image.

Another way in which computer printmakers output their images is to a photo process stencil for printmaking. As shown previously, all of the traditional divisions of printmaking have developed a method for using photo images in the print.

Photo Serigraphy is a positive to positive process. There also is no reversal of the image orientation. In my case, I make/draw my image on the computer. When finished, it is reduced to a palette of thirty-two colors. Some of the colors are usually unnecessary in the final work because either they are very close in hue to another color or there is only a few pixels of that color. In these cases, that color register pixels are combined with a similar color (in hue and value). When the palette is completed, the original full color image is recalled and separated into sixteen to thirty values, a number of which are then made into stencils. Several values may be combined into one stencil to cover a certain area. The areas that the values represent may sometimes coincide with color areas, in which case, one stencil will represent both color and value. The colors are then grouped into families- for example - any color that has yellow of any kind is grouped together with other yellows. This group of yellows then becomes the yellow base stencil. The same treatment is done for blue, green and red. Each of these groups is then printed on a laser printer to a transparent film for plain paper copiers. There are now four base stencils, each in the palest color needed for its color grouping- ie.pale pink, pale blue). These stencils will each be made into photo-stencils on a screen for the Serigraph, the ink mixed and the screen printed. Subsequent colors are overlaid using very transparent ink in the screen. Once the base colors are printed, new stencils are made using other color registers in the palette. Each of these colors are overprinted on the print using transparent ink - building up a rich, glowing print surface. At some point a value stencil will be used to tone down, add a color shadow or pull together an area on the print. For the value stencil, one or more of the gray scale color value stencils will be used. (These stencils are not printed in gray, but rather impart a pale color cast of my choice over the area.) This process continues for twenty to forty layers of varying transparent colors on the print. Each color or value that is printed requires its own screen, stencil and ink color to print it. An advantage to taking a computer print to Serigraph is that there is no limitation on the size of the finished print. Just like the non-computer way of printing, these stencils can be cut and glued into virtually any size and shape. The same method of making film positives may be used to make them for Photo-Lithography, Relief and Intaglio. In these cases the image will be reversed when it is applied to the paper. Computer pieces may also be printed to a film or slide which is then entered into a color copier. The resulting image may then be transferred to a ground (receiving paper etc.) by the transfer methods used in traditional printmaking. Both transfers and the actual computer printed piece may be cut up and used as collage pieces in the finished piece. Like all artists' collage pieces, they could be "left over pieces" or created implicitly for the image.

Many printmakers treat their compute images as Monoprints, printing them by one of the methods mentioned above and working into them with other art media. After they have been worked into, if they are not re-scanned into the computer to be printed in multiple, then they become a Monoprint or a singular print. Sometimes a Monoprint is capable of being a multiple but the artist chooses to print only one print of the image. At other times, the original multiple has been so altered by the artist and other media that the same hand work to another print from the same matrix would not begin to resemble the first print and so it remains a Monoprint. By re-scanning the print into the computer, the computer printmaker has the option to make that Monotype into a multiple.

Concerns

There are a number of concerns about computer printmaking. Some of them real, some indigenous to computer printmaking, some of them a concern in all areas of art.

Archiveability:

Lightfastness of the inks - This a problem in almost all areas of printmaking, especially wherever transparent inks are used. The less pigment in the inks, the more likely they are to fade. If at all possible, it is best to replace the dye inks in the printer with pigmented inks. If this is not compatible with the printer, there are artists' inks that are usually more lightfast than the manufacturer's inks. The thickness and nature of screen printing inks render them to be quite stable and lightfast. I usually use a good brand artists' oils mixed with transparent base for my screen-printing colors.

Paper - Today many printers will print on a variety of papers. The Sharp JX-730 will print on all kinds of surfaces and is able to use archival printmaking papers. It is necessary to test various papers to get the results you desire. The use of a good image processing program or printing program will enable the printmaker to manipulate the image so that it will print as desired.

Pixellation:

Some people seem concerned with the pixellation and strive for a smooth, photographic image. The newer programs and printers are getting better and better at their output with higher resolutions at more affordable prices. However, I have always loved "grain" and perhaps that is why I took so readily to computer printmaking. When I used a darkroom to create photo images for printmaking, I always used the fastest film and developed it to attain a grainy look. The pixels are a natural adjunct to that treatment. And I don't have to go to special lengths to get them. At times I even clump my pixels (pixellate an image) to create larger ones to work within the image.

Copyright and Copying:

These are major concerns to all artists. But the computer makes it more easier to abuse them. As I hinted at in this paper, the ease in which images can be imported and altered creates a nightmare of moral and legal responsibility. There are many areas to be explored and clarified here. The safest practice is to use your own images.

Conclusion:

I am a printmaker. Although I do most or some of all of my work on a computer, I am still a printmaker. The computer is a wonderful, exciting, challenging new medium of which after eight years, I feel that I have just begun to scratch the surface. Together with its peripherals, it allows me to explore images more thoroughly and uniquely than I have in the past and to execute them beyond the means of traditional printmaking. I am able to produce my work in a variety of techniques and moods that can not be duplicated by any one traditional medium, combining images and effects in one piece and achieving results that are impossible or extremely difficult to do with conventional media. By using the computer to draw and combine images, I can extend what I have always felt about printmaking - that it produces a living, growing image with an anima of its own. I have worked in all print-making mediums but never have I experienced the daily excitement and choice of directions that I find each day using the computer as my printmaking medium.

The following is a partial reprint of a talk given by Joe Greenstein (artist and Co-principal of G2DesignWorks) at the Franklin Institute SCAN Symposium on November 6, 1992. Since it was not printed then or since, and because the subject matter seems to suit your SCAN 1994 format, we thought it might be included in your *Proceedings*.

Moving Painting

by Joe Greenstein

I plan to throw a bunch of ideas at you concerning the concept of *Moving Painting,* the 20th century shift from passive art to active art. These comments are not meant to be a polished thesis, but just food for thought.

To my knowledge, no Western painting or sculpture produced prior to this century has ever involved actual movement of any kind. The purpose of art had been to *freeze* an image, to create a sense of permanence within the temporal. Life was short, and art was eternal.

I remember my childhood impressions of the museum...the art was still, the people were still and it seemed as if time itself was standing still.

