



# ats@50

Art and Technology Studies

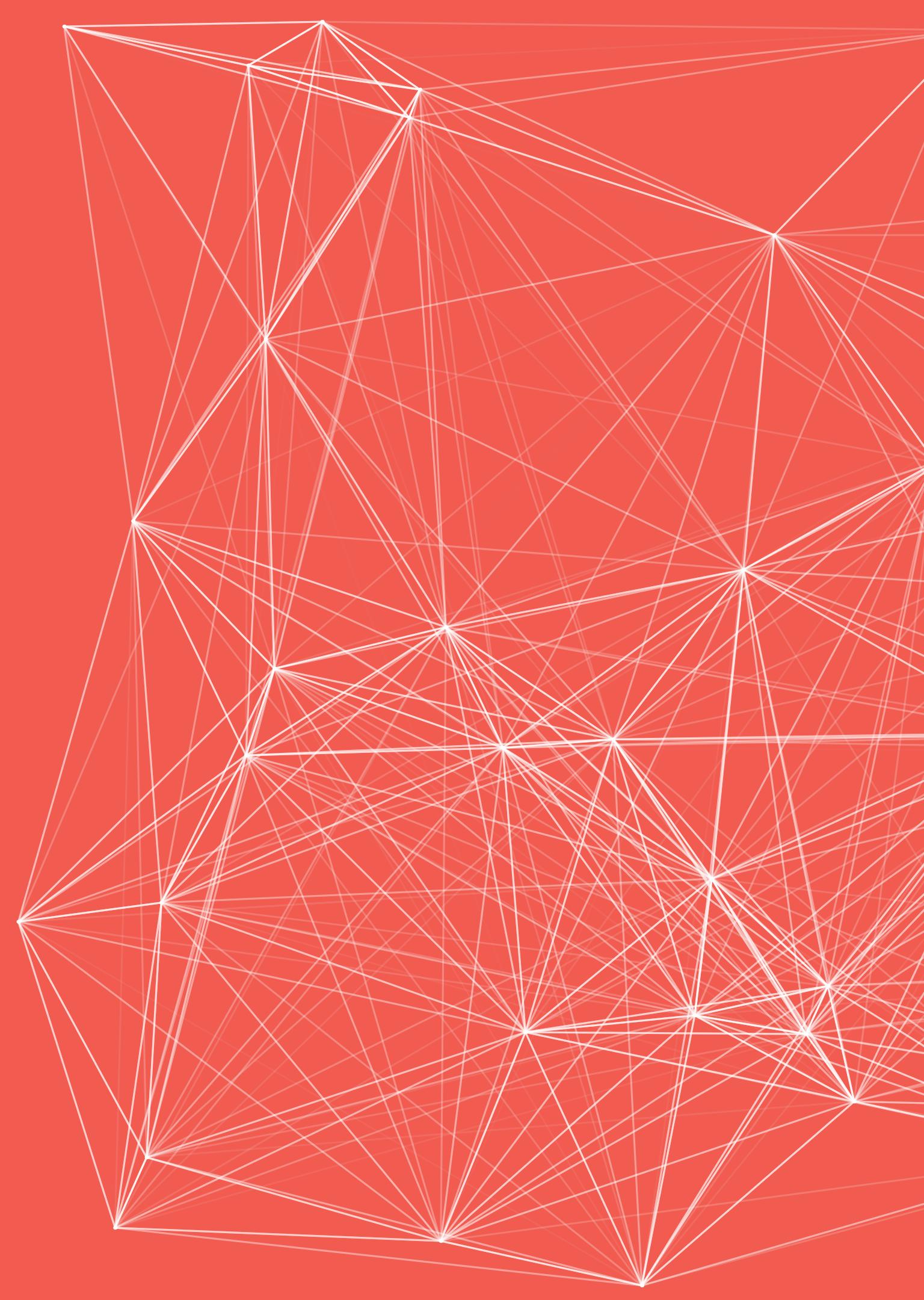
1969-2019



School of the Art Institute  
of Chicago

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**ART &  
TECHNOLOGY  
STUDIES**



# ats@50

Art and Technology Studies  
1969-2019



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Sukjoon Lee, *Code Reading*, 2017. Kinetic sculpture. Photo: Ziv Cohen.

# 50 Years of Art and Technology Studies at the School of the Art Institute of Chicago

The first two decades of the twenty-first century have witnessed a surge of interest in practices at the intersection of art and technology, a phenomenon well documented by the proliferation of exhibitions and edited volumes on the subject, as well as preservation efforts implemented at major international museums. This broad institutional embrace also casts new light on the use of technology as an art medium at SAIC, illuminating the significant contributions made by Art and Technology Studies (ATS) faculty and alumni throughout fifty years of uninterrupted experimentation, as well as the lack of precedent for such a milestone in the field at large.

The legacy of art and technology studies at SAIC was formally initiated in 1969 when Steven Waldeck began teaching electronics and kinetics, elements he had been incorporating into his own practice for several years. It was around this time that Sonia Landy Sheridan began a series of artistic experiments with a 3M Thermo-Fax machine, resulting in an industry collaboration between 3M and Sheridan that would develop into the first "Generative Systems" course in 1970 and ultimately a complete graduate program in 1972. Sheridan's Generative Systems program was renamed Art and Technology Studies in 1982, maintaining a curriculum that encompasses the study of any and all technologies—mechanical, electronic, photonic or biologic.

This focus on process or approach, rather than the specificity of the practice in question, distinguished these programs from traditional departments such as painting and sculpture, but also enabled them to anticipate and critically respond to the myriad new technologies that have come to inform contemporary life. ATS faculty and alumni have pioneered artistic engagements with emerging technologies—from the Thermo-Fax to the Internet and from genetically-engineered life to artificial intelligence. Many of the media, techniques, and concepts that were first introduced to the SAIC community through ATS curriculum have since become

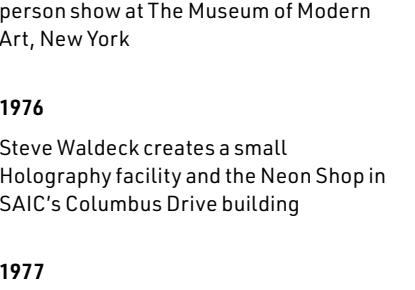
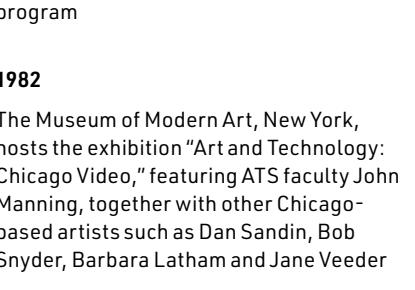
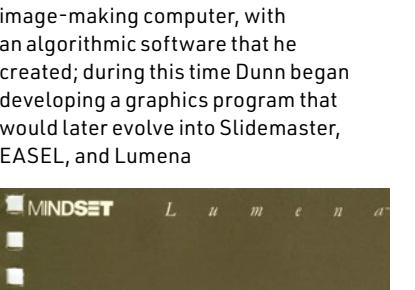
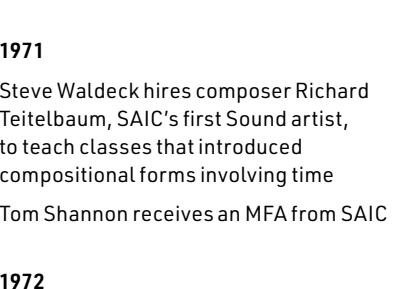
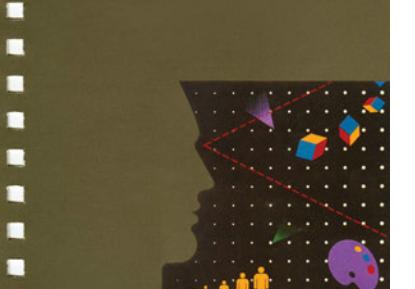
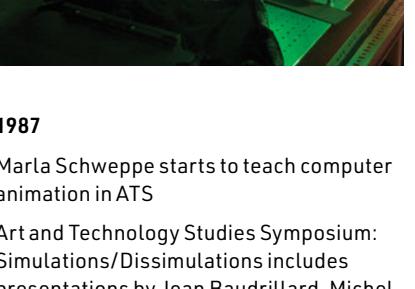
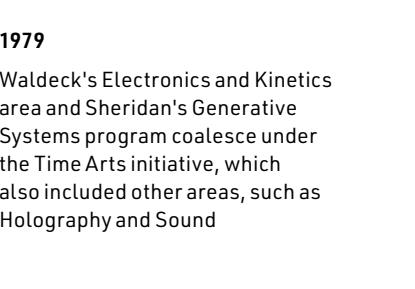
fundamental to broad swathes of artistic practitioners, including digital photography, computer animation, virtual reality, and sound.

The complete merger between Waldeck's Electronics and Kinetics area and Sheridan's Generative Systems program was a slow process. They first formally coalesced in 1979, under the Time Arts initiative, which also included Holography and Sound, both spawned by Waldeck. The process took several steps and was completed in 1993, resulting in physical integration in a single location.

In order to celebrate the first fifty years of the Art and Technology Studies department at the School of the Art Institute of Chicago, this publication documents this milestone and looks forward at the next fifty years. Here we find not only its rich history but also its ongoing contribution to SAIC and the larger art and technology community. The publication interweaves personal, historical and scholarly accounts of the department, faculty and alumni, including reflections from past department chairs Joan Truckenbrod and Peter Gena. ATS staff has also played a key role in the history of the department, as exemplified by Anna Yu's sustained commitment above and beyond the call of duty; this publication could not have succeeded without her dedication as project manager. Contributions from full time faculty Lee Blalock, Judd Morrissey and Jacob Tonski explore thematic undercurrents, such as performative practices, poetic media and creative coding; Judy Malloy, editor of *Women, Art, and Technology* (MIT Press, 2003) contributes an essay on the impact of women in the history of ATS; Duncan Bass discusses an exhibition he curated for the Ars Electronica festival of work by ATS graduates, and art critic and curator Dominique Moulon discusses the contributions of distinguished ATS alumni.

Eduardo Kac  
Professor and Chair, Art and Technology Studies

# Art and Technology Studies Timeline 1969 - 2019

1969	Steve Waldeck creates the Electronics and Kinetics area		1974	Sonia Sheridan and alumni Keith Smith exhibit their collaborative work in a two-person show at The Museum of Modern Art, New York		1981	Joan Truckenbrod joins the faculty as Chair of the Generative Systems program	
1970	Sonia Sheridan starts the Generative Systems program		1976	Steve Waldeck creates a small Holography facility and the Neon Shop in SAIC's Columbus Drive building		1982	The Museum of Modern Art, New York, hosts the exhibition "Art and Technology: Chicago Video," featuring ATS faculty John Manning, together with other Chicago-based artists such as Dan Sandin, Bob Snyder, Barbara Latham and Jane Veeder	
1971	Steve Waldeck hires composer Richard Teitelbaum, SAIC's first Sound artist, to teach classes that introduced compositional forms involving time  Tom Shannon receives an MFA from SAIC		1977	Holography area alumna Loren Billings opens Chicago's Museum of Holography  Generative Systems graduate student John Dunn assembles SAIC's first image-making computer, with an algorithmic software that he created; during this time Dunn began developing a graphics program that would later evolve into Slidemaster, EASEL, and Lumena		1984	ATS establishes a dedicated Holography facility	
1972	Three-way, real-time collaborative fax image created by Sonia Sheridan (sequential drawings sent from Chicago), Leif Brush (the sounds of raindrops from Iowa City), and Willard Van De Bogart (infrared photograph of the sun transmitted from Pittsburgh)		1979	Waldeck's Electronics and Kinetics area and Sheridan's Generative Systems program coalesce under the Time Arts initiative, which also included other areas, such as Holography and Sound		1987	Marla Scheweppe starts to teach computer animation in ATS  Art and Technology Studies Symposium: Simulations/Dissimulations includes presentations by Jean Baudrillard, Michel Segard, Joan Truckenbrod, Ed Emshwiller, James Seawright, and Pamela McCorduck	

1989

ATS begins to teach Robotics; the course is taught by Bill Mego

Eduardo Kac and hardware designer Ed Bennett collaborate in the creation of the telepresence robot *Ornitorrinco*



1990

The Electronics and Kinetics area begins to etch its own circuit boards for teaching and artmaking

1991

Eduardo Kac offers the first digital holography course, using a system previously developed by Kac, Bennett and Dean Randazzo



1992

Eduardo Kac introduces the History of Art and Technology course

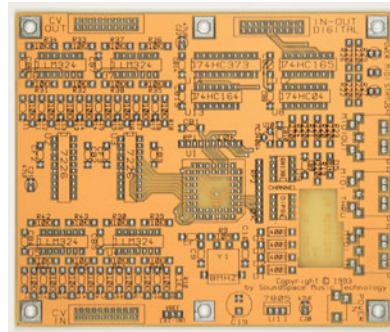
The 68HC11 embedded controller is introduced into ATS curriculum



1993

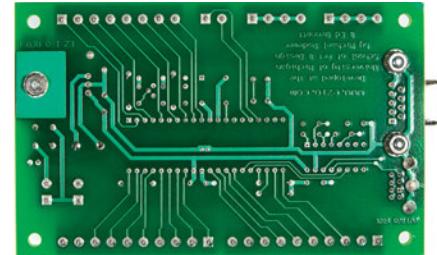
Electronics and Kinetics, Neon and Holography, and Art and Technology Studies relocate to the newly established MacLean Center

Shawn Decker and Steve Boyer develop a general-purpose MIDI controller for performance

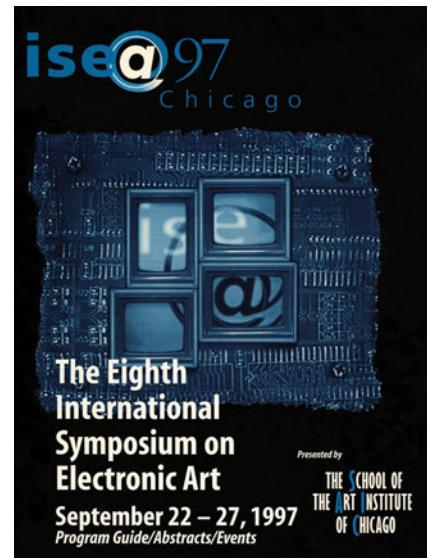


1997

Michael Rodemer and Ed Bennett develop the EZIO Board, an embedded microcontroller that predates the Arduino



ATS hosts the ISEA international conference, organized by Shawn Decker, Peter Gena, and Michael Rodemer



1998

Eduardo Kac introduces Bio Art, a concept he first articulated the previous year, to ATS curriculum



**1999**

ATS introduces rapid prototyping curriculum, conducting research and workshops in Computer Numerical Control (CNC)

**2000**

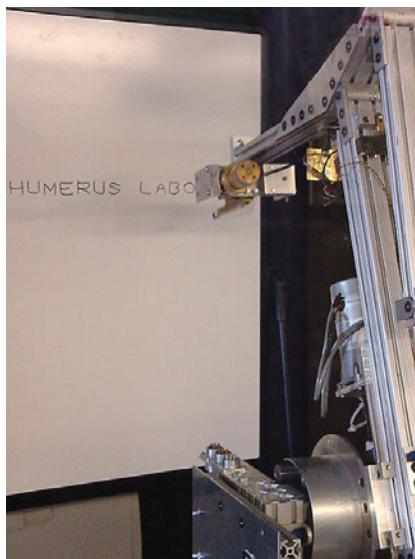
The ATS pedagogical display is designed and built by Ed Bennett to teach the fundamental concepts of mechanical engineering and the uses of analog and digital sensors



**2001**

ATS offers its first Virtual Reality course, taught by Shawn Decker

Ed Bennett and Jon Fisher develop Humerus Labor, a custom-built robotic arm that introduces complex engineering concepts, such as motion control, to the art school environment



**2003**

ATS offers a mobile media class

Eduardo Kac builds the first Bio Art lab in ATS

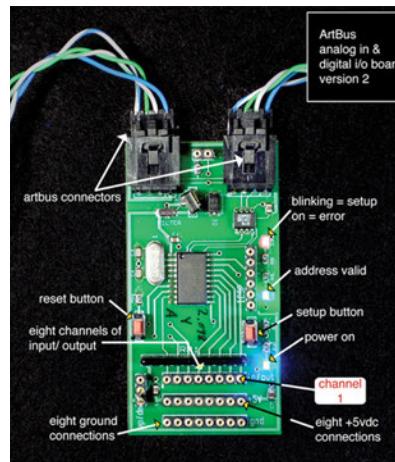
**2004**

ATS introduces the first surface mount lab, allowing for the production of contemporary electronics and the use of circuit boards with microscopic components

**2005**

Peter Gena initiates a collaborative research project between ATS and École supérieure d'art d'Aix-en-Provence to investigate the areas of robotics, sound and virtual reality. The project included exchanges between faculty, staff and graduate students, as well as a series of events, such as workshops and performances. Funded by the French consulate, the project is still ongoing

Ed Bennett begins developing ArtBus, a protocol for interfacing computers to sensors and actuators that could be used with limited coding knowledge. The project was completed in 2011



**2009**

A career retrospective of Sonia Sheridan, *The Art of Sonia Sheridan*, is organized by the Hood Museum of Art at Dartmouth University

**2011**

Jan Tichy presents *Project Cabrini Green*, a public art installation created with both the local and ATS communities in response to the demolition of the public housing project Cabrini-Green's last high-rise



**2013**

Chris Baker creates the openLab, a community dedicated to the sharing of information about hardware and software

ATS creates the ioLab for digital fabrication



**2014**

Chris Baker and Brannon Dorsey create ofSketch, an integrated development environment (IDE) for openFrameworks, making ofF accessible to artists with limited coding knowledge

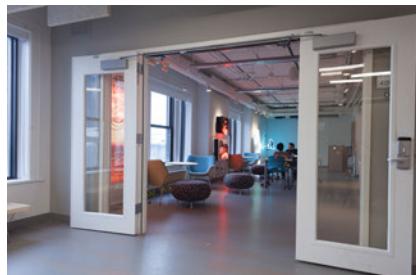
Tiffany Holmes begins SAIC's Art & Science initiative and the Scientist-in-Residence program