Physical animation in art, even simulated physical animation, is a distinctly contemporary phenomenon.

Where did this change begin?

I believe that the breakthrough medium was not painting or sculpture, but *motion pictures*. With their advent, we were suddenly able to capture and replicate a sequence or series of events. Now the visual imagery was enhanced by a dynamic new element---duration in time. Those who first witnessed this saw it as pure magic, and the impact on visual consciousness was intense. (For starters, film was the precursor of the media revolution, arguably the defining force of this century.)

But on an even more fundamental level, on the level where life copies art copying life, the introduction of actual movement into the fine arts---the desire to create *active* art---heralds the beginning of a complete new cycle. We are approaching the millennium and society is about to experience a radical change in mentality.

Let me characterize the cycle that's just ending. It has been about the need to find fixity, to codify, to analyze, to build secure structures, to control the environment, to develop mechanical processes, to perfect the written word, to crystallize thoughts and ideas. It has basically been a contractive or *cooling* cycle. Paramount in the development of this cycle has been the evolution of logic. It is interesting and revealing that this millennium is ending with the birth of the computer age, since the computer is the tool of absolute logic (pure process without prejudice of opinion).

How then can we characterize the approaching era? It will be expansive, instinctual, "hotted-up", breaking down barriers, uniting mind and body, uniting science and art, defying gravity, involving great leaps of faith, embracing contradiction and paradox, fracturing, ephemeral, explosive.

Over centuries, art has come to exist within certain sociological parameters. There are things we expect from our artists and certain liberties we are prepared to grant them in their pursuit of "freedom of expression". Even the *avant garde* impulse to shock or outrage has been absorbed into the accepted perception of the artist's role. But we still tend to see our artists as eccentric shadow figures on society's fringe. Because *all* fine art is based on the abstract premise of self-expression, it is easily relegated to the domain of the non-essential. In actual fact, it has been the artist—as much as the scientist—whose cutting-edge vision has honed our society. That this has largely gone uncelebrated (at least in America), speaks volumes about the way we undervalue the pure creative impulse.

What if this entire pattern changes?

Imagine a time when we experience the art of science and the science of art, when the restrictive boundaries of definition are lifted and our perceptions become fully integrated. What will this new context be like? For sure, it will be fast and furious and full of surprises. Art will no longer be viewed as ruminations from the fringe, but will become a vital and active force in the advancement of human potential. I envision an art of dazzling new perspectives—kaleidoscopic, multi-dimensional, mixed-metaphor renderings of time and space. An art of accelerated consciousness. An art as exciting and dynamic as the emerging technology that will help to make it happen.

Virtual Reality: Possibilities for Art and Art Education

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"Virtual reality [VR] is a new way to use computers. VR eliminates the traditional separation between user and machine, providing more direct and intuitive interaction with information. We can create virtual worlds and step inside to see, hear, touch, and modify them" (Bricken & Byrne, 1993, p. 200). VR is a highly evolving field with enormous potential for use by artists and art educators.

Virtual definitions

Virtual reality is a interactive computer-mediated experience using three dimensional modeling. It may be seen as an experience, rather than as a pure technology in itself (Delaney, 1994).

There are two broad types of VR interfaces: immersive and non-immersive (Jacobson, 1991). Immersive VR implies that the user is somehow placed within an environment by using various input devices. Most common links include: goggles or a helmet containing small computer screens for each eye; the DataGlove (produced by VPL Research) which contains tracking sensors and fiber optic strands running down each finger; the DataSuit which is similar to the DataGlove but with sensors accounting for motions of the entire body. The user is connected to the computer by a type of "umbilical" cord. Ideally, the immersive interface between human and machine would be totally non-intrusive—a goal that is not yet technologically possible.

Typical non-immersive systems are desktop VR applications. With these kinds of programs, people view and interact with a 3-D environment displayed on the conventional computer monitor, most typically by using a mouse or joystick to move within the virtual world. An example of this kind of system is *Walkthrough,* a computer-aided visualization program by Virtus.

Virtual history

There was some early work in facets of this technology during the 1950s (Fisher & Tazelaar, 1990). The first real example of a multi-sensural simulator was the *Sensorama* which was shown in 1962 (Gigante, 1993). However much of the theoretical base of virtual reality was set out by Myron Krueger in his 1983 book Artificial Reality (Fritz, 1991). This effort had been developed based upon work beginning as early as 1969 (Krueger, 1993); the term "artificial reality" was coined in 1974 for his doctoral dissertation (Helsel, 1992). Krueger (1991a, 1991b) lists other important contributors: Ivan Sutherland (invented the first three-dimensional head-mounted display), Tom Furness and Michael McGreevy (displays and other experiments, flight simulation), and Fred Brooks (manipulators). NASA's contributions cannot be overestimated (Krueger, 1991b); NASA continues to be an important player (Fisher, 1991). Most notable among academic institutions conducting VR research are the University of North Carolina at Chapel Hill, MIT, and the University of Washington (Newquist, 1991).

Krueger (1991b) states that 1989 was a time of special significance for the field. The headline of that year "What if Artificial Reality?" on the front page of the New York Times, created enormous interest in the popular press. Also, Jaron Janier, CEO of VPL Research coined the term virtual reality in 1989 (Krueger, 1991a).

There has been enormous growth in the field during the past few years. This is due in large part to improvements in technology and advancements of theoretical underpinnings. An example of one specific technology that has created new VR possibilities is Apple's QuickTime, which allows construction of interactive environments using non-immersive visualizations. Maybe the most visible growth and interest in VR in the 1990s however has been in the entertainment field with the great emphasis placed on immersive virtual gaming environments.

Virtual art

New possibilities for the creative endeavor

Krueger (1991a) states that VR technology holds significant aesthetic potential. He views it as an important new medium for artistic expression. VR opens new environments, probably with more open structures than traditional media, which would allow greater (or at least different) creative possibilities.

VR art is defined in part by VR's inherent structure. Walser (1991) finds a parallel between the structure of cyberspace and theater:

> Cyberspace is a medium that gives people the feeling they have been bodily transported from the ordinary physical world to worlds of pure imagination. Although artists can use any medium to evolve imaginary worlds, cyberspace carries the various worlds itself. It has a lot in common with film and stage, but is unique in the amount of power it yields to its audience. (p. 51)

Wyshynski and Vincent (1993) describe the development of a VR system (Mandala) where output is controlled by moving camera-based interaction. In describing their VR system, they provide an excellent summary of VR in its current state in the performing arts.

> The Mandala is a unique musical instrument. With it, a player holds the "keys". . .to innumerable musical voices, and to doors into virtual wonderlands. By simple video touch, the players calls his or her virtual instruments into being and sends them away. Through gesture the performer is empowered to control lights and cameras and is empowered to take the audience on audio/visual journeys into virtual worlds, projected on giant video screens above the stage. Here the performer can escape physical restraints, setting free a new dimension of expression governed solely through movement and dance. (p. 140)

Other work in VR in the arts have been detailed as well. Thalmann (1993) describes an interactive multimedia animation system for possible application in the arts. Friedmann, Starner and Pentland (1993) discuss *MusicWorld*, a system which allows users to play a virtual set of drums, bells, or strings using 2 drumsticks controlled by sensors. Hamit (1994) details an application where users can play a Costa Rican "bat flute" (image captured in QuickTime). Hamit also describes a virtual display of 3-D sculptures and ceramics in a virtual system at a museum at Emory University. Krueger (1991a) cites several examples in visual art, dance, theater, and poetry where serious art was created in virtual environments. Piantanida (1994) discusses the work of artist Patrice Caire. An exhibit (Cyberhead. . .Am I Really Existing?), which opened in April of 1994, employed a VR system to allow visitors to travel through a multidimensional representation of Caire's brain accompanied by music that was specially composed for the occasion.

There is some use of non-immersive VR applications in the arts. For example, VR-CAD systems, such as Virtus's *Walkthrough* are being employed in theatrical set design allowing users to move freely in the set before it is actually built (Berz & Bowman, 1994). This is a kind of functional VR, similar in purpose to an application program (software is designed to make some task easier to accomplish or to complete in a more sophisticated fashion).

VR as an artistic medium does raise some interesting questions. Artists struggle with philosophical questions such as the role and responsibilities of both the creator and viewer upon the aesthetic character of the art. As new mediums are developed, VR in this case, these questions are raised again—raised in the context and definition of the novel format. VR art advances some particularly onerous questions because of the profound degree of user interaction; the art-work can become a simulated environment with unlimited interactive possibilities. How free can structure be and still retain the artist's spirit? Although not a new question, it does call for re-examination in this new context. We do know that there are striking perceptual differences between non-immersive art and VR art (Gardner, 1993). It would seem that VR art might require a broader, or at least different, aesthetic definition. A specific VR work might have to viewed as a kind of artistic platform or framework rather than as a discreet work of art.

VR art-work is not passive, but is an active experience—at least in theory; the user interacts with the artist's created environment. Although the degree of involvement would be defined in large part by the artist's virtual creation, it would be also defined in some measure by the viewer, who might have pre-conceptions or physical challenges which might inhibit his/her involvement. To what degree is the richness of the experience limited by parameters of the interaction? How does the work of art change with changes of viewer interaction?

While these questions are important to consider, they should not indicate a position that might discourage virtual artists. As artists hope to create some form of impression through their art, it is however vital to realize that reaction might widely vary between different members of the audience.

Another issue to consider in the creation of VR art is the degree of technical expertise required. All artists produce/create within the boundaries of the medium. Musicians can perform technical passagework only to the limits of her/his physical capabilities; works created by painters are defined by the medium and the artist's skill to manipulate images within that given environment. With VR, the artist must also be proficient using rather advanced computer technologies, or must work collaboratively with individuals who possess these abilities. While this is also not a new issue, it does pose interesting aesthetic and pragmatic questions. The scope of the work might be limited because of technical limitations of the artist in this new medium. It is assumed however artists who would choose to work in VR would accommodate this concern without significant difficulty.

Another concern expressed in the VR community is user safety (Viirre, 1994). VR developers must consider both health and safety issues. This would certainly apply to VR artists.

Virtual possibilities in arts education

One of classic computer assisted instruction (CAI) models is the simulation model, where the learner is placed in a setting that might be dangerous, (i.e., flight simulators) or impossible to reproduce in the real world (duplicating an historical time period). Virtual reality systems carry this model forward to an extreme by placing the learner/user in a simulated reality. VR has the potential to move education from its reliance on textbook abstractions to experiential learning in a naturalistic environment (Helsel, 1992), engaging the whole learner in the task (Bricken & Byrne, 1993). Traub describes virtual reality environments "as an ideal milieu for learning" (1991, p. 111).

Perhaps the most practical application of educational VR in education is found currently in museums. The Association of Art Museum Directors recently met to discuss practical problems faced in implementing VR and other technology in museums (Hamit, 1994). Practical applications do exist and are being used with great success. One such example is found at the Liberty Science Center in Jersey City, New Jersey. In one exhibit (across from a more popular VR basketball shooting exercise), users can create musical compositions through gesture by moving and striking images of musical instruments; the instrumental palette changes every few minutes.

The technology holds special potential for the physically handicapped. With VR, students are not bound by physical restraints and may therefore move into environments free from physical restraints.

The possibilities of virtual simulations in the arts stagger the imagination. In music education, one possibility might be in teaching conducting. Students could practice conducting with an imaginary, virtual orchestra whose players would respond to every gesture. Students could perform compositions on self-developed instruments not limited by physical technique. Students could move to music with tempi varying according to student or instructor intent; a virtual partner could be present to complement or replay movements (as seen on a Star Trek, The Next Generation episode). Students might discuss sonata-allegro form with Mozart and drama with Shakespeare. The potential of VR in arts education is enormous (Berz & Bowman, 1994).

Conclusion

While still a bit of a fantasy, virtual reality is becoming more practical in the arts because of technological advances. VR's most widely seen applications at present include CAD (i.e., for use in designing theater sets) and immersive art experiences (in dedicated shows and exhibits as well as in science and general interest museums).

VR art does raise some interesting aesthetic concerns, many of which are rooted in issues surrounding the highly interactive nature of the medium. While these kinds of questions are not new to the art world, they must be re-examined in context with definitions of this new technological format.

VR in arts education is in a largely theoretical state. It will undoubted become practical, maybe not in the Star Trek Holodeck model, but first in simpler, more accessible applications. The possibilities for VR is arts education are very exciting, but will require considerably more development and study.