The Bio Art program establishes a dedicated facility



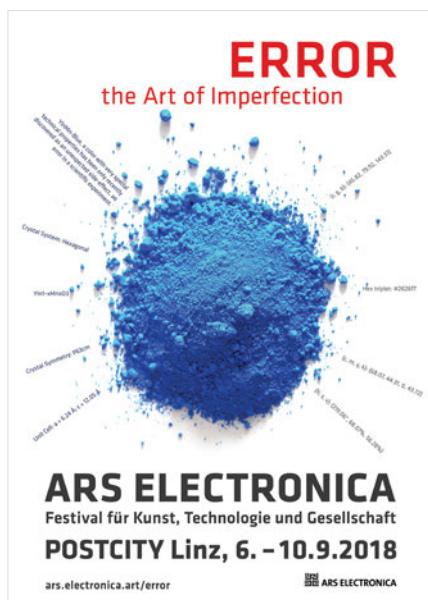
2016

Steve Waldeck's public art installation *Flight Paths* is unveiled at Hartsfield-Jackson International Airport in Atlanta, the culmination of fifteen years of development  
ATS facilities undergo renovation, creating more communal spaces, flexible use facilities, and new exhibition venues



2018

ATS introduces *Olfactory Art* into the curriculum  
First ATS exhibition at the Ars Electronica Festival for Art, Technology, and Society, Linz, Austria



2019

ATS celebrates its 50th anniversary with several initiatives, which include: readings and performances co-organized by ATS and the Electronic Literature Organization; the opening of the ATS Retro Lab and the unveiling of Nam June Paik and Shuya Abe's Video Synthesizer (donated by Jim Wiseman, who built it in 1972 under Paik and Abe's direct supervision); a symposium on Space Art featuring Eduardo Kac, Annick Bureaud, Xin Liu and Mark SubbaRao, exhibitions of neon art, and olfactory art, among others; and the publication *ats@50*



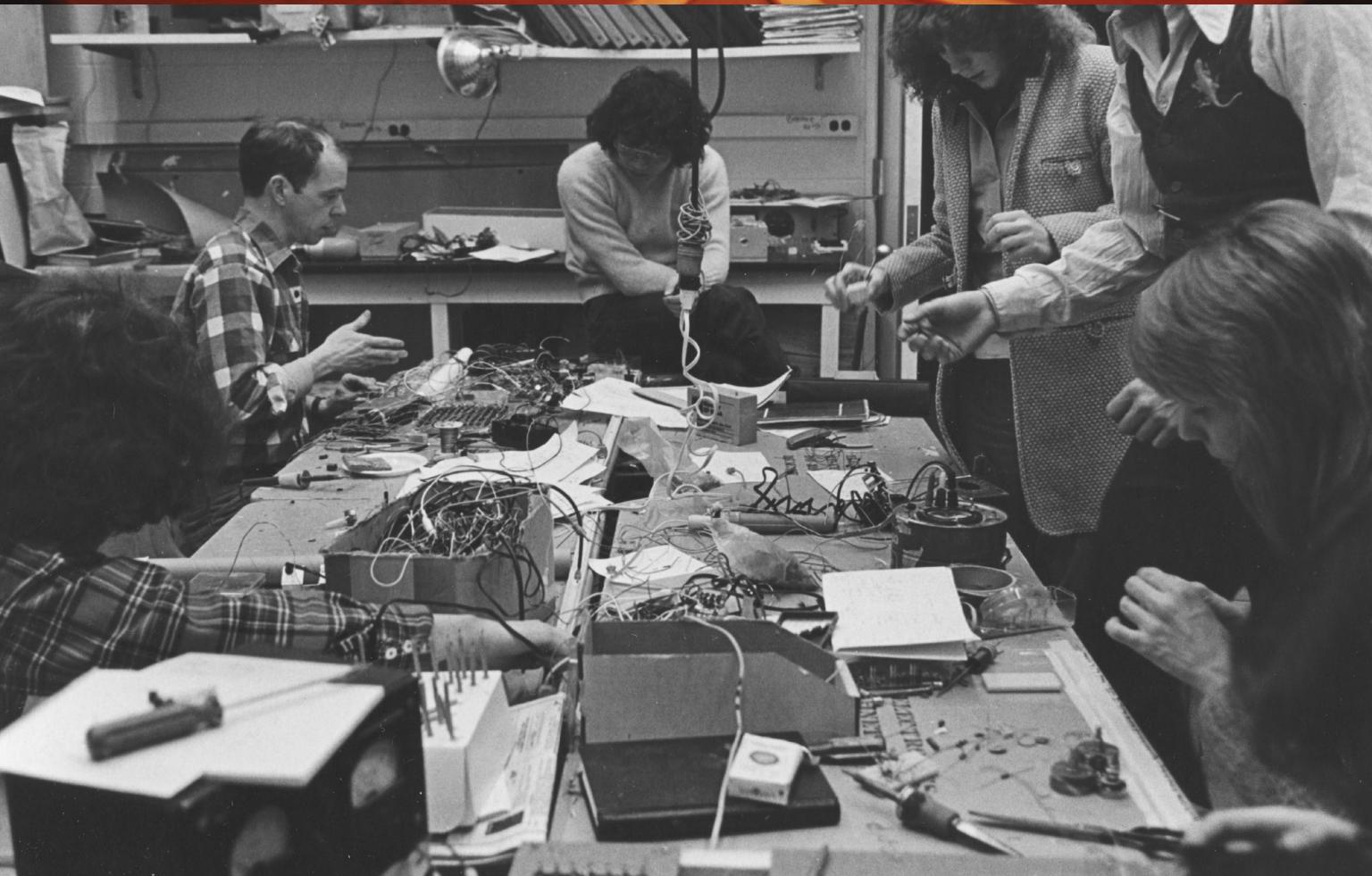
Retro Lab, 2019.  
Photo: Michael Powell



Paik / Abe video synthesizer, 1972.  
Donated by Jim Wiseman.  
Photo: Michael Powell.



Lee Blalock, *Solenoid mask instr/ augment*, 2018. Custom wearable instrument.  
Photo: Sophia Barr Hayne.



# Electronics and Kinetics

Steve Waldeck

The Electronics and Kinetics area was established in 1969. It is often an area devoted to the expression of an artistic form that moves and changes both physically and visually. It attempts to engage itself in both the practical elements involved in making artistic 'time' statements as well as the aesthetic concepts. Perhaps, it is easier to understand if it is said that the Electronics and Kinetics area is open-ended and most often uses electronics, mechanics or other unconventional technologies (i.e. synthesizers and laser lights) as media in order to present artistic statements.

The approach to time as an aesthetic concern is quite wide open in this area. Movement, lights and sound are most often employed, although experimentation has also been done in the areas of wind, water, solar and even the electronic manipulation of TV monitors. However, it is the overall statement of these particular means that is of importance. Since the art work's meaning is encompassed in the passage of time and its appearance is changing from one moment to the next, the result is often compared to a sort of abstract ballet. The forms used, whether they be lights or sounds, become part of a totality and no longer exist as separate entities. The scale can range from a small object-oriented piece to an overall environment. In the past, works have been done in a profuse variety. The activities of the lights, sounds, and movements have been programmed into compositions. Static sculptural forms have taken on new dimensions with unconventional treatments. Like any other artistic medium, expressions have run the gamut from serious to funny to satirical, and more.

The technical information offered to the students in the Electronics and Kinetics area is done as 'softly' as possible. The area is, after all, not for scientists and engineers; rather, it is a means to an end, that of

art-making. Recently the area has acquired a number of machine tools to aid the artist with mechanical problems. A class specifically for kinetic artists is offered now. However, electronics is often the most reliable and easiest way to organize abstract events or activities for the artist. It also can offer a rich source of sound-making devices. Electronics is, therefore, a very practical technology for an artist to use in making new expressions and is probably the most emphasized.

The Electronics and Kinetics area functions beyond the boundaries of its classes. It also exists as a unique shop and work facility. A 20 x 20 room called the Sensorium, light-proof and sound-deadened, is available to students as a viewing and listening laboratory. Experiments in perception phenomena will be done here. The Electronics and Kinetics area is now in the process of constructing a larger dome, laced with hundreds of primary colored lights and dozens of audio channels. Its purpose is to create a perception laboratory where most high-speed visual/aural phenomena can be studied. It will, however, also be of great benefit to performances.

Originally published in *Time Arts*, School of the Art Institute of Chicago, 1979, npn.

Opposite and above: Steve Waldeck, *Environment 1*, environmental sculpture with moving lights programmed in different colors that swirled around the center band of windows, 1967. Courtesy Jane Waldeck.

Opposite and below: Steve Waldeck teaching electronics and kinetics, late 1970s.

# Remembering Steve Waldeck

Peter Gena



Steve Waldeck, *Flight Paths*, Site-specific multimedia installation,  
1999–2016. Atlanta Hartsfield-Jackson International Airport. Courtesy  
Jane Waldeck.



Steve Waldeck, *Kinetic Wheeling*, 1964. Kinetic sculpture. Photo: Anna Yu.

It's rare these days for an artist to be equally fluent in painting and sculpture; rarer still to apply mechatronics (kinetics and electronics), light, and sound to the bulk of an oeuvre. Such an imaginative polyglot who possessed all of this, and then some, was Steve Waldeck, my SAIC colleague and dear friend. As if unbound talent weren't enough, Steve was a walking, one-volume encyclopedia—not only could he expound on the sciences, how things work, carpentry, auto repair, etc., but, as the product of a family farm from West Virginia, he would illustrate the essence of life and nature (he should have been named an honorary meteorologist as well).

Although Steve was outspoken about politics, social order, etc., he eschewed the trendy aspects of "political art." His determined path throughout his career embraced nostalgia through time and memory. Yet, as a teacher, he never expected his students to take this road. How could a 20-year old embrace nostalgia? In his kinetic light boxes, Steve mastered the art of perspective with paint, layers, light, motors, magnets and ambient sound. In a structure 7 inches in depth, he created a spatial illusion often as deep as 50 feet! Early on he realized that for pure maintenance

considerations, he needed to find stock components. However, Steve rarely used off-the-shelf parts without modifying them electronically to suit his needs. His DIY circuits were at times almost comical—laid out and soldered on plastic plates, etc. But, I don't know of any that ever failed!

Few who knew Steve were aware of the sheer amount of work that he created, and moreover how many were sold! The Cleveland Clinic commissioned him for multiple light and kinetic dioramas in their waiting areas. Cape Canaveral and the Chicago Railroad Museum asked for kinetic light works. He was the "artist in residence" for the McDonald's Corporation, who not only commissioned dozens of paintings (many of which they duplicated in the hundreds), but numerous dioramas for their corporate offices all over the world, including Hamburger U. Most of these are no mean "artworks." Many are triptych installations that run 4-6 feet high by as much as 24 feet wide! This exposure brought multiple private requests—I couldn't count how much work is hanging in private homes (mine included, I'm proud to say). If Steve had an ego, no one ever noticed it. His wife and soulmate, Jane Clarren Waldeck, an artist in her own right, played an indispensable role as Steve's collaborator and business manager.

After leaving UC Berkeley in 1969, where he honed his unique craft, Steve came to SAIC, where he was an active member of the Chicago sculptural community for decades as artist, administrator and curator. He founded the first kinetics and electronics studio at SAIC, and was the catalyst to establish the Neon, Sound, and Holography areas that followed. His commissioned work since the millennial involved permanent, larger venues. First, an interactive installation of light, kinetics, music and sound (*Passages*), for a 150-foot corridor at the College of Lake County. Then, (a project of at least 15 years) his crowning achievement (and unfortunately his last), *Flight Paths*, a continuous, sectional, light, video, sculptural and sound environment extending along the walkway for 420 feet between Terminals A and B, at the Hartsfield-Jackson Atlanta International Airport. If you find yourself between flights in Atlanta, walk—don't run and take in this marvel.

Eulogy delivered on the occasion of Steve Waldeck's memorial, realized in the Art and Technology Studies department on April 16, 2018.

# **Mind / Senses / Hand: The Generative Systems Program at the School of the Art Institute of Chicago 1970–1980**

Sonia Landy Sheridan



Sonia Sheridan manipulating the Cromemco Z-2D system with EASEL software, 1982. Courtesy The Daniel Langlois Foundation for Art, Science, and Technology, Sonia Landy Sheridan fonds.

The 1960s were tumultuous years in Chicago. There was enough charged negative and positive energy in the air to move the most inert of us to creative activity. It was in this climate that a new program, Generative Systems, was born at the School of the Art Institute of Chicago.

The program was first formalized as a single course in 1970.<sup>1</sup> Within 5 years it had become a full undergraduate and graduate program. During the 1970s a series of articles in *Afterimage*<sup>2</sup> charted the program's development; at first we taught extensions of traditional art processes, but later we developed a full program of investigation into the transformative process occurring in art as a result of the impact of the communications revolution on the society at large. Generative Systems was a research center; a resource and energy bank; a self-generating center where communication tools came and went while people remained; a nurturing ground for the Electronic Print Systems (EPS); an extension into the future of photography, drawing, textiles, and so on; a time machine from instant real-time back to mechanical time; an attitude; an interactive force between industry, education and the public; and, finally, a viable alternative to the present art education system.

Although Generative Systems courses were formally begun in the 1970s, they were rooted in my work at the Institute in the 1960s when I taught Two-Dimensional Design, Color, Drawing, and Printmaking. Two-Dimensional Design, Three-Dimensional Design, and Color were the basic art school foundation courses. They were influenced for the most part by Bauhaus teachings. Standard texts were Johannes Itten's *The Art of Color*,<sup>3</sup> Josef Albers's *The Interaction of Color*<sup>4</sup> and Paul Klee's *Pedagogical Sketchbook*.<sup>5</sup> It was mainly to these Bauhaus artist/educators that the art faculties looked for guidance in formulating foundation programs.

From 1961 to 1963, along with the rest of the faculty, I used Bauhaus texts in my teaching, but I used them primarily as jumping-off points, and my lessons in each area dealt primarily with the process of becoming, that is, with shapes metamorphosing in motion. Although the foundation courses did not require much understanding of multidimensional imaging beyond the third dimension, my personal education

and philosophy led me to develop lessons around the theme of 'Vision in Motion'. During the 1960s, however, my main educational resource was the highly pictorial journal *Scientific American*. It was not until I worked with high-speed communications tools that Moholy-Nagy's *Vision in Motion*<sup>6</sup> took on a real significance for me. The new communication imaging systems validated his perceptions.

In the 1960s, however, before we had access to high-speed communication tools, the exercises that I created for my basic Two-Dimensional Design courses were mostly handmade or hand printed. A typical 1961 exercise was as follows:

Draw a grid of squares. Starting in one corner, in one square divide the square into three even shapes. Paint one shape transparent yellow, one transparent magenta and one transparent cyan. Then in each subsequent square gradually let the left shape flow over to the right side of the square and so on until the left shape fills a square. Then transfer the right shape to the left and so on until all squares of the grid are filled. The transparent layered colors reveal the covered shapes in each square. This exercise is similar to one done by Frieder Nake in 1967 involving a mathematical process.<sup>7</sup> It is one example of many lessons from my teaching that required no machine for output but later could easily be machine created.

In the mid-1960s I brought industrial silk-screen techniques to my teaching at the Institute and we began to find a more rapid way of moving and metamorphosing shapes. For a decade, from 1967 to 1977, we were occupied with exploring many communications systems, which we gathered in a great variety of unusual ways too numerous to discuss here. The communications technology that emerged in the 1960s validated the dreams of the most imaginative minds. Objects could be stretched in time, layered in time, scanned in time, filtered in time, metamorphosed and synchronized in time, in a matter of seconds, on the new electronic copiers, telecopiers and computers with their moving lights, lenses, thermal and/or steel rollers and electronic gates.



View of Sonia Sheridan's Generative Systems Program at the School of the Art Institute of Chicago, 1978. Courtesy The Daniel Langlois Foundation for Art, Science, and Technology, Sonia Landy Sheridan fonds.

During 1969 and 1970 I created a body of work with copiers and their by-products that led to my becoming artist-in-residence at 3M's Color Research Laboratory with Douglas Dybvig, laboratory director and inventor of 3M's Color-In-Color photocopying machine.<sup>8</sup> This gave me the foundation needed to establish the first Generative Systems course in 1970, which was described in the Institute catalogue as "Photography, painting, printmaking, sculpture, et alia, wed into one field by the use of chemically coated papers, dyes, heat and a camera." Then, in the two ensuing years, Generative Systems became an energy bank, tele-link-up, exchange center, city nerve center, public relations center and interdepartmental link-up providing events, activities and performances. By the seventh year, the courses called Process I and Process II were created. This was partly as a result of my renewed exposure to scientists in 1976 as an artist-in-residence at 3M's Central Research Laboratories in Saint Paul, Minnesota.

Process I was intended to give the student a range of experience, from the artist's vantage point, in re-examining energy for imaging manually, mechanically, electronically and photonically. Process II gave the student an opportunity to pull apart and examine dozens of communication machines, such as high-speed copiers, telecopiers, video recorders and computers. One of the teaching assistants was Greg Gundlach, who in the process began research for a three-dimensional photographic system that, after graduation, he would patent as Z-Tranz.

Computer Graphics was finally made into a course in the late 1970s, when I obtained a 4K Radio Shack computer with a thermal silver paper printer. In a few months, a Z-80 computer was assembled from a kit by a graduate student teaching assistant, John Dunn, who in the process was setting the basis for the first computer graphic system for artists, his SLIDEMASTER, which

became EASEL and then Lumena (Time Arts Inc.). Computer graphics was the only course that was named for the technology. Possibly that was because it was developed primarily by students and had not yet been fully integrated into the program.

Since Process I was a lively inquiry into the nature of energy use for art imaging and Process II was an exploration of communication machines, and since the main emphasis of both courses was not on making 'Art', another course seemed necessary. It was not until the end of the 1970s, however, that we were ready for a course that would permit all aspects of the artistic process to function as a unity. We understood, more or less, the technology of many machines that we had imaginatively explored. Now we had to decide the next stage.

The course called Homography was created for just this purpose—to decide what to do with our new-found knowledge. We would be using tools from a whole spectrum of eras: the pen, pencil and brush; the camera; the copier and video recorder and computer. These tools would be used to create problems that did not yet exist. The catalogue description read, in part, "A dozen new lessons are being offered to explore the conceptual, artistic and scientific implications of the area." By the end of the semester I had created nine new lessons, nine ways of visualizing time through the use of manual, mechanical, electronic and photonic tools. George Kubler's *The Shape of Time*<sup>9</sup> and Moholy-Nagy's *Vision in Motion* were being realized not merely in film, video and sound, which were by nature time studies, but also in what are normally considered 'still arts': drawing, painting, printmaking and photography.

Moving-time and stopped-time imaging systems are interchangeable, but it was not until the availability of electronic photo/print processes in the 1960s that images, not merely of our imagination, could be stopped in time by simple accessible systems. Photographers knew of Harold Edgerton's pioneering work in stopped-time images, but fields outside photography, film, video and sound did not deal with multiple dimensions.