References

Berz, W. L. & Bowman, J. (1994). Applications of Research in Music Technology. Reston, VA: Music Educators National Conference.

Bricken, M., & Byrne, C. M. (1993). Summer students in virtual reality: A pilot study on educational applications of virtual reality technology. In A. Wexelblat (Ed.), Virtual Reality: Applications and Explorations (pp. 199-217). Boston: Academic Press Professional.

Delaney, B. (1994, August). Virtual reality lands the job. NewMedia, 4(8), 40-48.

Fisher, S. S., & Tazelaar, J. M. (1990, July). Living in a virtual world. Byte, 15(7), 215-221.

Friedmann, M., Starner, T. & Pentland, A. (1993). Device synchronization using an optical linear filter. In R. A. Earnshaw, M. A. Gigante, & H. Jones Virtual Reality Systems (pp. 119-132). London: Academic Press.

Fritz, M. (1991). The world of virtual reality. Training, 28(2), 45-50.

Gardner, B. R. (1993). The Creator's Toolbox. In A. Wexelblat (Ed.), Virtual Reality: Applications and Explorations (pp. 91-121). Boston: Academic Press Professional.

Gigante, M. A. (1993). VR: Definitions, history and applications. In R. A. Earnshaw, M. A. Gigante, & H. Jones Virtual Reality Systems (pp. 3-14). London: Academic Press.

Hamit, F. (1994, July). Imaging's reality invades virtual reality for new apps. Advanced Imaging, 9(7), 18-20.

Helsel, S. (1992). Virtual reality and education. Educational Technology, 32(5), 38-42.

Jacobson, L. (1991). Virtual reality: A status report. AI Expert, 69(8), 26-33.

Krueger, M. W. (1993). An easy entry artificial reality. In A. Wexelblat (Ed.), Virtual Reality: Applications and Explorations (pp. 147-161). Boston: Academic Press Professional.

Krueger, M. W. (1991a). Artificial reality II. Reading, MA: Addison-Wesley Publishing Co.

Krueger, M. W. (1991b). Artificial reality: Past and future. In S. K. Helsel & J. P. Roth (Eds.), Virtual reality: Theory, practice, and promise (pp. 19-25). London: Meckler.

Newquist, H. P., III. (1991). A computer-generated suspension of disbelief. AI Expert, 69(8), 34-39.

Piantanida, T. (1994, July/August). Cyberhead: Am I really existing? Virtual Reality World, 2(4), 67-68.

Spring, M. B. (1991). Informating with virtual reality. In S. K. Helsel & J. P. Roth (Eds.), Virtual reality: Theory, practice, and promise (pp. 3-17). London: Meckler.

Thalmann, D. (1993). Using virtual reality techniques in the animation process. In R. A. Earnshaw, M. A. Gigante, & H. Jones Virtual Reality Systems (pp. 143-159). London: Academic Press.

Traub, D. C. (1991). Simulated world as classroom: The potential for designed learning with virtual environments. In S. K. Helsel & J. P. Roth (Eds.), Virtual reality: Theory, practice, and promise (pp. 111-121). London: Meckler.

Viirre, E. (1994, July/August), A survey of medical issues and virtual reality technology. Virtual Reality World, 2(4), 16-20.

Walser, R. Elements of a cyberspace playhouse. In S. K. Helsel & J. P. Roth (Eds.), Virtual reality: Theory, practice, and promise (pp. 51-64). London: Meckler.

Wyshynski, S. & Vincent, V. J. (1993) Full-body unencumbered immersion in virtual worlds. In A. Wexelblat (Ed.), Virtual Reality: Applications and Explorations (pp. 123-144). Boston: Academic Press Professional.

OTIS: Operative Term Is Stimulate
ON-LINE ART GALLERY AND EXPERIMENTER

PO BX 241113/Omaha,NE 68124-1113 USA
email: ed@sunsite.unc.edu
http://sunsite.unc.edu/otis/otis.html
ftp sunsite.unc.edu /pub/multimedia/pictures/OTIS

OTIS began in January 1993 as an image-gallery for the Internet, a publicly accessible place for artists to store and exhibit digital copies of their images along with information about themselves and their projects. This continues to be OTIS' primary mission.

OTIS is a gallery, an exhibition space, a database, a browseable sketchbook of the world's artists, artists of all disciplines and cultures. OTIS is non-profit, no money is involved in viewing or exhibiting images on the gallery.

Beyond mere storage/exhibition of images, OTIS seeks to involve artists with one-another via collaboration projects (called SYNERGY), email-based discussion lists and hardcopy corporeal exhibits.

The SYNERGY collaboration projects have drawn a lot of attention for their unconventional merging of multiple artists' works and use of the Internet in their planning and execution. Ranging from exquisite corpses on display at Chicago's Kopi Cafe (SYNERGY:CORPSE) to computer generated Tarot cards (SYNERGY:ARCANA) to cross-pollenated evolution graphics (SYNERGYs REVOLT and CROSSWIRE) to live image exchange and mutilation (SYNERGY:PANIC), OTIS' collaborative projects have involved hundreds of artists and have sparked sometimes heated debates about the purpose, state and future of electronic "art". SYNERGYs, especially the on-going SYNERGY:PANIC, have dominated so much that sometimes they are mistaken for OTIS' sole reason for being. While SYNERGY is undeniably interwoven with OTIS, it's far from a synonymous relationship.

SYNERGY:PANIC, the most discussed active SYNERGY by far, is an on-going weekly gathering of artists on-line meeting to collaborate, speculate, manipulate and generate. The first PANIC took place in January of 1994 in cooperation with an event called smartBOMB1.0. A two-night dance and technology event, smartBOMB1.0 was held at a nightclub in Minneapolis, MN. From the nighclub, live still images were sent to a holding area in the OTIS computer archives. On-line, dozens of artists who'd been waiting for this event for weeks, snagged the images to their home computers and began to manipulate and merge them into works of art and circumstance... all the while communicating via written-word over another Internet chat service called IRC. The weekend's festivities, despite numerous hardware failures, produced hundreds of dynamic digital images and, most importantly, a desire for MORE. The following week, and every week since, OTISts have gathered on IRC to talk, exchange images and devise new modes of collaboration. Also, following smartBOMB's lead, other music and technology events have jumped in to integrate PANIC into their presentations, joining to contribute live image fodder and display the corruptive and disruptive artistic results on their digital walls. ROBOFest and BUZZFest, thanks to dedicated

Texan OTISts, both came off beautifully and this April's CYBERFEST.594, thanks to the efforts of Chicagoland OTISts, looks to be a grand and marked evolution of the idea. Cooperation, technology and creativity colliding and mating into a gargantuan angelic beast. Or something like that. Never since Reeses has there been such a tasty combo!