Process I and II provided the minimal experience with technology needed to pursue the development of Generative Systems. Homography was the course designed to permit two aspects of the creative process—personal/inner and objective/outer—to function as a unity. It was a search for the poetry of the process. It was an attempt to find the aesthetics and meaning underlying the shift from tools of one kind of time to tools of another kind of time. This was a complex process, and in my own case, since I was learning along with the students, it could be achieved only through the



View of Sonia Sheridan's Generative Systems Program at the School of the Art Institute of Chicago, 1978. Courtesy The Daniel Langlois Foundation for Art, Science, and Technology, Sonia Landy Sheridan fonds.

total integration of my own work and production with that of the classroom needs.<sup>10</sup>

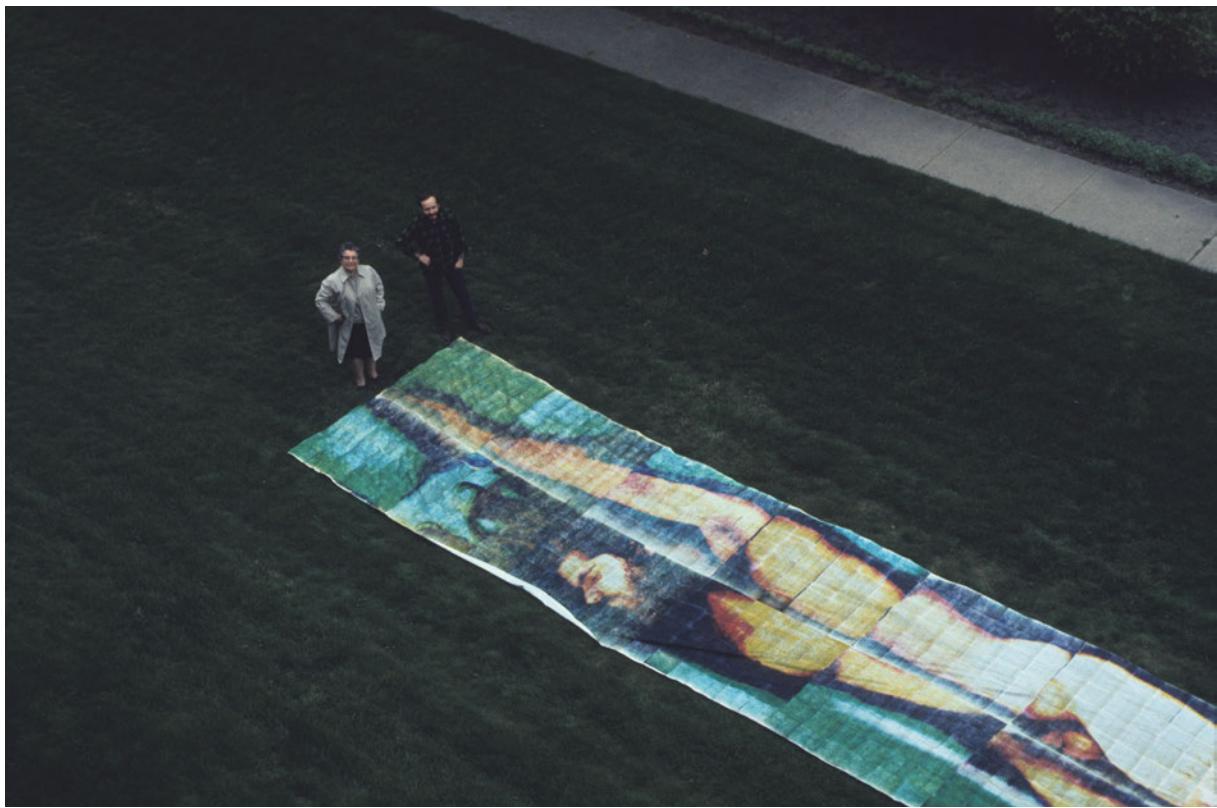
I have had many challenging discussions with splendid artist/educators who found my system to be dangerous, to say the least. My choice for this integrative process can be best explained by recognizing that my context, in Chicago at the time, seemed to demand a democratic, decentralized program with the support of people in industry, artists, those in educational institutions and a host of other people. My personal philosophy and my desire to integrate a first-generation creative process into art production and training, in synchronization with social and technological development, led me to no other conclusion. I could find no other acceptable alternative for the Chicago art school context. The time and place seemed to demand a fluid, non-dictatorial context. Yet the program had to be based on solid, objective discovery rooted in a knowledge of art history and scientific/artistic discovery.

Although I initiated the Generative Systems program with experiments I had done in the 1950s and 1960s, and with my work in 1970 as artist-in-residence in the 3M Color Research Laboratory, at all times I was assisted by a continual flow of people from around

the globe. Students, artists, gurus, scientists and, especially, industrial executives flowed in and out of our classroom.<sup>11</sup>

The Generative Systems program at the Institute was not a closed system or a variation on a theme. It was an open, ever-changing system, in which the machines would come and go, but the humans would remain the constant factor. Courses would not be named for a specific and therefore static technological process—as had been done before with the standard art courses of printing, painting, photography and video—but rather for a dynamic process encompassing change, metamorphosis, inconsistency and chaos. In the process, the mind/body of the human being could create closed and open systems, neither negating the other but, each complementing the other, rather, in a process of continual becoming.

Many lessons were written for the various courses of the Generative Systems curriculum. They are reflections of a process and are intended primarily to stimulate new thinking or to give support to those who feel they are travelling alone in their struggle to introduce new ideas and tools. Each of us creates lessons, asks questions, poses problems appropriate to our own



Sonia Landy Sheridan and Keith Smith, *Man Scan with Ric Puls*, 1974.  
Color-in-color. Photo: Dennis Longwell. Courtesy The Daniel Langlois Foundation for Art, Science, and Technology, Sonia Landy Sheridan fonds.

understanding, our own perceptions, our own locality and our own philosophy. Students need a refuge, a solid support structure, where they can pursue the path to their innermost dreams. The Generative Systems program was just one way, in one place and at one time, to tackle common problems of creativity in art, science and technology. Perhaps Generative Systems's 10-year existence in an institution was validated by its graduates, who invented new systems for society, set up new learning centers, created new art forms and influenced yet another generation of artists.

#### Notes

<sup>1</sup> The School of the Art Institute of Chicago, Catalogue (Chicago, IL: 1970)

<sup>2</sup> Sonia Landy Sheridan, "Generative Systems", *Afterimage* 1, No. 2 (April 1972); "Generative Systems: Six Years Later", *Afterimage* 2, No. 9 (March 1975); "Generative Systems a Decade Later: A Personal Report", *Afterimage* 6, No. 7 (February 1979).

<sup>3</sup> Johannes Itten, *The Art of Color* (New York: Reinhold, 1961).

<sup>4</sup> Josef Albers, *The Interaction of Color* (New Haven, CT: Yale Univ. Press, 1973).

<sup>5</sup> Paul Klee, *Pedagogical Sketchbook*, Introduction by Sibyl Moholy-Nagy (New York: Praeger, 1953).

<sup>6</sup> Laszlo Moholy-Nagy, *Vision in Motion* (Chicago, IL: Paul Theobald, 1947).

<sup>7</sup> In Douglas Davis, *Art and the Future* (New York: Praeger, 1973).

<sup>8</sup> Sheridan was awarded a Guggenheim Fellowship for Experiments in

Generative Systems done from 1969 to 1971.

<sup>9</sup> George Kubler, *The Shape of Time* (New Haven, CT: Yale Univ. Press, 1962).

<sup>10</sup> See Sonia Landy Sheridan, ed., *Time Arts* (Chicago, IL: The School of the Art Institute of Chicago, 1979). See also the course catalogues of the School of the Art Institute of Chicago for 1970 through 1979.

<sup>11</sup> The faculty members of the Generative Systems were Phil Hitchcock (1973–1974), Keith Smith (1973–1974), James S. Ostler, Jr. (1975), Joan Truckenbrod (1976–1978), Rudy Guzik (1976–1978), Fred Endsley (1976–1978), and Diane Kirkpatrick (1976–1978). Teaching Assistants were, in chronological order, the team of Cosmo (Robert Frontier and William McCabe), Michael Schumacher, Jackie Harrison, Marilyn Goldstein, Gloria Brush, Cynthia Solomon, Mary Burton, Mitch Petchenik, Mary Jane Dougherty, Philip Malkin, Kathy Cottong, Gerda Bernstein, Barbara Mackowiak, Michael Day, Ed Covannon, Steve Wilson, Martha Loving Orgain, Gregory Gundlach. Scientists who worked with the Generative Systems program were Douglas H. Dybvig (3M Graphics), Don Contin (3M Broadcast Systems), Robert Gundlach (Xerox Corp.). Artists who worked with the program were Philip Meany, Stan Vanderbeek, Aldo Tambellini, Willard Van De Bogart, Leif Brush, Ed West. Curators who cooperated with the author and the program were Nathan Lyons and Brent Sikkema (Visual Studies Workshop); Richard Wickstrom; Marie Czack (The Art Institute of Chicago); Dennis Longwell (Museum of Modern Art, New York).

Originally published as: Sonia Landy Sheridan, "Mind/Senses/Hand: The Generative Systems Program at the Art Institute of Chicago, 1970–1980," *Leonardo*, Vol. 23, No. 2/3, New Foundations: Classroom Lessons in Art/Science/Technology for the 1990s, pp. 175–181. © 1990 ISAST, reprinted by permission of the MIT Press.



Sonia Landy Sheridan, *Leaf*, Early 1970's. Copy art; 3M Color-In-Color II on paper. Collection Hood Museum of Art, Dartmouth: Gift of the artist. Reproduced with permission.

# Beyond the Digital: Generative Systems

Stephen Wilson

The term "digital age" is misleading. Digital technology is significant, but it is part of something much more momentous. Scientific research and technological development are doing much more than creating new gadgets and media. They are radically transforming basic philosophical ideas about the nature of the physical world, time, and space; the nature of life and intelligence; and the limits in our abilities to transform the world and humanity. The technological is intertwined with the ethical, cultural, and social-economic. The impact of the digital revolution has been enormous, but it is only one of many revolutions that are brewing—for example, the biological, materials science, neurological and cosmological. It is critical to consider how to educate artists for a scientific/technological age, not just a digital age.

Historically, the arts alerted people to emerging developments, examined the unspoken implications and explored alternative futures. As the centers of cultural imagination and foment of the times have moved to the technology labs, the arts have not understood the challenge. It is a critical error to conceptualize research as merely some narrow, technical specialized inquiry. Merely assimilating the new gizmos to create new media is a timid response.

The arts have a much more profound calling. They can become an independent zone of research. They can pursue agendas ignored by commercial interests and scientific disciplines, integrate critical commentary with the search for new knowledge and elaborate new technical possibilities. Those who believe that the arts are now up to date because they pay attention to digital technology have misunderstood the course of history because the research goes on, investigating many other fields in which the arts should be proactive pioneers rather than merely consumers of the results.

Assume a definition of art that sees keeping watch on the cultural frontier as one of its central functions. Assume an analysis that scientific and technological research and all their associated implications are critical drivers of culture. The question, then, is how to prepare artists not only to master the historical issues for all artists, but also the special challenges of becoming a strong, independent voice who is competent and innovative in the worlds of both art and research.

An extraordinary artist and educator named Sonia Sheridan introduced an innovative program called Generative Systems at the School of the Art Institute of Chicago in the 1970s. Sheridan had established her artistic reputation through her early experiments with color copier machines, which were just then becoming available.

For example, she created a series of leaves which were synthetically colored by the machine to suggest the passing of seasons. Her work was collected widely by museums. She was also famous for taking on research residencies in industrial research labs.

Students (including me) came from all over the world to study with her in relation to these new artistic technologies. But Sheridan held that the specific technologies should not be the focus. Much more interesting were the processes by which ideas could be transformed (the generative systems) and their philosophical and artistic implications. She felt the scope of interest must stretch from historical art practices to the latest technologies and research. She taught students to tear the machines apart in order to develop core understandings. She taught lessons in light, heat, time, sound, magnetics, etc. She taught courses called Process I and Process II. She noted the Bauhaus as a source of ideas but without the utilitarian preoccupation. In one famous move, she unplugged

the machines for a year so students could overcome surface infatuation with the technologies.

Many students remember the time fondly; it was an exhilarating place. Curiosity and inquiry ruled. Any source of ideas—e.g. from art, commerce, technology, or science, was welcome. She brought in guest speakers from outside the closed circle of art and art history. Sheridan was famous for her two-foot-long technician's screwdriver. Students brought in strange devices and she would enthusiastically take them apart to understand how they worked. It was clear that she was investigating and learning right along with the students. When a few advanced graduate students got interested in microcomputers, which were just then becoming available, she offered to change the budget for the department for that year so she could buy one with which to experiment. MFA students undertook highly speculative projects—for example, one experimented with growing mold as an image-generating system; another tried to understand fax technology sufficiently so that he could create images by singing into the machine.

Generative Systems was an influential source in shaping approaches to educating artists for a technological age.

Excerpted from Steve Wilson, "Beyond the Digital: Preparing Artists to Work at the Frontiers of Technoculture", in: Mel Alexenberg, Editor. *Educating Artists for the Future: Learning at the Intersections of Art, Science, Technology and Culture*, Intellect Books: London, 2007  
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### Ocean Merge

Stephen Wilson, CSU Summer Arts Festival, San Luis Obispo, CA, 1987



*Can computers put us in touch with forces of nature?*

Is there such a thing as "nature"?

*Sensors placed in the surf read the movements of the waves and the surf.*



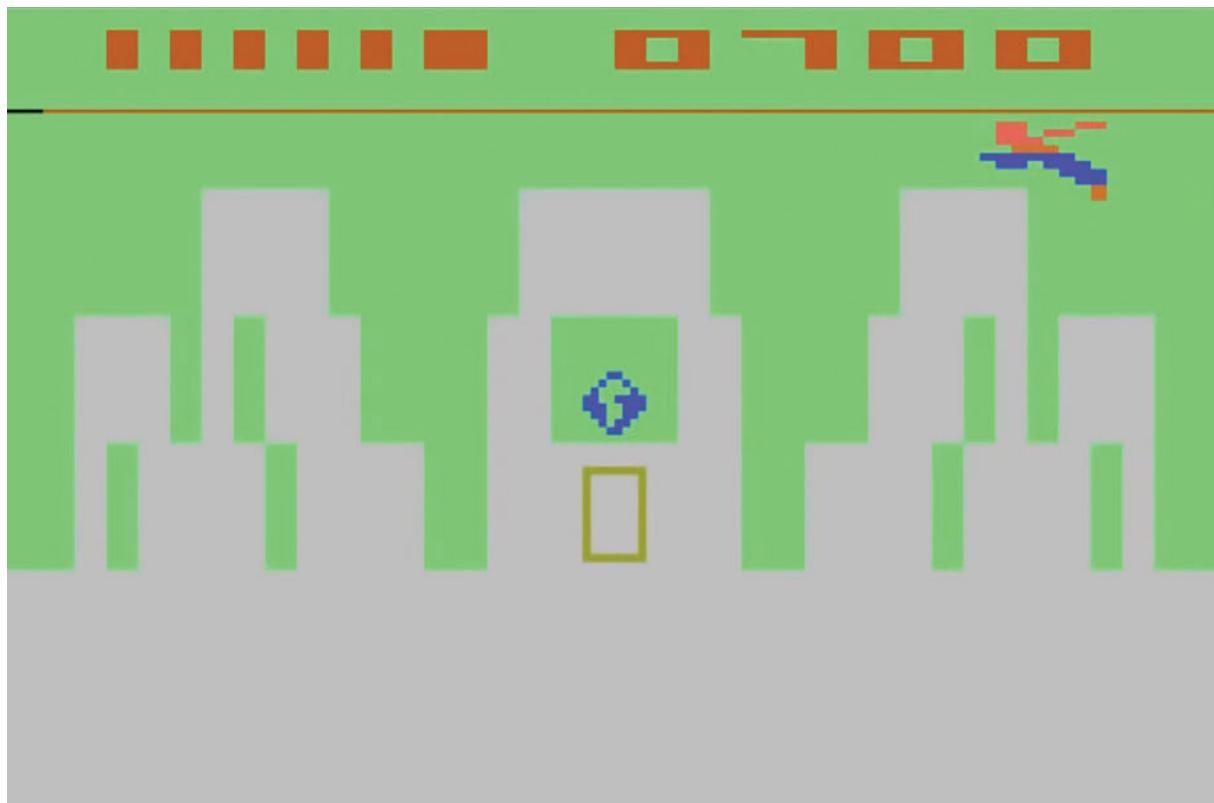
Iron salvage stakes were put in the surf as sensors. Using inexpensive game controller ports, the Apple II computer read the resistance at the sensors. Sea water conducts electricity. As the surf and waves moved out the sand became less saturated with water and thus less conductive. This poor man's sensor (cost \$6 for wires) allowed the computer to read the movement of the water. Speakers were stretched out on either side of the audience. As the water moved in, so did the sound.

The installation attempted to use the computer to cause the audience to notice the shifting of the waters.

A screen capture from Stephen Wilson's website, featuring his artwork *Ocean Merge*, 1987, Apple II computer, video monitor, sensors, sea water, sand.

# Algorithmic Arts

John Dunn



I have sought to bridge the worlds of art and science since the 70's, when I combined microcomputers and analog sound and video synthesizers as a graduate student at the School of the Art Institute of Chicago. I earned a Master of Fine Arts degree there, mentored by Generative Systems founder Sonia Sheridan.

I was one of the early programmers for Atari video games and developed the first ever professional paint program for a microcomputer, Cromemco's Slidemaster, released in 1981. I went on to write a ground-breaking professional paint program called Lumena for the IBM-PC in 1983, and founded Time Arts Inc. of Santa Rosa, California, to market "Computer Tools for Artists."