New SYNERGY Projects are emerging all the time. Contact us for the current SYNERGY schedule. Future projects include: SYNERGY:SYNTAX, a word's worth a thousand pictures; SYNERGY:CORPSE2, the chance meeting of a larva and a cadaver on a turntable; SYNERGY:POW!, collaborative comic strips; SYNERGY:MANDALA, hypnotic patterns; SYNERGY:GRID, complex geometry connected; SYNERGY:CUBE, 2d to 3d and back again...

OTIS was founded on the idea of "digital immortality". OTIS seeks to make today's art available to future generations. Utilizing the pure information binary storage of images and the subsequent ease of replication and distribution, the plan is to so widely disseminate the gallery as to insure it's perpetual existance, immortality. The very growing vastness of Internet should, itself, guarantee that anything stored on OTIS for any length of time will make its way to thousands of computer screens and onto thousands of digital storage devices. Images can then never be destroyed, and hopefully the structure of OTIS will provide an easy and congenial method of browsing and appreciating the art of today's artists for the children-at-heart of 2113.

OTIS invites artists of all types to exhibit their work on-line. All work must be original, though media-collage and other forms of creative appropriation are accepted and/or the artist must have full knowledge that their work will be displayed on OTIS and available to the world via high-quality computer image-files. All styles and mediums are accepted: photography, illustration, painting, sculpture, fashion, digital, video, anything else that can be somehow digitized into a binary file and displayed on a computer screen. There is no charge for exhibition, there is no charge to view or copy images.

===========TOURING THE GALLERY==========

There are several ways of browsing the information and images stored on OTIS, most require Internet access.

INTERNET METHODS:

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GOOD OLD FTP
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FTP is the basic file-transfer method on Internet and is the basis for OTIS' distribution. There are two FTP sites with access to OTIS images.

The Primary Site:
sunsite.unc.edu
/pub/multimedia/pictures/OTIS

The Secondary Site:
aql.gatech.edu
/pub/OTIS

All directories have INDEX files to guide you. To read an INDEX file while in FTP, you should be able to type "get INDEX|more".

......
WWW, WORLD WIDE WEB
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By far, the preferred method of OTIS browsing, WWW offers point-and-click friendliness with hyper-referencing and pop-up colorful graphic displays. WWW is accessible with a high-speed link to the Internet and a program called MOSAIC.

OTIS Home Page
http://sunsite.unc.edu/otis/otis.html
alternate: http://aql.gatech.edu/otis/otis.html

Using a program called LYNX and VT100 emulation, you can browse the text of WWW pages. LYNX is the second best thing to having a full graphical WWW link. If you don't have access on your Internet machine, you can TELNET to sunsite.unc.edu and login as "lynx" for a public-access version. The "G" option will allow you to link to a WWW page of your choice (for OTIS, you'd type: http://sunsite.unc.edu/otis/otis.html).

......
GOPHER
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GOPHER is a textual browsing format that uses point-and-click-style info-surfing techniques, but is built for use with keyboard and text display, much like the abovely mentioned LYNX WWW browser. GOPHER could be called an early version of WWW.

You can access OTIS via Gopher from the following sites, just follow the menus:

sunsite.unc.edu (Worlds Of Sunsite, Browse All, Multimedia, Pictures, OTIS)
gopher.well.sf.ca.us (art, OTIS)

GOPHERing to OTIS will only readily gain you access to the text information stored there (Artist bios, image information, directory indexes), but downloading and file transfer is available on some GOPHER clients. Check with your system administrator for more information about GOPHER.

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EMAIL
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There are email-accessible FTP servers. Send email to ed@sunsite.unc.edu for information about this mode of FTP.

NON-INTERNET METHODS:

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DIAL-UP BBS
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Pair O Dice BBS in Texas offers a large number of OTIS images for download. Pair O Dice can be reached at:

512.451.7117

......
MAIL
......
Perhaps the slowest way of obtaining OTIS images is through regular mail. If you have email, send a message to ed@sunsite.unc.edu for a current list of OTIS files. If you don't have access to email, you'll have to send a SASE for the current catalog of OTIS images. If you'd prefer to forgo this step, we'll gladly send you an arbitrary grab-bag of images for your perusing pleasure.

You can either send $2 per disk (to cover disk cost and postage) or send disks and return postage. We'll fill the disks to your specifications as accurately as possible and send them right back to you. Specify Mac, DOS or Amiga for your disk format.

===========SUBMITTING IMAGES==========

Images are accepted in JPEG and GIF form, animations in MPEG, QuickTime, FLI and self-executing form. There are several methods of submitting images for exhibition.

You'll need to fill out a short simple form for each image you submit. Forms appear at the end of this section. If you're a first-time submittor or would like to update your information, an Artist-Info form is also included.

......
MAIL
......
For those without the facilities to digitise images or video, there is hope. You can send your pictures or photocopies to us and we'll digitise them for you, please include a SASE if you wish your photos, photocopies or video-tapes returned and include one 3.5" floppy disk for every two images with your SASE if you'd like your digitised images to be returned to you with your materials. If possible, please only send COPIES and not originals of your artwork. We'd both hate to see the works damaged.

Display on the gallery is free and so is scanning/digitising images. However, the latter does take a lot of time and access to expensive equipment. Donations of $5-$10 (US Currency) or trade of interesting goods (zines, comics, videos, toys, etc) are appreciated for big digitisation jobs. You are encouraged to first look for your own method of digitizing images, as the OTIS curators would rather spend time on less menial tasks.

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FTP
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You can FTP your image submissions to the following site and directory:

sunsite.unc.edu
/pub/multimedia/pictures/OTIS/Incoming

If possible, please ZIP, TAR or otherwise archive your submissions together. This helps us keep them organised before we actually get to merging them into the gallery.

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EMAIL
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You can UUENCODE or BINHEX your images to ed@sunsite.unc.edu. Please include a cover letter identifying the artist and name of images.

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DISK
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You can snail-mail DOS or MAC disks to us at the address listed above. Include cover letter and a SASE if you want the disks returned. We'll fill the disks with OTIS images on request.

===========INFO TO INCLUDE WITH SUBMISSIONS==========

Here are the forms for submitting images and personal info for display on and retrieval from the OTIS on-line gallery.

Please send all forms to ed@sunsite.unc.edu.

....
ARTIST INFO
Please keep the lines starting with "--" in the completed form, replace all other lines with your own information.

If you want to leave any lines in the "--VITALS" section blank, either type "none" or "#" in them.

The "--BIO" section can be written in HTML format if you know how. If you don't write it in HTML, please keep your lines at 80 characters wide or less and put blank lines in between paragraphs. The "--BIO" section can be as long as you like.

Unless you're using HTML, *do not* use the following characters in your "--BIO section": '<', '>', or '&'.

Here's the form...("--VITALS" is the FIRST line, "--END" is the last)...

--VITALS
<long name> (ex: Joe Q. Otist)
<email> (ex: joe@otis.org, joe@nasa.gov, maurice@anon.serv.org)
<snail mail>(ex: Joe/PO BX 222/Otis, PR 68686/USA)
<dob> (ex: May 3, 1972)
--BIO
<fill with information about yourself... phone number, schooling, ambitions, homepage, permission for use of your images...etc.>
--END

....

IMAGE INFO

You can submit multiple IMAGE INFO forms at once, merely designate the filename before each form.

If you're uploading your IMAGE INFO files to OTIS via FTP, please save them as "filename.ext.nfo". For example, the INFO file for the file "blue.jpg" would be "blue.jpg.nfo".

Each line is separated by carriage-returns. Make sure this is the case with your submitted forms. This generally won't present a dilemma save on the "Image Description" line. Be sure that your "Image Description" line (the last line in the INFO file) does NOT contain any line-breaks. You might also want to include the file-size and color-depth in your "Image Description" line.

If in doubt about your Artist-Name, email ed@sunsite.unc.edu. It's usually your lastname, underscore, first initial. If you have a common lastname, then you might want to include your middle initial (ie. Jones_BJ).

Image Types are listed at the end of this file. If your image fits into more than one category, separate them by a comma (ie: photo,abstract,animal). If you think a category needs to be added, email us.

Be sure your listed Image Types are in lower-case and separated only by a comma (no spaces or other punctuation).

Image Description should be a short blurb about your image along with any size, resolution or copyright info you'd like to include. Make sure there are no carriage returns or line-breaks until the end of the description.

Here is the form. Replace all lines in the order you see here.
Artist_N is the first line, Image Description is the last.

....

Artist_N (replace with your artist-name, Ed Stastny = Stastny_E)
Image Title (replace with the title of your image)
Image Type (list of categories and mediums your image fits into)
Date (date image was created)
Image Description (description of image, try to keep under 320 chars)

Here is an example NFO file for the image "Blue.jpg" which is an abstract painting by an artist named Lile Elam....

....beginning of example....
Elam_L
Blue
painting,abstract
June 1993
(56k) The pure experience of the colour blue. Painted in oils on a 22x11 canvas
. Inspired by the sky over California.
....end of example....

Notice the last line runs across two lines. You are encouraged to keep your image descriptions brief, but you can use a few lines.

....
MEDIUMS and CATEGORIES

MEDIUMS
----
execute :executeable (self viewable) program
drawing :pencil and pen drawings (and crayons)
painting :wet pigment on surface
sculpture :statues, solid forms molded or constructed
graphic :computer-based/aided imagery
raytrace :raytracings (3d modelling and rendering)
math :images generated purely by mathematical equations
morph :animations created by morphing
photo :photographic images
photo-manip :significantly altered photographs
etching :woodcuts, etc to make prints
carving :a sculpture created with a sharp object
collab :multiple-artist creation
animation :moving images that aren't video
video :video grabs
jewelry :worn decorations that aren't clothing
body-art :tattoos and scarifications
installation :whole-room pieces or walk-throughs
quilt :sewn and patterned blankets
weaving :woven materials
fashion :worn decorations that ARE clothing
architecture :buildings and large constructed dwellings or shelters
publication :text and images juxtiposed (layup, DTP)
ascii :ASCII text art (in .txt format)
ansi :ANSI art

CONTENT
----
abstract :non-representational image (non-objective)
nude :mostly or totally unclothed human
animal :usually unclothed non-human setient life
landscape :landscapes
grid :PANIC Grid image
corpse :PANIC or CORPSE exquisite corpse
mask :PANIC Mask image
political :political commentary or content
portrait :image of person only...subject=person in pic
techno :images of robots and cyborgs
cover :zine, cd, tape or album cover
flora :plants and flowers
comic :comic strip, character or panel

......
PERMISSIONS AND COPYRIGHT
......

Keep in mind that the artist retains ALL copyright to images they place on OTIS. Unless it is specifically stated that an image is in public-domain, it is illegal to use it for any purpose other than personal non-profit view or display. Always contact an image's artist about publication or public display. If in doubt about an image's creator or owner, contact ed@sunsite.unc.edu.

To emphasise: It is okay to copy an image to your own computer. It is also okay to copy the image to friends, as long as you tell them where you got it and who created the image. It's also okay to post OTIS images to local dial-up BBSes, as long as you include information about it's origins.

Of course, we don't have an omniscient security force out there to watch for violations and punish perpetrators. We rely on trust and respect.

A word to artists: Mass media is a triple-edged sword. There's always the chance that someone will steal your image and use it for their own gain. OTIS has never encountered such a case, but it could happen. Keep this in mind when submitting images for display. One precaution you can take is to add your name to all images and to make your images small enough (using DPI adjustments in your scan/paint software) so as to make printing of the image impractical while keeping a practical on-screen display size.