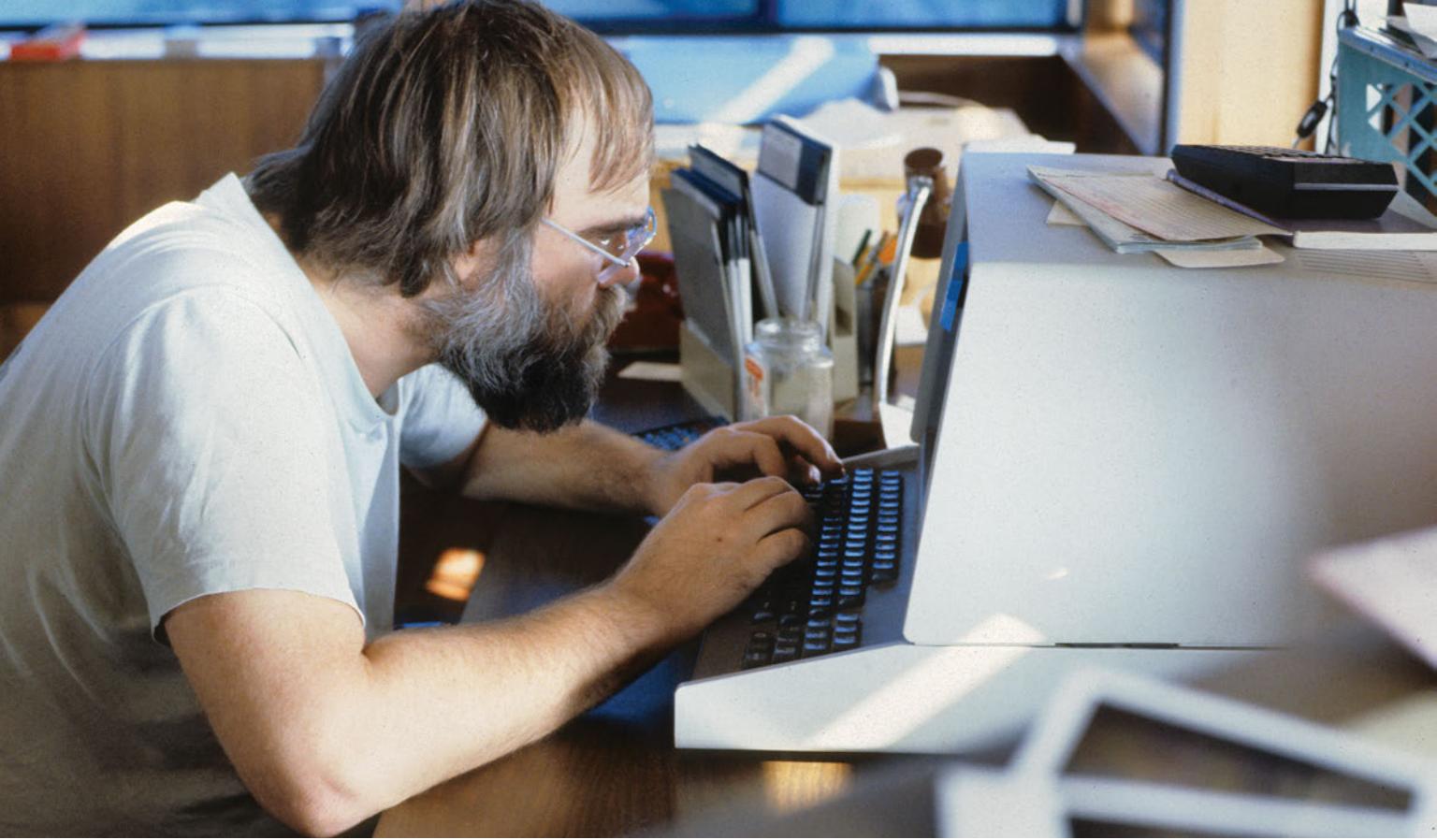
In 1986, I wrote one of the first algorithmic composing programs for MIDI, MusicBox, which was released with full source code to the public domain two years later.

In 1989, I expanded MusicBox to include algorithms to convert DNA and protein genetic sequences into music and released it as KMM (Kinetic Music Machine).

In 1995, on a two-year Research Fellowship in the Arts grant from the University of Michigan at Ann Arbor, I reworked the basic concepts of KMM—generative algorithms and functions represented by interactive, game-like graphical objects—into a more comprehensive algorithmic art workstation that produced graphics and wordplay as well as MIDI music. This was released as KAM (Kinetic Art Machine).

Since 1996, I have continued to produce interactive algorithmic art software under the Internet company name, Algorithmic Arts.

Top: John Dunn, *Superman*, 1978. Atari 2600 console video game.  
Opposite: John Dunn, *Superman*, 1978. Atari 2600 console video game.



John Dunn manipulating the Cromemco Z-2D system with EASEL software, 1982. Courtesy The Daniel Langlois Foundation for Art, Science, and Technology, Sonia Landy Sheridan fonds.

## ArtWonk

In 2002, after developing SoftStep, which grew out of, and greatly expanded, the capability of KAM, I began to lay out the architecture for a more "obsolete proof" meta-program for algorithmic art. "Meta" because I wanted it to be more of an environment for creating algorithms and generative processes than an end product to use premade ones. And "obsolete proof" in that it would utilize a generalized database to define the modules and their connections, so the program could be revised and expanded indefinitely without ever obsoleting the user's prior work.

For this project I reached out to friends, colleagues and users of my previous software to provide input and wish lists. Three in particular have provided such extensive contributions that their roles often have been as much collaborators as consultants. These are long-time friends and colleagues, artist Jamy Sheridan and composer Dr. Warren Burt, who provided (and continue to provide) deep conceptual knowledge for algorithms in graphics and music respectively; and biologist and my wife, genetics professor Dr. Mary Anne Clark, who contributed deep background for the DNA and protein biosequencing.

ArtWonk became, to me, a sort of "Die Kunst der Fuge," a project that distilled all I had learned over the years about algorithmic art processes, from tape splicing and looping in the 60s to modular sound and video synthesizers in the 70s, through Lumena and MusicBox in the 80s to KMM and KAM in the 90s, and on to BankStep and SoftStep at the turn of the century.

ArtWonk was to be my last major program, not because I was finished programming but because it was designed from the start to be less an end product than an evolving, extensible language-like workspace.

In April 2015, I unexpectedly lost my vision, which made me unable to continue software development. Because of this, I released the final version of ArtWonk as freeware, and Algorithmic Arts has transitioned from a commercial small business to a not-for-profit support site.

## **Machine music**

Having gotten my start with *musique concrète* in the 60s, with a tape splicer and a bank of tape recorders, I've never been a traditional music maker. From splicing tape, I went on to the big modular video and sound synthesizers. What fascinated me even more than the unique sounds and abstract moving images these monsters were capable of was the sequencing and control of them, with their dozens of knobs and switches to manipulate in real time. And, of course, the ultimate control module was the personal computer that was just emerging in the late 70s.

I learned to program PCs as a student at the School of the Art Institute of Chicago under the tutelage and encouragement of Prof. Sonia Sheridan. The visionary founder of Generative Systems provided a kit computer, lab space in which to build it and connect it to an analog synthesizer, and a Teaching Assistant stipend that enabled me to focus full time on the project. I was to build it over the summer and teach it in the fall. "But I don't know anything about computers," I warned her. Smiling Yoda-like she replied, "But you will learn."

Most modular synthesizers, if they had a sequencer at all, had only one or two which were rarely used for anything beyond riffs and arpeggios, with the synths mostly controlled by a keyboard. I never wanted a keyboard, but I did want as many sequencers and logic modules as I could get. To me, this is where the magic happened, where these machines could go that human players could not. By setting up multiple banks of sequencers and clocks and other logic, with sequencers stepping other sequencers and in turn being controlled by them in a giant feedback loop, I could build the most amazing fugue-like constructs that went on and on, Zen-like. A river of flowing sound, always changing, ever the same.

First with the modular synthesizers and later with software, I found it far more interesting to explore this new musical space unbound by a tradition based on human capability. And in listening to these super sequences for hours on end, as I programmed and reprogrammed them, they revealed a different musicality, an unexpected subtlety and, to me, beauty.

So, I've pursued a sound that is frankly mechanical. Machine music. Mostly I keep the rhythm rigidly unvarying as a lattice for the pitches, which impart a sense of virtual rhythm. Often, I play two voices off each other, using various types of delay and wandering pointers to provide a sense of space, but otherwise treating them as a single voice. Pitches are usually data derived. DNA and proteins, pixels from image scans, star charts, fractals and random generators. I pay attention to the physics of sound but not to musical tradition, western or otherwise. So, there will be harmony of a sort, even chords; but not chord progressions.

It has only been in the last generation that music has become free of human player constraints. We explorers of this new territory are just at the threshold. It's not so different from the state of aviation at the time of Kitty Hawk: the bounds of what was possible have dissolved, but we have yet to learn quite what that means or how to make it fit into society at large. I am well aware that my musical efforts are as awkward and primitive as those first flights, but I am pleased to have developed some of the new tools and to have participated in their launching.

Originally published in <[algoart.com](http://algoart.com)>, 2015. Reproduced with permission from Mary Ann Clark.



Joan Truckenbrod at her home in DeKalb, Illinois. Photo: Eduardo Kac.

# Integrated Creativity

Joan Truckenbrod

Art and Technology Studies at The School of the Art Institute of Chicago emerged at the intersection of the art studio and computing technology. Beginning in the mid-1970s, envisioning the potential of computers in the arts precipitated radical experimentation for me as I learned to program in FORTRAN Programming Language to make a “visual mark” using a mainframe computer.

I was energized by the infinite potential of computer programming to create artwork. I began working with computers in 1975, using FORTRAN to develop algorithms to create drawings. In my programs I used variables to create series of lines, drawings and abstract patterns. A fluidity emerged in this process for me. Variables were like pebbles on the beach, shifting dynamically with each influx of the tide, twelve hours later their patterns transforming again.

In my digital drawings, I was interested in imaging phenomena in the natural environment that are invisible, yet palpable. In order to capture the visceral experience of wind currents and light reflecting off of irregular surfaces, I incorporated mathematical descriptions of these phenomena into my FORTRAN programs and developed algorithms that expressed these sensations. The visual translation of these phenomena were drawn by a pen plotter activated by the programmed instructions.

This process involved writing code for each drawing program, line by line, which was then transferred to a computer card with a key punch machine which made holes into the card, allowing the computer to read the code. Next, the cards were run through a card reader that communicated the program instructions to the large mainframe computer. This process was based on the presence, or absence, of holes in each card. A computer printout was then made of my program,

allowing me to check the instructions for errors. If the program was correct, I requested that the drawing instructions be put on a 16 BPI tape, which was taken to the Geography Department, where they had a plotter used to draw maps. The operator would mount this tape on the tape reader, and the plotter would draw the image on paper. There were no display screens using mainframe computers, so my imagery was envisioned and drawn in sketch books. Some of these plotter drawings are now in the permanent collections of the Whitney Museum of American Art in New York and the Victoria and Albert Museum in London.

As the Geography Department used black ink, I had to invent a method for creating color drawings. Consequently, I translated black and white drawings into color by xeroxing them onto transparencies in individual colors. The color drawings were overlapped to create multiple colors. One of these drawings is in the collection of the Block Museum of Art at Northwestern University.

Since computer processing was also a generative system, Sonia Sheridan began recruiting graduate students who, like myself, were already working with computers and microprocessors. As one of these grad students working with computers, I had already completed a series of coded algorithmic drawings using a mainframe computer. She was expanding this department to include personal computers as an extension of her work with copy machines.

Sonia Sheridan was an inspiration and a catalyst in a range of arts innovation. She created the Generative Systems Department with a rich diversity of systems that produced images using time and light. I worked with her as a teaching assistant for the courses Process I and Process II, in which we studied natural energy sources and mythologies about them. The new



Joan Truckenbrod, *Symmetrical Drawing*, 1975.  
Computer-generated drawing: ink on paper. Collection  
Victoria & Albert Museum, London.

undergraduate curriculum developed by Sheridan allowed students to create images with heat, light, water, pressure and magnetics, the underlying processes in both copy machines and digital processing.

At this time, graduate students were teaching programming on homemade computers. John Dunn developed excellent Paint Software on a PC computer that was eventually sold as Lumena Software. Stephen Wilson developed interactive projects and John Manning worked with analog image processing. Some of the graduate students were Ed Covanon, Philip Malkin and Kathy Cottong who became curator of the galleries at the Arts Club of Chicago. Envisioning the potential of this technology in our studio practice, we explored and experimented with digital technology creating innovative and unique modes of artistic expression.

With the invention of personal computers, images were displayed on computer monitors, which for me was an intermediate stage in the creative process. I wanted to get the imagery out of the computer into material artworks. Containing the digital data in the computer seemed too limiting for me, as I wanted to create physical forms using the computer. In 1979, for my graduate project I devised a method for creating textiles using the Apple II. I developed algorithms and wrote programs in BASIC for the Apple II computer to create different sequences of images similar to a frame-by-frame animation, displayed on the monitor one at a time. I turned the monitor upside down on a 3M Color-in-Color copier that had a backlight setting, allowing it to make a copy of each of these digital images on heat transfer material. Each image/print was cropped, arranged and hand-ironed onto polyester fiber to create my digital tapestries. The first and largest, *Electronic Patchwork*, references the technology as well as the process of quilting, and is now in the permanent collection of the Block Museum at Northwestern University. Other textile works from this series are in the permanent collections of The State of Illinois Museum, the Textile Department at the Art Institute of Chicago, and the Digital Art Collection at the Whitney Museum of American Art.

## **Chair, Art and Technology Studies**

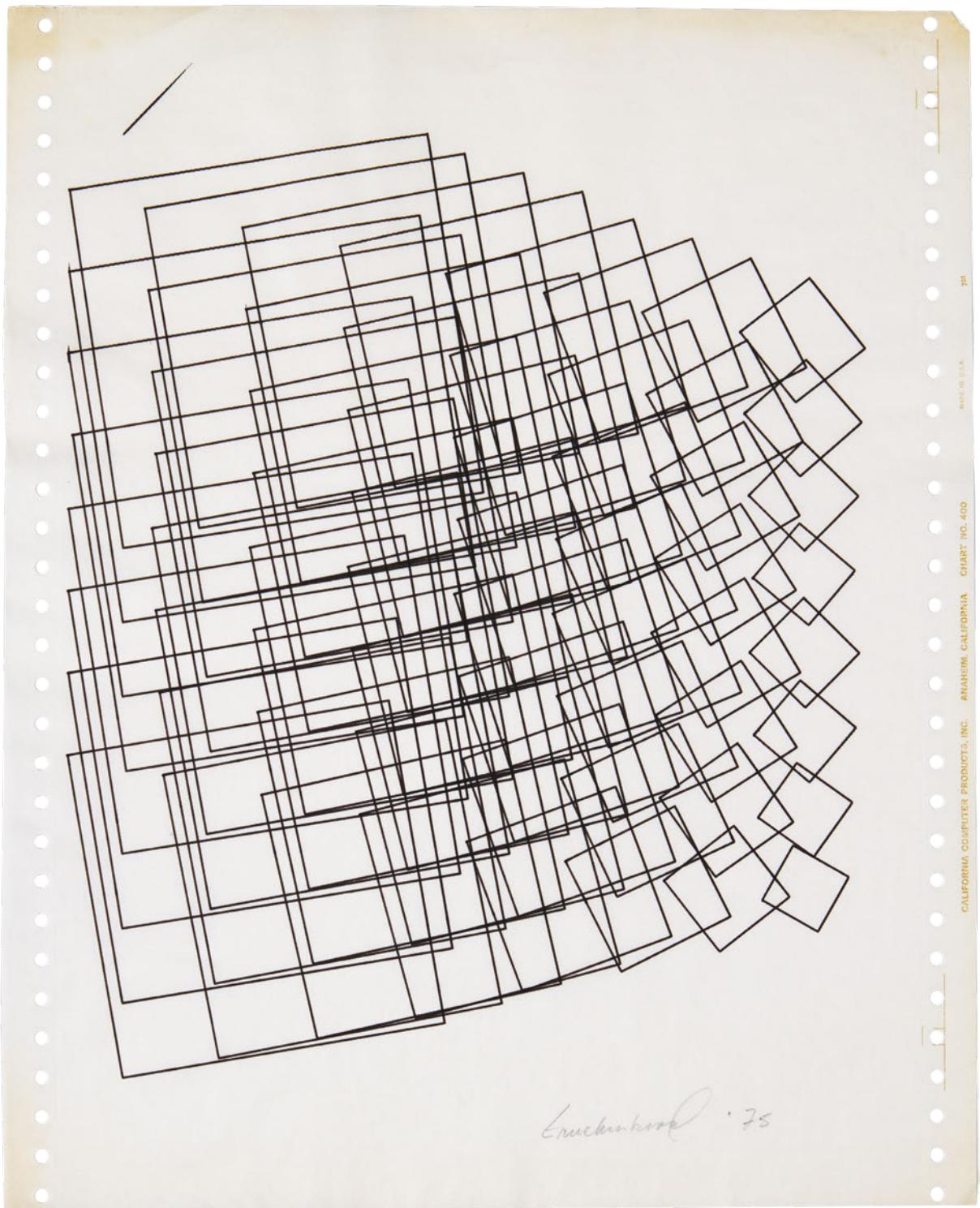
In 1980, I was invited by Dean Roger Gilmore to chair the Art and Technology Studies department. Envisioning the potential of digital technology for creative expression in a diversity of forms and materials, the department expanded as graduate students and faculty developed innovative and unique projects. Our mission was to subvert the technology of computers, to sculpt and form them according to our own visions. Computer processes are malleable—the artist gives form to the artwork.

I created one of the first courses for the department titled Creative Computer Imaging. In this course, students engaged in visual imaging, sound imaging and animation—imaging in time. I taught this course on the Apple II computer, initially on Saturdays to allow professional artists and designers to enroll alongside SAIC students, creating a rich diversity of knowledge in the classroom. We worked with drawing, painting, animation and sound software; with the latter we captured sound and created aural landscapes. The most intriguing process was the scanning video digitizer in which images became malleable, sculpted using light and time.

The experimental context of this course made it very successful in the development of innovative artworks. Digital data is given form and meaning by the artist in provocative ways. This artwork was not shaped by the medium, but by the artist's vision, a process that I considered an integrated creativity. I explored these ideas in depth in the book *Creative Computer Imaging* (Prentice-Hall, 1987) and the article "Integrated Creativity: Transcending the Boundaries of Art, Music and Literature" (*Leonardo Music Journal*, Vol. 2, No. 1, 1992).

With the acquisition of the first Macintosh computer at SAIC in the Art and Technology Studies department, I developed and taught a course in Visual Communications, again on Saturdays to allow professionals to enroll. In addition to exploring the creative potential of computing technology, Art and Technology created courses that demonstrated the potential of this technology in other areas and departments of the School. I also taught in an interdisciplinary fashion, co-teaching Digital Photography in Art and Technology with Frank Barsotti, a full-time faculty member in the Photography department. These courses provided models for other areas, migrating out of Art and Technology into other departments.

My philosophy was to inspire faculty and graduate students, to be a catalyst for them to pursue innovative



Joan Truckenbrod, *Coded Algorithmic Drawing (#9)*, 1975.  
Computer-generated drawing: ink on paper. Collection  
Whitney Museum of American Art, New York.

directions in their own artwork and courses they developed for the department. This approach created energy and vitality, an environment of inspired art making in new directions according to each individual's vision. We were able to support research and implement innovative curriculum. For example: Eduardo Kac, during his graduate studies, had the vision to create holograms using digital images. After he developed the technology to accomplish this, he created a course, Digital Holography, which he taught for a number of years.