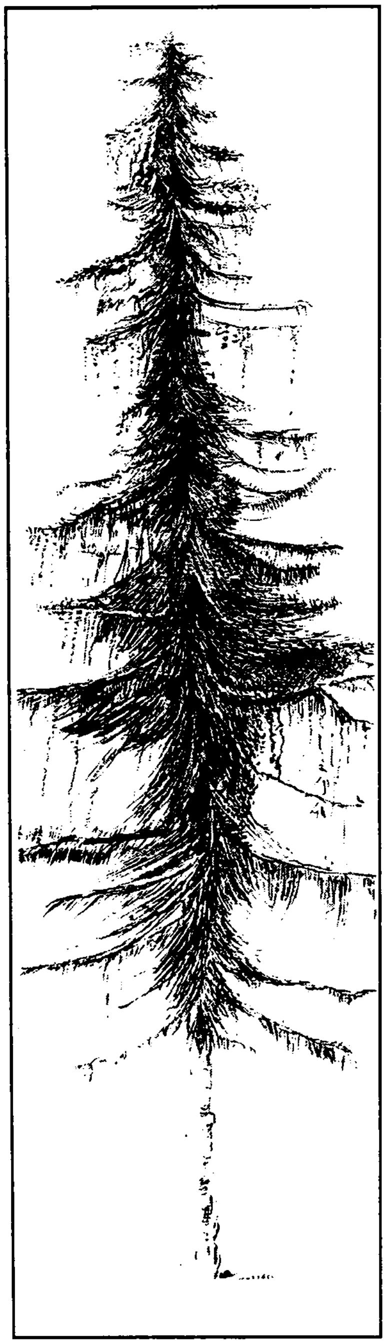
CD-ROM AND THE BOOK BUSINESS

Stella Pandell Russell, Ph.D
Author: Art In the World, Art In the Modern World
Prof., Nassau Community College, N.Y.

Abstract

A headline grabs attention. "Save a Tree... Read an Electronic Book". And that's only the beginning... Tap a few keys and you can read tomorrow's news today. For the time being, growing numbers of computer networks serve as a two-lane blacktop for an information exchange. People on Internet start the day by checking the messages collecting (by modem) onto e-Mail. The CD-ROM market moves fast and furious. But will computers kill books? What does history tell us? The clock is ticking...

As great a single shift in the publishing field since Gutenberg's presses outmoded the hand-written MS, our technologies are converting printed communication into expressive forms of interactive events. Multimedia can transform all of us into vigorous participants in a media-rich climate. The expansion of anyone's *electronic* world can begin when each participant is fully involved interactively with hands-on encounters. Such a process taps into everyone's basic *need* to make personal choices, actively taking part in all the decisions that can affect our lives, as explorers, not just passengers on a trip someone else has laid out. But, what about CD-ROMs? Are they books or something else? The technology looks good, but real books have survived more than 500 years. What does the future hold for the CD? History may give us all the answers we need.



* * *

Let's step back in time to Gutenberg almost 550 years ago, when one day supposedly he made a one CD-ROM disk. Every approach to any topic found in any one of the reference books on disk can be located in less than 30 seconds with search-and-retrieval software. Huge Low Library of Columbia University, housing printed materials that reach back to a few illuminated manuscripts and onto the luminous waves of a SuperComputer, has begun massively to scan in millions of pages and reams of references using technology simply called a Connection Machine. An image of every page of every book and document is saved as a bit-mapped file. This includes pictures, graphs and graphics, notes scribbled in the margins, and even catsup stains left by careless readers. With this kind of access and retrival potential, publishers of encyclopedias, and stock photograph agencies have begun to catalog their collections. The computerized Visitor Center of the National Gallery in Washington already has hundreds of works scanned into their system.

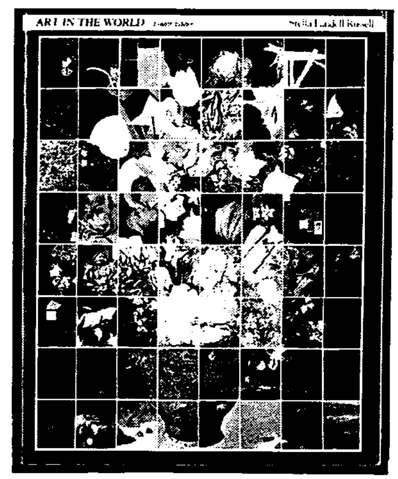
Has the technology outstripped our ability to deal with it? Can we be buried in this glut of data and what can we lose in the process? Isn't it too much emphasis on process that few understand? We once knew how all our tools worked. In blind acceptance of modern technology, aren't we, as Alan Turing warned, in danger of forgetting to think?

Computer-based interactivity permits a measure of involvement with the forces that affect our lives. The Town Halls reintroduced by Ross Perot and expanded by Bill Clinton had their place in the last election, but their major impact may still lie ahead. Already present is a new kind of access to information ...the electronic book offering opportunities to vary every program according to the reader's responses. Decision making with multiple branching tracks can determine what if anything will occur. Such interactive textuality may ratify what our culture has been inventing for some time. Much of our post-modern thinking about the nature of language involves the critical, often skeptical, weigh of available data, at the time it emerges and is interpreted, to the moment it's possible to put it all together. It is this prospect that speeds our ongoing path on Information Superhighways. Our society wavers at a confusing, perhaps treacherous, breach between those who accept the benefits of reading and those who either cannot or will not take part in traditional paths to learning. Non-reading masses are growing faster than may be obvious. The USA has the lowest literacy rate of any developed nation in the world and by 2001, we and our children will reap the results of whatever action or inaction chosen. Can CD-Rom fix problems?

Publishers are still competing for their share of a troubled market and struggle for control of their own industry. There is rivalry *not only* from entertainment, to which we often forget books always contributed, *and* CD-ROM, but from book editions that fly wholly or in parts connection between his wine press, and his signet ring... That printing press ran by means of impressions made through raised type that could be moved and used over again and again. The world was on its way to the Information Age. Ever since Gutenberg ... humankind has been attacking the problem of how to get information to people fast. It took only a hundred years to easily solve Gutenberg's early goal of printing in great quantities. Mass reproduction today has become part of the problem. Today's flood of information that washes over us offers exposure to much over which we have little control and often even less interest. Instead of 60 TV channels, we'll soon have 500, maybe a thousand. According to many scholars, Marshall McLuhan among them, humanity gave up too much in exchange for the textuality that Gutenberg offered. Societies that preceded writing took meaning from all the sensual cues around them, relying as much on intuitive thought as they did the environment. Many of us have forgotten to listen beyond "sound bites" or to see beyond the flickers of the screen image. How can we cope with the bombardment of imagery we face? The challenge becomes how to purposefully thread through the global village and a primary key may lie in Interactivity.