Another example is telecommunications art, which I incorporated into my courses and developed in collaboration with the Electronic Cafe in Santa Monica, California. We used both color and black and white video phones, together with a fax machine and telephone, to create live performances. This was before the advent of cell phones and social media. Kac, who also worked with telecommunications, organized a course entirely focused on telecommunications art. As the Art and Technology Department grew, we had several part-time faculty teaching programming and hired Marla Schweppe to teach computer animation, initially on an Amiga computer. In addition, numerous graduate students contributed to the environment of innovative projects and courses.

The Art Institute of Chicago museum is an incredible resource in our mission of teaching art and raising artists. In my courses, I used the museum collections for reference and to inspire students. In one of my beginning digital art classes we visited the museum on the first day to view the collection of Joseph Cornell boxes and hear a lecture about his work. The first project was to create a digital object inspired by the Cornell boxes with a digital and/or interactive component. Lessons were presented through the first month, on the EZIO board used to activate objects, digital imaging and video with video projection, to provide the tools necessary to envision and complete this project.

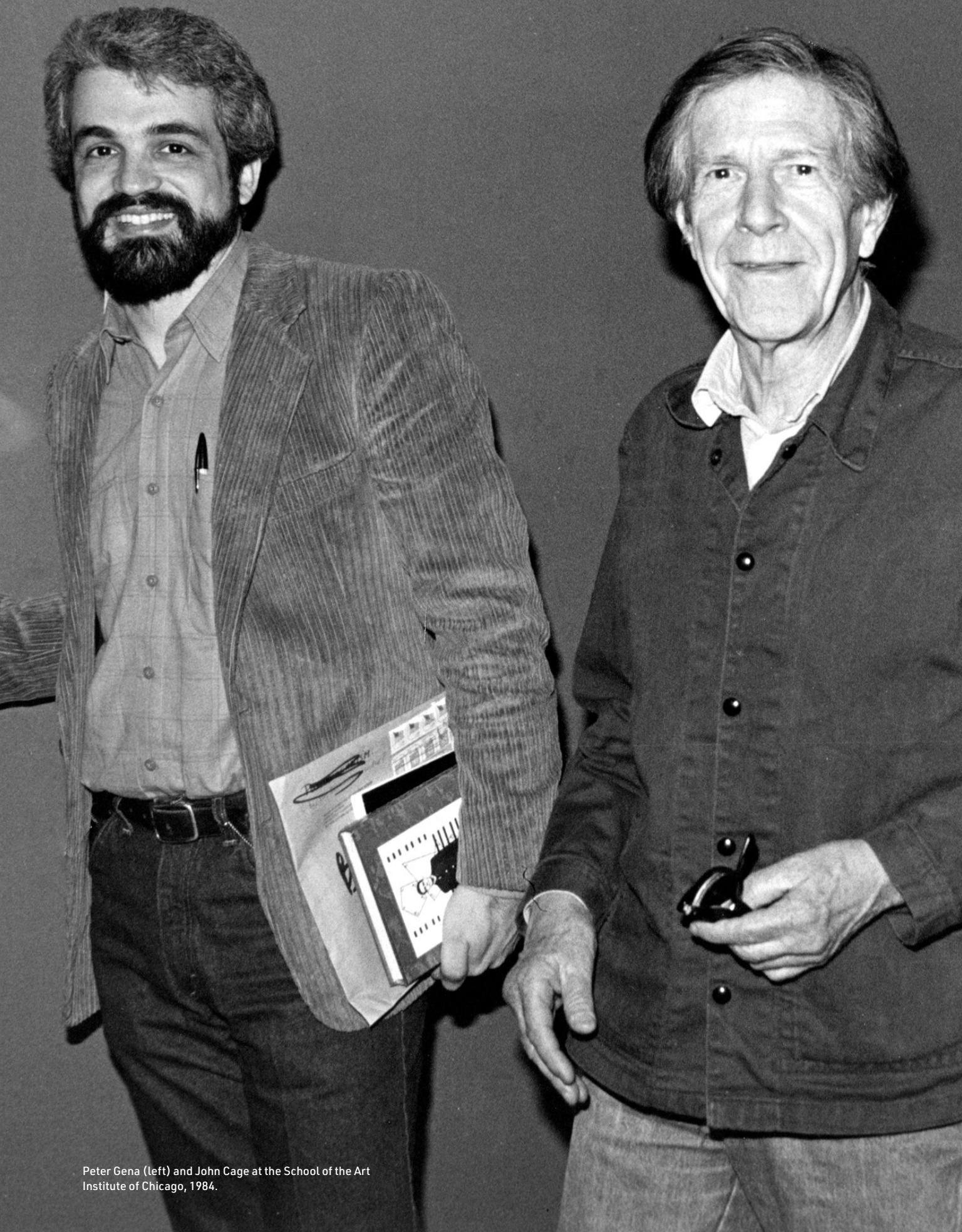
Another course I developed came out of my study of indigenous cultures with provocative ritual objects and powerful ceremonies. In studying how ritual and ceremony functions in indigenous cultures, I identified parallels to the digital culture—including creating portals to other realms, transforming identity, creating community, and distorting time. The course Electronic Ritual and Ceremony explored these ideas through interactive performances and installations.

Prior to coming to SAIC, I had been integrating the computer into the art and design curriculums at Northern Illinois University, using the Apple computer

to teach color theory, and earlier the mainframe computer to study the theory of symmetry operations. As using color in computer analysis and presentation of data was in its infancy, I presented a paper titled "The Effective Use of Color in Computer Graphics" at the SIGGRAPH Computer Graphics Conference in 1981. I was exhibiting my early drawings and had published the article "Computer-Assisted Instruction in Beginning Design" in a book titled *Computing in the Humanities* that documented papers presented at a conference in Toronto in 1977.

I continued to exhibit my artwork, which shifts periodically as new digital tools become available. During the 1980s, I created digital paintings using Lumena software and a large drawing tablet that considered and questioned family structures and transformations. In the 1990s, I continued to paint more atmospheric imagery. I was always more interested in what I could create using the computer than I was in the computer itself. So when I was invited to chair the SIGGRAPH Art Show in 1998, I created the framework of the show to reflect this perspective. The show was titled *Touchware* with the criteria that the computer would not be a visual element in the artworks and installations that were submitted.

I later became interested in activating objects which are embedded with social and cultural meanings. I created video sequences with sound that collaborated with objects in my video sculpture installations. I published a book about artists that inspired these installations, together with some of my projects titled *The Paradoxical Object: Video Film Sculpture* (Black Dog Publishing, 2012). As I continue to produce video and sound sequences, I have embarked on a new direction in my studio practice. I have a TC2 digital loom in my studio that is inspiring a new body of artwork.



Peter Gena (left) and John Cage at the School of the Art Institute of Chicago, 1984.

# The Computer as Collaborator

Peter Gena

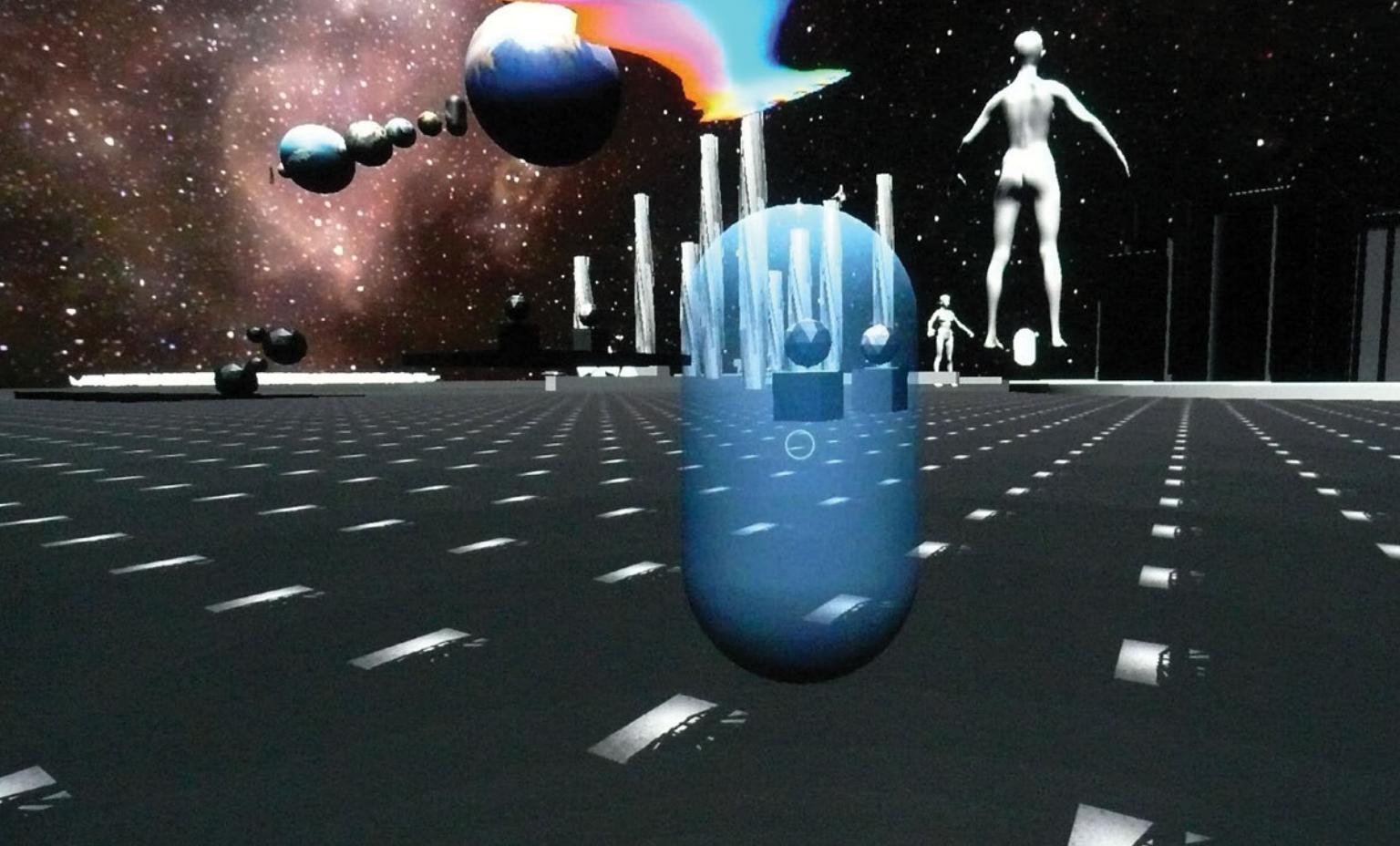
When I came to the SAIC in the early 1980s, the use of computers in the visual arts (even in ATS) was still in its nascent stage. Conversely, the tradition of computer music had been underway for more than a quarter-century. I began programming for music in 1969 as an undergraduate, after the first algorithmic composition was already 13 years old. In those days of punch cards and mainframes, software was non-existent—one had to write a program to execute tasks, often in the cryptic assembly language of the machine, and turnaround for debugging large routines was usually overnight. Although I had worked in both computer-aided composition and sound generation, my main interest centered around employing the computer as a collaborator in the creative process of writing music, rather than as a data-processor meant to gain more precise control of personal choice.

This pursuit in part was due to my mentor Lejaren Hiller, one of two great computer music pioneers, and the composer of the first computer-aided piece: the Illiac Suite for String Quartet in 1956. The other pioneer was a signal processing genius, Max Mathews of Bell Labs. As a graduate student at SUNY, Buffalo, I wrote MUSICOL, a programming language for music composition for a master's thesis (resulting in an ensemble piece as well). My goal was that the user could program in this language to create music in their own familiar style. Subsequently, a fellow student used it to realize his doctoral composition even before I used it, myself, for my own PhD orchestral piece. Two years later, as an assistant professor at the Northwestern University School of Music, I introduced MUSICOL in graduate courses, as NU fortuitously had a similar mainframe computer to Buffalo's—the CDC 6600.

While teaching at CSU, Fresno (1974-1976) and NU (1976-1983), I also continued to write idiomatic music

without computer assistance. I contributed a waltz to a publication of short waltzes, which included those of John Cage, Philip Glass, Virgil Thomson, Tom Constanten (of the Grateful Dead), and numerous others. We premiered the entire collection at none other than the Chicago Stock Exchange Trading Room in the Art Institute of Chicago in 1978! All were recorded on Nonesuch Records around the same time. A decade later, dance companies had choreographed the collection, most notably Peter Martins in 1988, which was premiered by the New York City Ballet at the three-week long, American Music Festival for the 40th anniversary of the dance company. After these events at the New York State Theater in Lincoln Center, The Waltz Project toured the country. Shortly afterwards, my wife and I hosted a large party at our home for visiting artist John Cage and numerous SAIC faculty. Cage had become a rather frequent visitor to SAIC.

Having lost access to the CDC mainframe as I transitioned into SAIC in 1983, I began a phase of writing socio-political music, first without the aid of the computer, but using a hybrid mix by the late 1980s. Although the Apple II microcomputer was already a presence in ATS, with the advent of the Macintosh in 1984 I immediately strived to convey to art students my respect for the computer as decision-maker. I looked for ways to integrate the stochastic methods that I had developed over the years into art-making. The 1980s brought a gradual surge of high-level languages, more accessible than Fortran, Pascal, or C (my first programming course for ATS involved teaching straight C on the so-called Fat Mac-512k machines in the north wing of the museum). Languages with a built-in, user-friendly front-end for the Mac were on the rise, so by the early 1990s we started working programming at all levels into the ATS curriculum courses. After I was given a beta copy of MAX in 1990 (named in honor



Peter Gena, Ben Chang, Peter Sinclair, Roland Cahen et al. *New Atlantis*,  
a networked multiuser virtual environment for sonic experimentation  
and telematic performance, 2011–ongoing).

of Max Mathews), an object-code language for music developed at IRCAM, I taught the first course using it in the Sound department. Now, of course, MAX/MSP permeates the time-arts areas, including ATS. MAX/MSP was a godsend for my own work after 1990. It satisfied my penchant for programming algorithms and added a virtual electronic music studio to boot.

The presence of composers among visual artists is well-documented throughout history, particularly in the vivid New York experimental scene of the 1950s, where those downtown had more in common with painters and art gallery venues than with academics and concert halls. Composers like John Cage, Morton Feldman, LaMonte Young, etc., explored the ontology of sound—music as sound; sound as material. Artists who lacked the traditional musical baggage, i.e. ear for teleological harmony and structure, were better suited to “get it” than musicians. At SAIC, Steve Waldeck, then a kinetic artist on the Sculpture faculty, had recognized the impact of music’s temporal role in the time-arts. From the early 70s, he promoted a presence of composers that led to the creation of the Sound department. Now, composers, sound artists, and music historians permeate the SAIC faculty. Hence, the use of sound as material became second nature to our

students. Visiting composers that I have invited to the campus—Cage, Pauline Oliveros, Philip Glass, Robert Ashley, Eliane Radigue, Harold Budd, Sal Martirano and Maryanne Amacher to name a few—tended to garner huge audiences, considerably more than in the past whenever I brought these same luminaries to music schools.

By the late 1980s, my tenure at SAIC spread across no less than four departments. I could be found teaching in ATS, Sound, Liberal Arts and Art History. Over the years I offered programming in C, Hypercard, Director, Max/MSP, etc., along with seminars for ATS; synthesis and algorithmic composition for Sound; a full-complement of music history courses for Liberal Arts; and Renaissance history of music and art, sonic art, John Cage, etc., for Art History. In addition, I team-taught several courses on contemporary music and art with faculty from the Art History Department.

Similarly, I ran ten study-trips in France and Italy. For several years I was chair of the Time Arts Program, a now-defunct collective established at a time when it was necessary for the time-arts areas, ATS, Sound, Video, Film and Performance to politically band together. These Columbus Drive “basement dwellers”

discovered the need for a stronger, unified voice in a school that was mainly defined by painting, sculpture, and the traditional arts. Time Arts accepted graduate students whose mixed-media work appeared to slip through the cracks amid fixed departments. In addition, they received study space, unlike their peers in the basement departments.

By the mid-1990s, after the Sculpture department began to look at videos of kinetic art, Film and Video merged and Sound later started a graduate program. Now, Time Arts Grads could find homes in these departments, particularly ATS, as students in the “basement areas” were finally given studio spaces. Incidentally, we benefited at that time because Steve Waldeck had moved out of Sculpture’s facility, bringing kinetics, electronics, neon, light, and holography to ATS. After Time Arts, my career as chair was further developed during a few stretches with ATS. Equally gratifying, I had the pleasure of interviewing and hiring most of the faculty teaching music history and have either chaired or sat on search committees, and/or reviewed as Graduate Chair many distinguished new faculty members.

Programming my way through 50 years of composing (also lecturing and performing), I put together a catalog of works in various media from instrumental, electro-acoustic, computer synthesized music, to installations and VR worlds. My work with biomusic began quite unexpectedly in 1974 when I was a new faculty member and Director of the Electronic Music Studio at CSU, Fresno. A young bio-physicist knocked on my door asking if I was interested in making music from brainwaves. I consented, being aware of several brainwave pieces made by composers from 1965 onwards. The next day he rolled in a WWII EMG and several newer machines for monitoring biofeedback (with electrodes). Soon we were producing four-note chords by control oscillators from our own diadic alpha-waves (each head generated stereo). We proceeded to present our music at two meetings of the International Biofeedback Society—*Logos I* (tape), and *Biomusic and (live) Piano*. I encountered much difficulty after moving to Chicago in finding another like-minded scientist for collaboration who could not get past the expectation that brainwave music should sound classical.

Jumping ahead to 1994, I happened on another unexpected encounter. My wife taught violin at home, and the father of a student (living a block away) began to hang out during his son’s lessons. He turned out to be a distinguished, internationally-known geneticist (PhD and MD in pediatrics). No sooner had

I settled in on our once-a-week chat, than Dr. Charles Strom proposed that we pursue realizing DNA with music. He rekindled interest in biomusic from my biofeedback days. Our symbiosis was perfect. He knew everything about science and genetics, and I was the programmer/composer.