The Information Super-Highway combines the switching and routing capability of telephones with video and the most advanced cable systems and data banks. Already, we are tied into cable, but the rest of the highway is close behind. The e-frontier is building itself right now. The digitalization of all forms of information is on-going, and heading forward with the impact of onrushing trains. Everyone possessing the technology can process it. It is almost possible now to communicate with anyone on the planet with an electronic message. Wherever we are, a bundle of bits can follow.

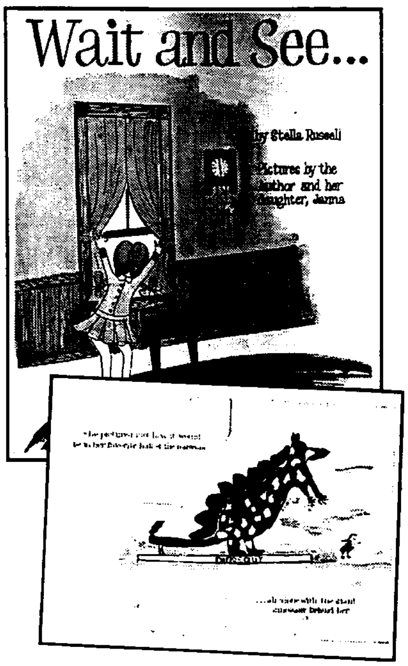
Imagine the masses traveling through multimedia data-banks, themselves making the choices of which routes to take. Interactive multimedia provides the information only when requested, incorporating the full range of media-- sound, graphics, stills, animation and video. Broadband communication can reach into the human brain's advanced sensory processing,



as was once possible to yield the richest and most meaningful route to knowledge.

How far have we come in the management of information? CD-ROM can hold about 270,00 pages of text. My own last book *Art In the World*, the weightiest so far, occupies 515 pages; permitting 899 other volumes to fill only through on-line services to arrive directly on-screen.

A contribution that begins with interactivity in all forms of education



may offer the best chances. My own new route is the design of books in any form everyone wants to read. I've begun with **Wait and See**.

Summary

No one is certain of what the future holds. As for right now, joint ventures in the publishing game may be the way to go. Many are publishing work in conventional binding *and* CD-ROMs, like Sony Imagesoft's **The Haldeman Diaries**.

Yet, why did William Gates, **Microsoft**'s chairman decide to publish his book the old-fashioned way? While companies are scrambling for a technology to mimic books completely, none has succeeded. CD-ROM has not yet replaced curling up with a good book... except perhaps for kids. Children are comfortable with technology. Living Books offer lively sounds and graphics, and limitless chance to play with choice. The next generation won't likely begin with page 1 and go to the end, but will read in fragments.

Not since the onset of movable type have publishers struggled so hard to define what a book is. One thing is certain, for ease of access and readability of references like encyclopedias CD-ROM is unbeatable Click a mouse to read of a composer and hear a snippet of music. For almost any kind of instruction, from science and art to a game of golf, CD-ROM is ready. Try this sampler now:

Reference

Encarta. More than 25,000 topics on all themes imaginable. Leap around the globe with the atlas in sight and sound. Skate through the Timeline of History. Microsoft: Windows, and Mac.

Education

Bookshelf. Multimedia version of 7-volume desk set with thousands of video clips, full-color photos and illustrations. Microsoft: Windows, and Mac.

Games

The 7th Guest. A pioneering classic in cinema-style entertainment. With viewer's decisions unfold 36 minutes of video and dialogue sequences; two disks to hold all the secrets in this haunted mansion. Virgin Interactive: Mac and Dos.

Books

Beauty and the Beast. The classic tale enhanced by multimedia. Learning and storytelling interaction. Compton New Media;

Additional Readings

The New York Times
Patton, Phil *The Pixels and Perils of Getting Art on Line,* August 7, 1994

TO: SCAN (Members and attendees, 1994 Conference)
FROM: Herbert A. Deutsch
SUB: Casio, Inc. vs. The United States Judgment

Last November, I presented to SCAN a synopsis of the trial held in August, 1993 in which Casio as the Plaintiff alleged that their music synthesizers and keyboards be imported at a duty rate which applied to *"electrical parts or articles"* rather than *"musical instruments"*. The purpose of the suit was simply that electrical devices are dutiable at a rate which is about 50% of that paid for musical instruments.

As an expert witness for the United States, I gave testimony based on the history and evolution of musical instruments and their continual incorporation of available technology. I also played music using a Casio keyboard and all of its added bells and whistles during the trial. Expert witnesses for the Plaintiff testified that the built-in sequencers, drum machines, MIDI, etc. made these devices MORE THAN - and therefore no longer - musical instruments.

The trial itself was interesting (including the live performance) since it became in many ways an evaluation and a defining of music in a digital age. Casio based its arguments primarily on several factors: The existence of ROM chips that stored demonstration melodies ("these are therefore playback devices, not instruments"). The existence of digital sampling ("these are recording devices"). The addition of MIDI (it was somehow assumed that this was not a "musical" addition) etc.

Although it took over a year for the decision, the judge ruled on October 7, 1994, that the Plaintiff's expert's tesimony "shed little light on the issue and provided inadequate support for the classification argument" and that sequencers, MIDI and other devices "appear to become part of and enhance the musical instruments in which they are found . . . expand the sounds available to be played and permit manipulation of sound to enhance creativity". He further added that "the electronic synthesizers at issue are the result of the evolution of musical instruments".

However, in a final turn, he decided that some of the instruments in question did not have any amplifiers or speakers, and that musical instruments *must be able to produce sound.* Therefore, all of the thirty-or-so Casio keboards and synthesizers in question that had built-in amplifiers and speakers were "musical instruments" while five other sound modules and (high-end) synthesizers were "electrical articles capable of producing an audio signal but incapable of producing sound as imported".

Since there may be appeals to this decision, I will not comment on my interpretation of this judgment.

I wish you all a wonderful SCAN 94. Sorry I'm missing it.

Herb Deutsch

Herb