DNA music was not new, but my algorithmic formulas attempted to make a logical physio-musical connection, and Dr. Strom knew everything about the chemistry of DNA. This led to a catalog of pieces named after DNA sequences of human tissue, diseases, etc., first by way of digital synthesis, and more recently transcribed for piano. The DNA pieces for digital sound, or instrument with digital sound, have been performed internationally. I programmed a “DNA Mixer” that can play in real-time up to six simultaneous sequences. Each is chosen from a drop-down menu of over 30 different sequences. The DNA Mixer installation has enjoyed gallery stints, etc., in the US, France, Italy, Germany and in the National Gallery of China (Beijing). In addition, Dr. Strom produced unique sequences for a bioart installation consisting of a projection of actual living bacteria, and I realized its real-time sound in Eduardo Kac’s *Genesis* (1999). The installation, with interactive internet streaming, was commissioned by the prestigious Ars Electronica festival, and has since been presented at some forty-one venues worldwide.

The many festivals, concerts, and conferences that I directed, co-directed and produced perhaps peaked with the week-long Mayor Byrne’s *New Music America* 1982 in Chicago. John Cage was the guest of honor in observance of his 70th birthday. I had already co-edited and contributed to a publication of essays in *A John Cage Reader* for *TriQuarterly* (NU) and C.F. Peters (NYC, extended hardbound) earlier that year. The presenter/curatorial involvement nurtured my subsequent affiliation with several European consulates. In the mid 1980s, I facilitated concerts and festivals involving European visitors—many in the SAIC ballroom.

A working relationship with the French consulate inspired the cultural attaché to sponsor me for fact-finding trips to France in the pursuit of cultural exchanges with Chicago. These missions led to two consecutive grants from the Franco-American Cultural Exchange Program that I received in collaboration with art schools in Nice and Aix-en-Provence. The initial plan was for semester-long graduate student exchanges, and indeed we sent five ATS students from 2005-2007 and hosted five from Aix. We discovered immediately that this program was unsustainable, largely because the French semesters were

# Mensuration Botox à 5

[Clostridium Botulinum (Botulism) for disklavier]

Peter Gena

Piano { *(dynamic changes and pedal indications are numerous, and are not notated here)* 3

uncoordinated with our own. We quickly discovered that the most efficient and productive means of maintaining a relationship was through joint-research via regular workshops.

In the ensuing years I have sent over forty ATS faculty and staff on international trips along with 15 graduate students. Along the way we added collaborators from organizations and art schools in Paris, Nantes, Bourges, Troy, NY (RPI) and Montreal. In the midst of these Franco-American collaborations, I was decorated by the French government at the rank of Chevalier dans l'Ordre des Palmes Académiques.

Our most fruitful collaboration has been *New Atlantis*, a VR project inspired by Francis Bacon's utopian novel of the same name. I act as one of the project coordinators along with Peter Sinclair (École Supérieure d'Art d'Aix-en-Provence), Roland Cahen (École Nationale Supérieure de Création Industrielle, Paris), Benjamin Chang (Rensselaer Polytechnic Institute) and Jonathan Tanant (JonLab, Paris). *New Atlantis* provides an online environment for new-media artists to showcase research projects that investigate relationships between sound, virtual 3D image and interactivity. It offers a pedagogical platform for audio-graphic animation, real-time sound synthesis, object sonification and acoustic simulation. It is a place to organize virtual sound installations, online concerts, soundwalks and other audiovisual art experiences. Participants join each other online, guiding their avatars through numerous virtual spaces. Anyone can initiate a performance, using their own computer as a server. We are currently planning our third iteration—version 1 (2009-2013) used Panda3D and PureData for its engine; version 2 (2014-2018) Unity 4-5; version 3 (2019-) will employ Unity plus others. In retrospect, I was fortunate to obtain the grant, but an award is only as good as the follow-up provided by its team. Needless to say, the success of SAIC's contributions to this ongoing project would have been impossible without the eager engagement of the many talented ATS faculty and students throughout the years.

I looked on with pride as several of these students transitioned into SAIC faculty and followed admirable art pursuits. Four who have been involved with *New Atlantis* come to mind. I mentioned Ben Chang above, now at RPI, who came to SAIC as a post-baccalaureate student and stayed on for his MFA. He joined us immediately as part-time faculty, and progressed into a tenured professor in ATS. Two others, Brett Balogh and Robb Drinkwater, were similarly elevated from graduate students to adjunct associate professors. Brett, who maintains an active career in kinetics and

electronics, was the very first student that I sent to Aix during the first year of the grant. He adapted so well that he became involved in the fledgling *New Atlantis* project and returned with us several times. Robb, a sound artist who was already a student when I arrived at SAIC, has participated in seven trips to France as a *New Atlantis* contributor—nearly as many as me. While a graduate student in ATS, Margarita Benitez specialized in interactive wearable objects via the use of sensors and circuits imbedded in textiles. Subsequently, she taught courses in wearable objects for ATS before joining the faculty at Kent State. Margarita participated in several NA workshops in France, where she joined the 3D programming group.

*New Atlantis* has enjoyed many live and virtual performances and installations. A typical presentation entails a host venue with a live audience, plus several live participants, with or without audiences, who participate from their own locales. Several have emanated from France, including at the Fondation Vasarely and Second Nature (Aix), Le Cube, the Palais de Tokyo (Paris). In addition, others were led from The Ear Taxi Music Festival (SAIC, Chicago), the Villa Bombrini, (Genoa, Italy), the CMMR (São Paulo, Brazil) and the Black Box Space (SAIC). *New Atlantis* in installation form was exhibited at the Sullivan Galleries (SAIC), and the Cité internationale des Arts (Paris). All productions involved participants in situ at ENSCI (Paris), ESAA (Aix), RPI (Troy) and SAIC (Chicago).

I began as a student positioned to wade through the murky waters of a career as a composer. By chance, I would find myself among many renowned experimental musicians and thinkers of the 20th century: influential composers like John Cage, and teacher/mentors Morton Feldman and Lejaren Hiller who piqued my early interest in interdisciplinarity. Cage and Feldman were informed by New York visual artists, Hiller by science (he held a PhD in Chemistry). That I should end up spending the bulk of my career at a progressive art school would appear to be divine intervention. Nonetheless, it is my good fortune to have taught, worked, and collaborated with many distinguished faculty and students, particularly those in Art and Technology Studies where I found countless kindred spirits as colleagues and collaborators.

Opposite: Peter Gena, *Mensuration Botox à 5 [Clostridium Botulinum (Botulism) for disklavier]*, from the DNA-PNO series, 2005.



# Disruptive Generation: Ars Electronica 2018

Duncan Bass

As an art historian and curator interested in the role of technology in contemporary life, I worked closely with ATS faculty and students throughout my time as a graduate student. In the summer of 2018, I was invited to organize an exhibition of recent ATS graduates to be presented at the annual Ars Electronica Festival for Art, Technology, and Society in Linz, Austria. Exhibiting at Ars Electronica for the first time was a significant occasion for ATS, allowing students and recent graduates to present their work at one of the most significant events in the field for an international



audience of more than 100,000 visitors. Acknowledging this milestone, *Disruptive Generation: Art & Technology at SAIC* set out to celebrate the legacy of the department and embrace the theme of the festival by articulating the role of technology in constructing and mediating our experience of reality.

Celebrating scientific and poetic revelations made by mistake or happenstance, the 2018 edition of the Ars Electronica Festival, *Error: The Art of Imperfection*, set out to recast error as opportunity. The notion of error—whether

functional or computational—implies some sort of discrepancy from the expected or deviation from the norm. This position casts unanticipated outcomes in a negative light and celebrates results that reinforce the existing perception of reality.

One of humanity's defining characteristics is the timeless attempt to overcome the inherent corporeal, societal or terrestrial shortcomings through technology. The resulting solutions produce new problems to be solved or, at the very least, new modes of perception that make existent

phenomena discernable as problematic. These new modes of perception are also capable of concealment, reproducing systemic errors behind a veil of signal noise and technical illusion. Featuring artworks by Ziv Ze'ev Cohen, GREYMAR (Igraine Grey + Jonatan Martinez), Changyeob (C.Y.) Ok, Santiago X and Li Yao, *Disruptive Generation* questions the relationship between archetype and prototype, disrupting the cultural and computational systems that circumscribe lived experience in order to render space for alternative futures.

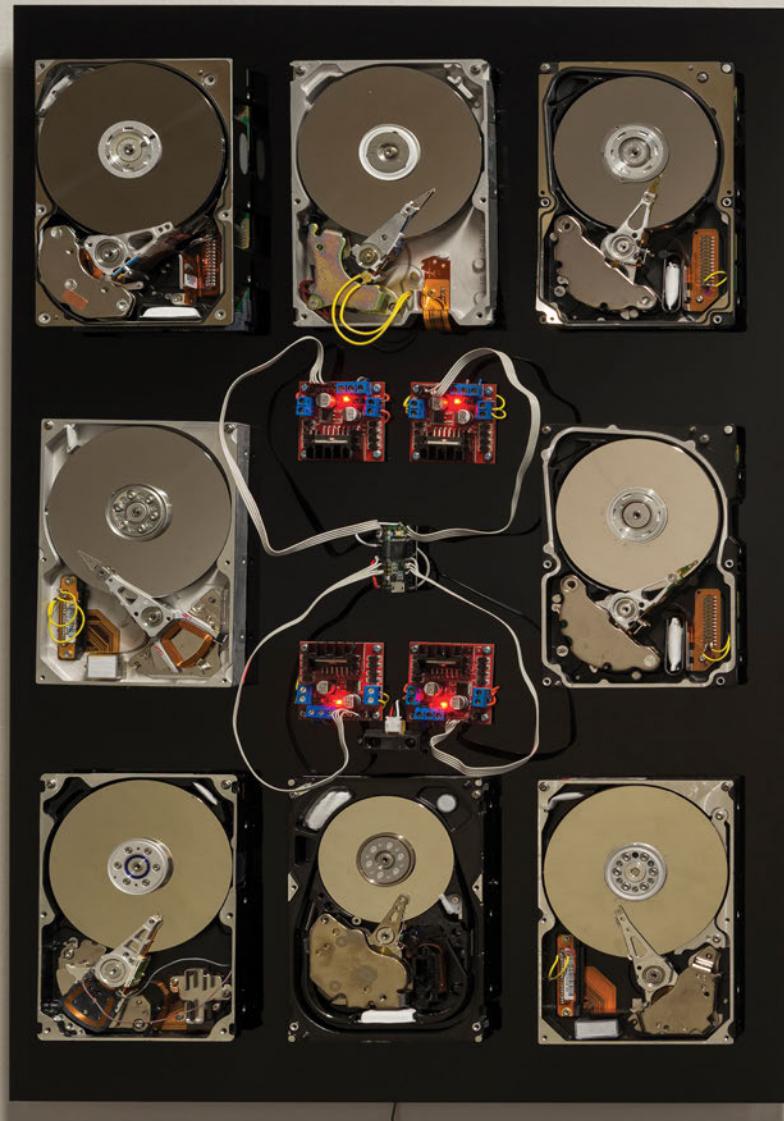
← Changyeob (C.Y.) Ok uses technology to draw attention to natural and societal phenomena that might otherwise go unnoticed, highlighting the apathy and disconnect engendered by the same platforms. A major draw at the Ars Electronica Festival and a centerpiece of the exhibition, Ok's audiovisual installation *The One That Shatters in The Air* detects muons, elementary particles that are imperceptible to human beings, and translates them into an immersive sensory experience in real time. Created when cosmic rays

collide with Earth's atmosphere, muons move through and around us at nearly the speed of light. Ok's project slows these interstellar particles to a human pace, engulfing the viewer in ambient audio and a shower of colored light that expresses the potential beauty of the invisible world.

Changyeob Ok, *The One That Shatters In The Air*, 2018. Muon detector, optical fiber, acrylic sheet, electronics. Photo: Otto Saxinger.

The series *Mathematical Monsters* by Ziv Ze'ev Cohen, suggests a space wherein our most quotidian experiences are determined by sensory apparatus. *Asteroids* features videos retrieved from NASA that construct images of distant asteroids from returning radar signals reflected off their surfaces. The images are indiscernible and could just as easily function as a Rorschach test than as a scientific rendering. A second work from the series, *Submarine* establishes a metaphor for this technologically mediated reality using a simple composition of black and white Xerox prints that together reveal a bitmapped image.

Ziv Ze'ev Cohen, *Machine 010 Long Memory*, 2017. Interactive kinetic sculpture: PC hard drives, acrylic. Photo courtesy of the artist.





Disruptive Generation: Ars Electronica 2018

Li Yao's *Bunker* inverts the hierarchy between reality and virtuality, presenting a gallery installation that is effectively a bankrupt vision of the virtual environment. The viewer progresses through spaces that are simultaneously minimalist and monumental, including a war room that appears suspended in time and a server farm where endless stacks of digitally rendered hard drives depict the physical infrastructure underlying virtual worlds. The authoritarian aura of the virtual environments suggests the comprehensive digitization of real-world power structures, while the deliberate pace and the linear but cyclical nature of the experience provide the opportunity to examine humanity's willful reenactment of history.

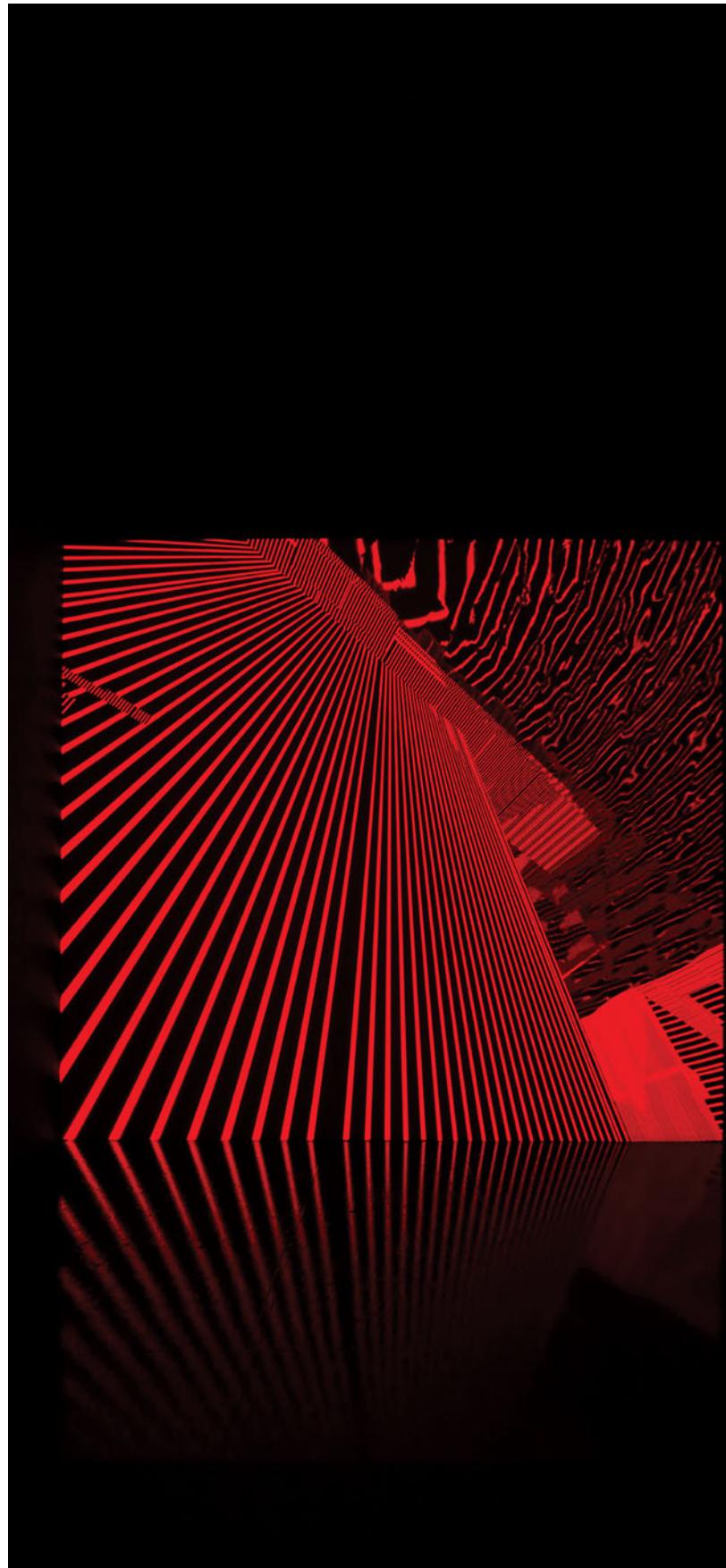
To err is human, but humanity does not possess an exclusive claim on error. Cohen's *Long Memory* exemplifies this claim by transforming the collective failure of eight computer hard drives into an interactive auditory experience that changes based on the proximity of the viewer. When a visitor stops to view the static wall-mounted object, the opportunity for quiet introspection is brief—rudely interrupted by the jarring sound of a metal stylus arm clashing against the frame of a hard drive in a frantic series of scans that each ends in failure. As the accompanying hard drives are activated, the cacophony is subsumed into a symphony of coordinated failures, demonstrating the potential for art to emerge in the most unlikely

of places. The rhythmic melody of *Long Memory* unsettles the traditional notion of "computer music" by reimagining a key component of the computer as an acoustic instrument rather than a tool for digital composition.

Li Yao, *Bunker*, 2018. Virtual reality environment and site-specific installation. Photo: Otto Saxinger.

It is difficult, but perhaps necessary, to imagine the global network of information technology—like the server farms depicted in Li Yao's *Bunker*—erupting into a similar orchestra of dissonance. Through this lens *Long Memory* also provides a contemporary update to Plato's pharmakon, critiquing the externalization of human memory through a new form of writing. While Plato's criticism is centered on the inability of the written word to participate in dialectics, the hard drives in *Long Memory* appear to carry on a conversation of their own that is incomprehensible to the human eavesdropper. This dialogue simultaneously indicates our present condition, wherein black-box systems influence lived experience in unknown ways and suggests a future where the extraneous human observer is no longer an integral component in the network it constructed.

In a similar embrace of technical error, *RED* by the collaborative duo GREYMAR (Igraine Grey + Jonatan Martinez) constructs a virtual architecture and a visual language out of moiré, a 'watered' appearance generated by the perceptual interference of dots or lines. This interference is not limited to the human eye and expresses itself differently through distinct technical processes, appearing as unwanted artifacts in photographic reproductions of halftone prints, television screens, and digital monitors. *RED* embraces this pattern distortion, creating a virtual environment populated by monumental architectural forms that are themselves composed of simple lines conforming to a rigid geometry. Any subtle touch of the joysticks used to navigate the space initiates a state of perpetual misalignment, wherein the moiré appears and evaporates, interrupting the architectural forms and perspectival illusion of the virtual environment. Instead of using virtual reality as an escape from the real, *RED* collapses these spaces, using visual artifacts created by the technical hardware to destroy the illusion of an alternate world.





While *RED* demonstrates the inseparability of virtual reality from our real world, *The Return (o:lači okhiča)* by Santiago X imagines alternative futures assembled from fragments of reality. A proponent of Indigenous Futurism, X advocates for the potential of art to transcend representation and become a sacred and multiplicitous embodiment of life itself. This unique branch of post-humanism expresses itself in *The Return (o:lači okhiča)* through an embrace of the uncanny. Incorporating audio of prelinguistic speech and video of clouds floating slowly through a blue sky, *The Return (o:lači okhiča)* allows the viewer an explicit opportunity to project their own perspective onto the work, while providing the space to reorient themselves in relation to the natural world, ultimately extending the subjectivity of nonhuman experience to contemporary society.

The creative and destructive potential of technology becomes more astounding as emerging technologies come to further determine contemporary existence, a phenomenon that necessitates a more critical engagement by society-at-large. The error on display in *Disruptive Generation* does more than question the function-failure binary—it advocates for generative systems that do more than perpetuate the need for new solutions.

Left: GREYMAR (Igraine Grey + Jonatan Martinez), *RED*, 2018. Virtual Environment. Photo courtesy of the artists.

Right: Santiago X, *The Return (o:lači okhiča)*, 2018. Responsive audio-visual installation. Collection of Trend One / Future Space, Berlin. Photo: Otto Saxinger.



# Art, Technology and Trends

Dominique Moulon

*The major art schools participate in initiating trends. The Art and Technology Studies department of the School of the Art Institute of Chicago is a leading example. By analyzing significant works by several artists who have carried out studies there, we can begin to understand the range and impact of the practices under consideration and to affirm the excellence of its teaching.*

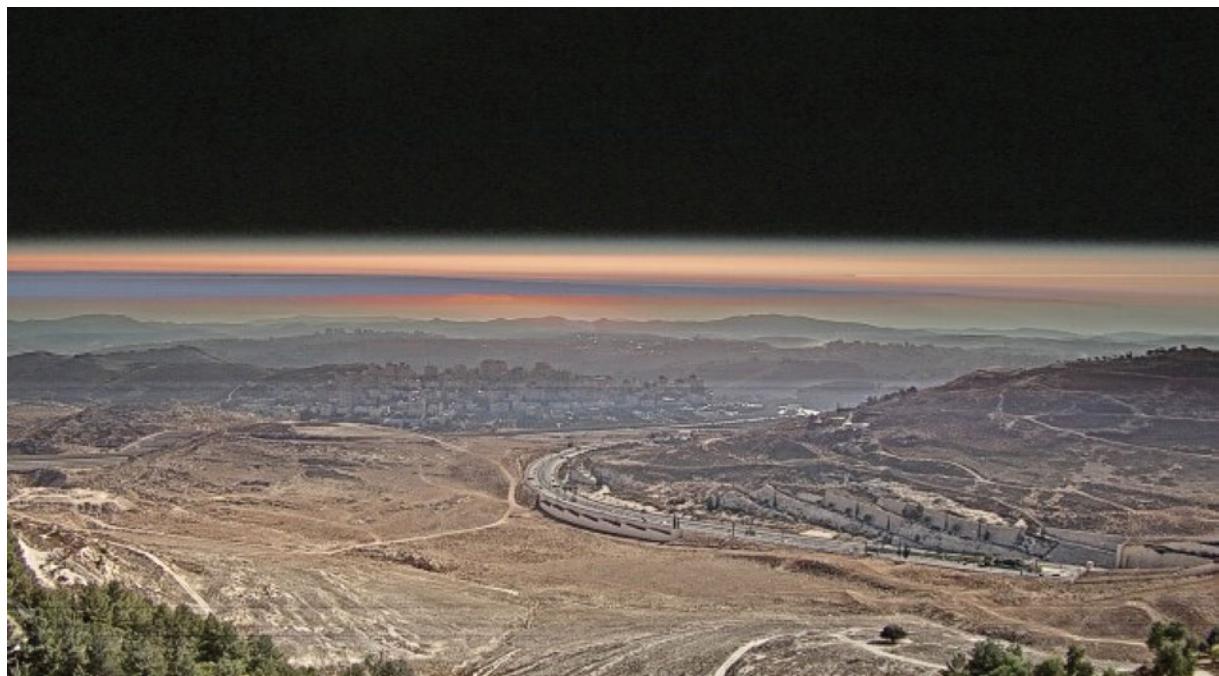
Since the mid-1970s, Carlos Fadon Vicente has constantly questioned the medium in which he works, ranging from still to moving images, captured or broadcast. Fadon won a Leonardo Pioneer Award in 2017, largely in recognition of the experiments that he started in the department of Art and Technology Studies in 1989, when he seized a color printer at SAIC to produce his series *Vectors*. Working in total symbiosis with a PaintJet (HP's first color printer) Fadon even accepted printing errors. Further, he incorporated them at a time when computing, in becoming generalized, already symbolized the perfection of images. In a form of letting go, of which serendipity only has the secret, he in a way became the first viewer of a work being produced before his eyes. This makes the Brazilian artist one of the pioneers of what many years later would come to be known as glitch art, a trend that became particularly appreciated by younger generations for whom the extreme perfection of images, controlled in all regards, ends up being boring.

The works of Jason Salavon, which are included in the collections of the Metropolitan Museum of Art, the Whitney Museum of American Art, and the Art Institute of Chicago are familiar to us. Yet, without their titles they would be, for the most part, pure abstractions. When the artist squeezes every frame of James Cameron's movie *Titanic* into a single image, we

use our memories of this feature film to distinguish between the light tones of the early sky and the darker ones of the climactic shipwreck. *The Top Grossing Film of All Time, 1 x 1* (2000), offers us the visualization of all the hues of this same film through a large number of pixels that, strangely, fit so perfectly, even for those who have not seen the film. With *Every Playboy Centerfold, The Decades (normalized)* from 2002, it is the body of women and the male gaze that is in question. Salavon merges, decade by decade, the centerfold of a magazine that everyone knows, at least by reputation. Each image is a fusion of 120 bodies—resolutely pictorial representations that evoke imprints, and more precisely that of the Shroud of Turin. In this case, the art lover appreciates the quality of the blurs that translate the depth of the images while the sociologist deciphers the evolution, over time, of the poses or morphologies emerging from the amalgam of codified representations. Through the synthesis and use of data, Jason Salavon offers us distanced interpretations of whole fragments of our popular cultures.

Opposite: Philomene Longpre, *Cereus Queen of the Night*, 2009-2013. Responsive Art System. Phi Center, Elektra Festival, Montreal, Canada 2013. Photo: Claudio Pino.

## Public space



Susan Collins, *Land*, 2016. Site specific installation and projection, network video transmission. Photo courtesy of the artist.

The work of Susan Collins is about duration. The duration of processes that allow her, for example, to capture the images from the *Seascape* (2009) series pixel by pixel, line by line. Her work references the tradition of plein-air painting and the origins of photography. Her seascapes merge temporalities, focusing on luminosities while the scanning inherent in the acquisition process reinforces the extreme horizontality of the points of view. Collins has also dealt with architecture, ranging from the intimate to the monumental. In one example, *Excavation* (2012), Collins projected a film of an archaeologist digging with a trowel on the floor of the historic All Saints Church in Harewood (United Kingdom). The scene cannot be reliably located in the past or future and, covering just a few slabs, Collins addresses only a handful of privileged spectators. Conversely, *Brighter Later* (2013), performed at the Radcliffe Observatory in Oxford, addresses the greatest possible number. From sunrise to sunset, her luminous installation informs the surrounding populations about climatic variations including temperature, pressure and rainfall. At a time when each individual responds to the slightest alert from their connected objects, Collins has chosen to create an interface that provides collective observation.

Even the most mundane objects, creatively assembled and in surprising quantities, are likely to intrigue

us. Artist Byeong Sam Jeon reveals the magic that can be found in the objects that fill our daily lives by skillfully multiplying them, as in a 2015 installation in which he covered the facade of an abandoned tobacco factory with nearly 500,000 CDs. The choice of such a support is interesting because it fascinated its users in the 1990s by the amount of data contained. Then, one innovation replacing another, it ended up disappearing from the shelves of our supermarkets—places of accumulation par excellence. But what is interesting about the CD Project is the fact that the CDs were offered by ordinary people, thus confiding some personal data to the artist. No one knows the nature of the data that make up the silver dress of an industrial building where the repeated gestures of the workers of yesteryear still resonate. Beyond the monumentality of Byeong Sam Jeon's installations, there is a symbolic dimension, as is again the case with *The Men with Five Tongues* (2016). This work brings together, in relative darkness, a hundred fans that the public triggers when approaching. The title of the work encourages us to reconsider the violence of those who are protected by online anonymity within this new agora that is the public space of social media.

## Aesthetics of the hybrid



Sophie Kahn,  
*Machines for  
Suffering V*, 2018-19.  
3D print (laser-  
sintered nylon) from  
3D scan, gesso,  
acrylic pigment 17"  
x 19" x 16". Photo:  
Rachel Hammersley,  
courtesy of C24  
Gallery.

Philomène Longpré's *Cereus, Queen of the Night* (2009-2013) is a hybrid artwork at the crossroads of sculpture, robotics, image, and sound. This makes it, in a way, a total work of art, a concept born with German romanticism in the 19th century and celebrated in the 1950s by the artists affiliated with Black Mountain College. In the center of *Cereus, Queen of the Night*, there is a woman who performs, and the title of this immersive installation suggests her standing. The video sculpture creates the context of her environment that each viewer interprets in their own way. Formally recalling either a flower or a cocoon, the robotic elements also position it as a technical object. The sculpture protects and, at the same time, encloses the image, making this Queen of the Night the prisoner of the object that allows it to exist. A key element lost in reproductions, the video sculpture *Cereus, Queen of the Night* reacts to changes in its immediate environment, and the sounds inherent in the mechanized movements of its translucent petals add to the music of the piece when it is played in front of the audience. *Cereus, Queen of the Night* is an augmented video that exemplifies the expanded cinema theorized by Gene Youngblood as early as 1970, renewing it with the technology of our time.

Sophie Kahn's subject of study is the human. She experiments as much with the possible representations

of both still and moving images as she does with sculpture. Her favorite tool is a 3D scanner, with which she captures body fragments that are never really immobile. The act of capturing three-dimensional models generally requires poses that once again recall the origins of photography, although Kahn refers more explicitly to the history of radiography. The lack of points, lines, surfaces or matter summon the idea of the unfinished in painting, while the invisible parts of her sculptures correspond to the white or black monochrome backgrounds of her prints or sequences. Though some faces seem to have been burned and limbs mutilated, there is no suggestion of suffering whatsoever. When it comes to whole bodies, they appear to us reassembled, as in natural history museums. Sophie Kahn's work is about capturing life to reveal an element of eternity that lies dormant in each of us. These elements of eternity reveal themselves intermittently, because it is death that gives life its full meaning—a sentiment expressed by past civilizations through the creation of funerary masks, shadow portraits of those whose three-dimensional avatars are eternal.

Samuel Adam Swope combines the natural and the technological in a unique way. Most recognized for his aerial art, he constructs and controls aesthetic systems that work with air, and are often themselves airborne. For Swope, aerial art "frames air, giving



it a perceptible and systematic volume." He often creates objects or environments that facilitate novel situations that oscillate between playful and poetic, introducing an uncanny apparatus to challenge cultural constructs, manipulate norms and produce ephemeral spectacles, which are then complemented by skillful documenting and storytelling. This approach is evident in Swope's technological-natural hybrid Banana 'copter, a flying banana created for the project *Banana Mission; a monkey behavioral study* (both 2010). *Banana Mission* was filmed throughout Hong Kong, from its emergence in the open market to its encounter with feral monkeys at Kam Shan Country Park (also known as Monkey Mountain). Reversing his approach and bringing natural-technological hybrids into the gallery, *Ecotone* (2017) constructs a narrative around a flying creature, assembled from a mixture of plant and electronic constituents, that is transformed into a ghostly apparition. Each of these works plays with the intersection of technology and the non-human, framing these encounters through an anthropomorphic lens to explore our place within these complex hybrid systems.

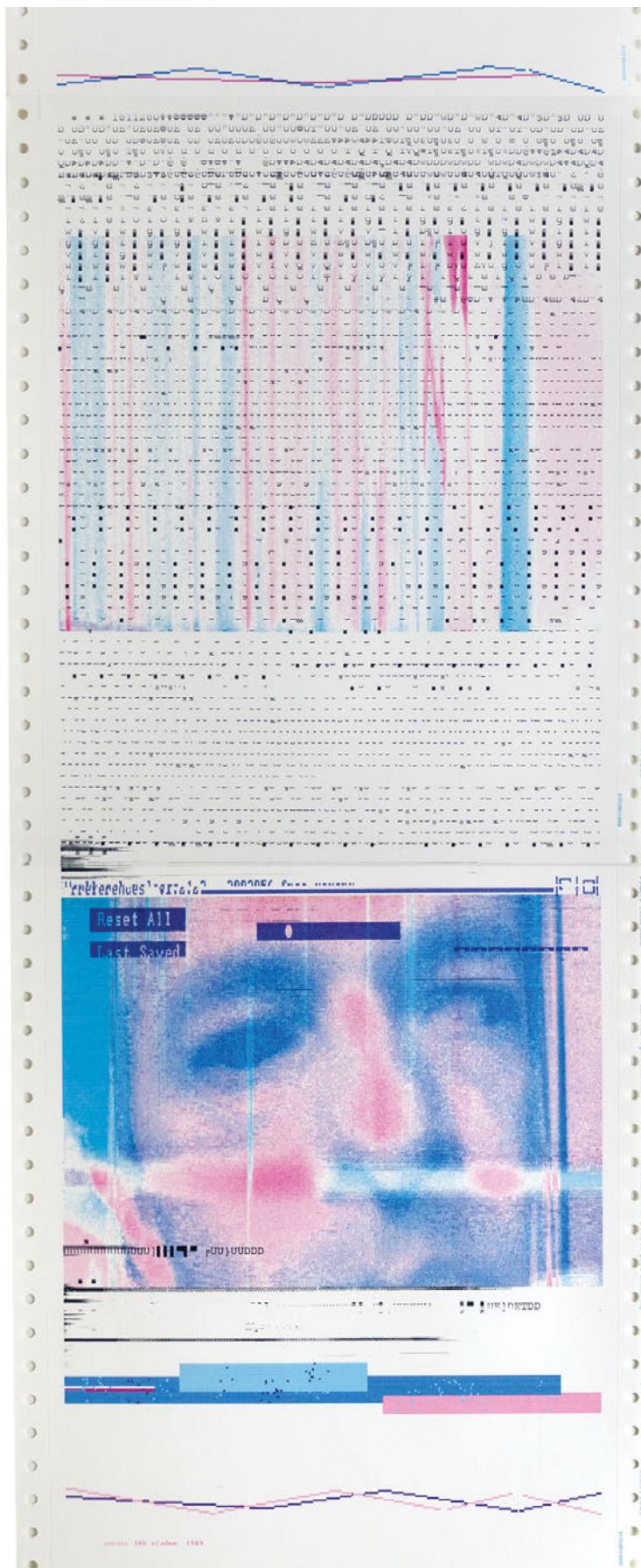
## **Expanded cinema**

Joshua Mosley is an artist who practices another expanded form of cinema by combining ancient processes from the pre-cinematographic period, such as stop motion, with the most advanced post-production technology. As a director, he produces animated short films whose subjects are unusual. They are often presented as animation loops in contemporary art events, such as the 2014 Whitney Biennial which featured Mosley's *Jeu de Paume*. As for the public, it can only let itself be carried away by stories in which the real appears sublimated. We never really know what we are observing as materials ranging from clay to models intermingle with media combining drawing, watercolor and photography with computer graphics. Joshua Mosley is also an artist who leaves clues in his worlds. Clues that disturb our perception of scenarios borrowed from the history of the human sciences. In *dread* (2007), for example, French philosophers Jean-Jacques Rousseau and Blaise Pascal discuss the human condition. The artist also details his production process on his website where we can see how his aesthetic depends on the intersection of techniques and technologies.

3D engines are to video games what post-production is to cinema. With their appearance in the 1990s, the general public finally discovered the attractions of immersion combined with interaction. As the

Opposite: Samuel Swope,  
*Floating Room*, 2016. Custom  
floating clock, lamp, rubbish bin,  
vanity mirror, & box. Custom  
chair, jar, coffee mug, & pillow,  
ready-made things, quadcopter  
tech, laptop, custom software  
& performance, custom carpet,  
metal studs, chain-link, door,  
paint, interior lights, light  
switch, books, paper, plants,  
aroma, 8 x 4 x 3 m (variable).  
Chronus Art Center, Shanghai.  
Photo courtesy of the artist.

Carlos Fadon Vicente, *Vector*  
*10b*, 1989. Ink on paper, 44" x  
9.5". (detail). Photo courtesy of  
the artist.



power of machines continues to grow, the renditions of these applications have continued to approach a certain idea of reality. During the 2000s, John Gerrard—another graduate of the Art and Technology Studies department at SAIC—focused on the narrative potential of generative simulations. His landscape scenes, without beginning or end, allow contemplation in infinite variations using camera trajectories whose extreme slowness is immediately noticeable as the opposite of the pace of video games, the aesthetics of which the artist readily borrows. In 2009, at the 53rd Venice Biennale, the art world was seized by his large-scale projected video landscapes reminiscent of the American Great Plains region. More recently, Gerrard's echoes the challenge facing humanity—global warming—by virtually planting his *Western Flag* (2017) in the Lucas Gusher, in Spindletop, Texas.

The work is literally “on Texas time,” which symbolized economic development through a natural resource that would change the world: oil. The flag, which usually expresses pride and whose fabric has been replaced by thick black smoke, evokes the end of a world. An end where unbridled consumption can only lead to an announced catastrophe that we still hope we can avoid.

Since its origins, cinema has developed in two distinct ways, one of which is more industrial and the other, resolutely experimental. A department dedicated to experimentation with creative technology in an art school must prepare its students simultaneously for such orientations, as distinct as they may be, at least in appearance. Stephanie Andrews works at the boundary between commercial cinema and experimental art. For example, she began as a technical director for some of the most successful animated films, such as *A Bug's Life* and *Toy Story 2*, during the late 1990s. Her latest research has led her to offer audiences virtual reality experiences. Becoming the main actors of *Ghost Forest* (2016), audiences know that they are in two different places at the same time: in the indoor space where they wear a VR headset and in that of a virtually reconstructed nature that they perceive all around them. With *Shards* (2017), the experience becomes progressively more complex when the user is immersed in the empty space of a three-dimensional monochrome. During their experience they have the opportunity to observe the fragments of the multiple worlds which virtually surround them. Is the user witnessing a future in which the film industry joins that of video games?

## Politics in art

Andrea Polli is an environmental artist who, through her often monumental creations, sounds the alarm. In 2015, Polli's light installation *Particle Falls* addressed the world's most prominent political actors by appropriating the wall of a facade adjoining the Mona Bismarck American Center in Paris. At the same time and in the same city, the 21st United Nations Conference on Climate Change was taking place and we were awaiting important political decisions for universal action on global warming. The projected work represents a cascade of blue water symbolizing purity. But, activated by a nearby sensor, it is transformed into a burst of flames when the air quality indicates an excessive presence of fine particles in the environment. Contemporary threats are invisible or well hidden, and air pollution is one of them. *Particle Falls* warns us about the quality of the air we breathe while contemplating it. Since 2016, Polli's *Energy Flow* has been enhancing Pittsburgh's Rachel Carson Bridge with a myriad of LED lights powered by wind turbines attached to the structure of the bridge. Thus, from sunset to sunrise, the people of Pittsburgh are visually informed of the unseen potential energy of the passing winds. Artists will inevitably have a role to play in the necessary energy transformation that companies, cities or states must initiate without delay all around the world.

If there is an artist of the invisible it is Trevor Paglen, who uses photography, among other mediums, to reveal what we usually cannot, or do not know how to, see. In the images of his series *Limit Telephotography* initiated in 2007, the secret military infrastructures that he presents us are less interesting than the blur due to the thick layer of atmosphere, heat and dust that protects them from being seen. The real subject in these same shots is the distance that prevents approaching them. In *Untitled (Reaper Drone)* from 2010, the subject ‘drone’ can appear to us as a pretext to photograph the morning or evening skies that evoke both the painter William Turner and the photographer Ansel Adams. However, in each of these images there are tiny details informing us of the contemporary threats of constant surveillance or possible strikes. Likewise, the *NSA-Tapped Undersea Cables, North Pacific Ocean* (2016) remind us of the materiality of the internet network that companies and states share. Let's end this non-exhaustive case study with an exhibition of Huong Ngo that brings us back to Chicago in 2018. Her title, *Reap the Whirlwind*, evokes the idea of consequences to be inflicted, in this case, those relating to the French colonial past in Indochina. Based in Chicago, the artist also works



John Gerrard, *Western Flag (Spindletop, Texas)*, 2017. Site-specific installation displayed on artist-designed frameless LED wall at Desert X, Palm Springs, 2019. Photo: Lance Gerber.

in France and Vietnam, creating works which depict the fragments of a personal story that she assembles with historical events or characters, like Nguyen Thi Minh Khai, a young communist activist who lost her life at the age of 31 in a colonial prison. In *Reap the Whirlwind*, documentation is essential, exhibited aside other pieces as part of the artwork. The figure of the concubine evoking the relationship of a young Indochinese woman with a French man, possibly one of power, is central. The concubine, in her relation to the colonist who in a certain way she controls, is considered as politically engaged in the artist's books, which draw in the spectator's body. For it is by placing one's hands on the pages of the volumes that the heat temporarily reveals the characters, like so many family secrets that are hard to evoke before forgetting them again. Huong Ngo contributes to an emerging trend in contemporary art that shifts the boundaries between the artwork and its documentation.

What all these artists have in common is that they studied in the department of Art and Technology Studies at the School of the Art Institute of Chicago, which, over the past fifty years, has constantly evolved to best stimulate art students or emerging artists from around the world. They not only continue the research of their predecessors, they initiate new trends in art that uses the technology of their time.

Translated by Geoffrey Finch

# The Women Who Shaped Art and Technology Studies

Judy Malloy

*"Women have played a key role in the history of ATS, from its foundation and early stewardship, to the present, when they form a significant constituency among faculty and students. Throughout the years, women have taught a wide array of courses in ATS, from games and computer animation, to neon, holography and electronics, to name a few. This legacy continues into the present, with women currently teaching in areas such as virtual reality, games, electronics, data visualization, social networking, physical computing, and coding. The department also has women in staff positions, such as Anna Yu, our facilities director, who has done a phenomenal job for over two decades, and Lynika Strozier, the Bio Art Lab coordinator. Some of the groundbreaking women that have directly influenced ATS, such as Sonia Sheridan and Joan Truckenbrod, have received recognition from MoMA and the Whitney, respectively. They set an example for future generations of women (and men) working in the field of art and technology."*

- Eduardo Kac, Chair, Art and Technology Studies, School of the Art Institute of Chicago



Sonia Sheridan manipulating the 3M Color-in-Color copier in the Generative Systems classroom, 1978. Courtesy The Daniel Langlois Foundation for Art, Science, and Technology, Sonia Landy Sheridan fonds.



France Cadet in her studio, 2011.

The roots of what is now the Art and Technology Studies department (ATS) at the School of the Art Institute of Chicago (SAIC) were two separate programs established in the late 1960s and early 1970s: the Kinetics area in 1969 by Steve Waldeck and the Generative Systems program in 1970 by Sonia Sheridan. From a merger of these programs, an artist-centered art and technology department was born.

In the late 1960s to the early 1970s, computer graphics were becoming a part of fledgling University-based computer science departments, such as that at the University of Utah formed in the mid-1960s by computer graphics pioneer David Evans, who was joined in 1968 by Sketchpad inventor Ivan Sutherland (Gaboury). But the art and technology programs at SAIC were among the first, if not the first, art school programs in this field. Furthermore, that SAIC's Generative Systems program was led by a woman was unprecedented. It should be noted that the Alternate Media Center at Tisch School of the Arts, an informal program co-founded by Red Burns in 1971, was the root of the Tisch Interactive Telecommunications Program in 1979. But Sonia Sheridan's Generative Systems was first formalized as a course in 1970, and within five years it had become a full undergraduate and graduate program.

Women have been at the forefront of art and technology for decades (Cox, Sandor, and Fron; Malloy). At SAIC, the role of women faculty and their students—in the 50 years that ATS has centrally fostered art and technology—is the focus of this paper which, in addition to Sheridan, looks at the roles of Joan Truckenbrod, Tiffany Holmes, France Cadet, Heather Dewey-Hagborg, Lee Blalock and others in shaping creative practice at SAIC ATS.

## Sonia Sheridan: Generative Systems at SAIC

In the early 1960s, Sonia Sheridan left her teaching position at the then California College of Arts and Crafts (CCAC) and began teaching drawing and printmaking at SAIC, where her innovative approaches to printmaking led to the first course in Generative Systems in 1970. The name of the program was suggested by SAIC publications coordinator, Ian Robertson, in response to Sheridan's description of her process, which was not strictly reproductive but rather employed artist-codified systems in the creation of machine-involved results (Farley, 2007).

As if her roles as both teacher and experimental artist were together a system that was integral to the program, Sheridan's concurrent term as artist-in-residence at the 3M Color Research Lab—where she worked with Douglas Dybvig, the inventor of the Color-in-Color photocopier, as well as with other developers of C-in-C—not only furthered her own work but also signaled the creation of an open-system SAIC-based teaching laboratory, which would eventually house a continually changing collection of imaging machines, including a Haloid Xerox darkroom unit scavenged from a U.S. government store for recycled office supplies and used at SAIC for making portraits on Arches paper. With the machines came scientists and engineers, such as Xerox engineer Ed Kobs, who procured a lens, processor and fuser for the Haloid Xerox, and 3M research director Dybvig, whose interactive presence in the Generative Systems program enriched both the SAIC program and 3M research (Farley, 2006).

A journey through the extensive array of Sheridan's images that are accessible on the Daniel Langlois Foundation for Art, Science, and Technology's web-based archive, Sonya Sheridan Fonds, reveals the role of imaging machines and collaboration in her work as artist and teacher. (Farley, 2007). For instance, in 1974 Sheridan collaborated with book, photography and textile artist Keith Smith to produce a series of *Man-Scans of Ric* for a Projects exhibition series at The Museum of Modern Art in New York. The nine immense *Man-Scans of Ric Puls* were created using a 3M Color-in-Color II machine installed at SAIC; ranging from eight to forty-seven feet in length, they were capable of being exhibited either horizontally or vertically.

Process art — codified in late 1960's exhibitions, such as the 1969 *Anti-Illusion: Procedures/Materials*, at the Whitney Museum — was a logical basis for the incipient field of art and technology. However, as machines entered the studio environment, Sheridan's Generative Systems program explored process in terms of research, innovation, industry collaboration and

experimentation. This process—as exemplified by the ongoing collaboration between Sheridan and Generative Systems alumnus John Dunn, founder of Time Arts, Inc.—extended beyond the personal and institutional partnership with 3M. For example, a 1982 series of dual portraits, *John Dunn with Sonia*, was created using a Cromemco Z-2D microcomputer, a black and white video surveillance camera, and Dunn's EASEL software.

In addition to Dunn, Smith and Ric Puls, many other students, whose names resonate in contemporary art history, worked and studied in the SAIC Generative Systems program. Among them are Jessie Affelder; Gerda Bernstein, founding member of ARC (Artists, Residents of Chicago); Michael Day; Elizabeth De Ribes; Mary Jane Dougherty; Marilyn Goldstein; pioneer Spanish multimedia artist Marisa González; Greg Gundlach; Pete Lekousis; Bill McCabe; Barbara MacKowiak; John Mabey; Phil Malkin; Brian Oglesbee; colorist Martha Loving Orgain; Holly Pedlosky, who was instrumental in founding the Generative Systems Facebook Group; Mitch Petchenick; Suzanne L. Seed; Kokilam Subbiah; and pioneer digital artist Joan Truckenbrod.

Marisa González, who attended SAIC as an MFA student from September 1971 to February 1973, has since collaborated with Sheridan on mutual projects, including *Processes: Culture and New Technologies*, the 1986 inaugural exhibition at the Reina Sofia art museum in Madrid. González remembers that

*"I was fascinated by Sonia Sheridan in her Generative Systems class. Once I discovered her, I dedicated all my time to the GS workshop-class because she offered me a wide and unlimited way to an interdisciplinary and critical approach to a range of artistic concepts. I was working with every new tool in a symbiosis between art and technology, its transformation and its metamorphosis."*

With the spirit of the legacy of the generative systems program, in the past few years 94 year-old Sheridan has worked with the Facebook Generative Systems Group to create three publications: *Exhibition in a Box:16 Silk Scarves*; *Portable Postcard Exhibition II* and *Art at the Dawning of the Electronic Era: Generative Systems* (dedicated to Holly Pedlosky). A fourth publication is slated to be released in 2019. Additionally, in 2013 Sheridan had her first solo exhibition in Europe, *The Generative Art of Sonia Landy Sheridan* at transmediale and she is scheduled to be a guest of honor at the Hood Museum's re-opening of its permanent collection, including an exhibition of Sheridan's work curated by Senior Curator of Collections Katherine Hart, in 2019.

Given the nourishing role of the program she founded it is not surprising that, when asked for a statement for

this publication, Sheridan responded, “*As I approach 94, the last years of a century of life, I am forever grateful for parents, who provided me with an appreciation for life, with the hope of each emerging generation of the young, for understanding learning as opening the mind, for explaining the dynamics of history, and the limits of validity of systems...What finer teachers for an aspiring artist could one hope for*” (2018).

## ***Joan Truckenbrod, the First Chair of Art and Technology Studies***

From 1981 through 1986, computer graphics pioneer Joan Truckenbrod was the first formal Chair of the Art and Technology Studies department. Truckenbrod came to SAIC from Northern Illinois University (NIU), where she had been an Assistant/Associate Professor since 1973. At NIU, in the mid-1970s, she created a series of algorithmic drawings using FORTRAN, an IBM computer and a plotter. Because there was no monitor in the hardware system, they were initially visualized only in her sketchbook and imagination. The process involved writing a program based on formulas for modeling environmental factors, such as wind dynamics; keypunching the code to create a deck of IBM cards; and walking across campus to the computer room where, behind a locked door, the large IBM computer was so inaccessible that she never saw it. Her program was run by the gods of the computer center and then transferred to a tape. With the tape in hand, she then went across campus to the Geography Department, where they ran the tape on a plotter. A drawing was the output of this final process (Truckenbrod, 2018b). In a statement for this publication, she observes that, “*Initially creating my drawings through the process of developing algorithms and code, [it] was my desire to express ephemeral experiences or sensory experiences that were invisible yet physically palpable...For me there was the juxtaposition of analytical, mathematical constructs and the visceral experience of the actual drawing.*” (2018a)

However, the controlled access to computing facilities was problematical, and in the late 1970s, when she went to SAIC for her MFA, she was searching for a more hands-on process that integrated color. Thus, while she worked as a teaching assistant to Sheridan, bringing computer systems into the curriculum, she created a series of works by utilizing available color on an Apple II, holding the computer monitor directly over the 3M C-in-C copier, and then transferring the output to fabric. The result was a series of tapestries composed of algorithmically created, computer-mediated pieces. For



Joan Truckenbrod, *On Becoming*, 1984. Digitized image superimposed on live video; photographed on the screen. Photo courtesy of the artist.

instance, *Curvilinear* (1979)—a remarkable visualization of natural processes that is now in the collection of the Whitney Museum of American Art—began as a BASIC program based on formulas that described invisible natural phenomena. Directly from the Apple II monitor, the resultant images were printed on heat transfer stock. The final process involved heat transfer onto polyester fabric (2018b,190,201).

Now, as an emeritus professor living in Corvallis, Oregon, her work remains central to her life. Published by Black Dog Publishing, her 2012 book *the Paradoxical Object: Video Film Sculpture* explores contemporary work by Susan Collins, Ann Hamilton, Bill Viola, Joan Jonas, Krzysztof Wodiczko and Tony Oursler, as well as Truckenbrod's own work, such as *Peripheral Vision*, 2018, in which large plastic bottles, a model train, a small video camera, a projector and real-time video projection combine to simulate a future of living in a landscape of discarded plastic bottles (2017).

*carries all of nature's systems with it, so that all that is becomes the context of one's work." - Jo Hanson (2003)*

Since the 1970s, if not earlier, a lineage of distinguished women artists have explored nature's systems in process-redolent works, which range from Jo Hanson's *Crab Orchard Cemetery* (1974) that, with 12 foot high film panels and recordings of ambient sounds, explored the natural environment of a family cemetery in her native Carbondale, IL; to Helen Mayer Harrison and Newton Harrison's 360 foot long environmental narrative mural, *The Lagoon Cycle* (1973 –1986); to Joan Truckenbrod's early work with computer-mediated images based on mathematical formulas that describe natural processes; to Reiko Goto's *Nezumi* (1989), a human-sized rat box into which humans were invited to crawl.

In Chicago, ATS has hosted a core group of women faculty whose work explores nature's systems from a diversity of viewpoints. In addition to Truckenbrod, they are eco-artist Tiffany Holmes; France Cadet, who creates robotic animals to explore human-animal relations; Heather Dewey-Hagborg, who has made portrait sculptures from DNA analyses of found material; Lindsey French, who engages in gestures of communication with landscapes and the nonhuman; and Lee Blalock, who explores body modification by way of behavior or 'change-of-state.' (Blalock, 2018).

## **Exploring Nature's Systems from a Diversity of Viewpoints**

*"Leaps of imagination and conceptualizing are the artist's working mode. Involvement with Nature at any point*



Tiffany Holmes in front of her *Drinking the Lake*, 2018.

## Tiffany Holmes

“...artists have a fundamental role to play in creating work that ‘translates’ site-specific environmental data, once solely the domain of scientists, into easily accessible visual narrative” (Holmes, 2007).

When Tiffany Holmes arrived as a professor in ATS in 2000, Joan Truckenbrod was the only other woman professor (Holmes, 2018a). Eventually, Holmes chaired ATS and became Dean of SAIC Undergraduate Studies, a role she held until 2018, when she moved to Baltimore to become Vice Provost for Undergraduate Studies at Maryland Institute College of Art.

In a statement for this ATS Anniversary publication, she writes, “I came to teach in the department of Art and Technology Studies in the y2K year—I gave my official job talk in what is now the coatroom for the SAIC Ballroom utilizing a complicated array of now mostly dated technology: a slide carousel, a SVHS player, and a Macromedia Director animation.

*The first graduate seminar that I taught the following year had only one female student; the next year there were several more. I was so pleased that more and more women were finding that they could utilize either old or new tech to communicate a set of complex ideas. I am so honored to have taught or advised the following notable SAIC MFA women who have gone on to amazing art careers: Stephanie Andrews, Stephanie Rothenberg, Fi Jae-Lee, Huong Ngo, Irina Botea, Noelle Mason, and Lindsey French—to name just a few; there were so many! I should also say I was deeply inspired by Joan Truckenbrod, one of my female mentors in the department as well as many of the women working with technology in the 2000s in interesting ways at SAIC: Jessica Westbrook, Claudia Hart, and Ellen Sandor—an alum who also participated in the life of the school as a board member*” (2018a).

With a core of natural processes and environmental stewardship, in her work Tiffany Holmes has used STEM research and methodology and digital humanities approaches as a foundation for a creative practice that addresses public environmental and information issues.

For instance, when she first moved to Chicago, she was surprised by the number of surveillance cameras in public spaces in the city.

*"I was curious about the hidden data streamed from these lenses and I wanted to know more about this and other bodies of information available in the urban context," she said. "I made a piece called 'Your Face Is Safe With Me' that appropriated live feed temporarily from these CCTV networks and montaged those images into a custom animation of a computer playing video games against itself" (Holmes, 2018a).*

A few years later, Holmes was commissioned by the Sonnenschein Gallery at Lake Forest College to complete *Drinking the Lake*, a large-scale photographic piece that, utilizing existing data sets, visualized the rise and fall of the water levels in Lake Michigan from 1860 to 2010. Holmes is an advocate for "the capacity of art and design to heighten awareness of ecological changes," and went on to complete a PhD at the University of Plymouth, where her dissertation explored "eco-visualization:" her term for the potential of images to tell new stories with existing environmental data sets.

## **France Cadet**

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French robotics artist France Cadet served in various roles as associate professor, professor, and chair of ATS. Currently, as head of the robotics lab at the École Supérieure d'Art d'Aix-en-Provence, she continues to create works of robotic sculpture with a vision of "*exploring the complex relationship between natural and artificial, between humans and animals, between humans and androids, while blurring boundaries.*" (2018) For example, her work includes an assortment of robot dogs whose behavior has been modified in various ways. And in *Hunting Trophies* (2008), a series of eleven robotic hunting trophies hang on the wall; the robots respond to audience activity, "*showing their anger because they have been tracked, chased, killed, cut up, and exhibited as decorative icons.*" (France).

## **Heather Dewey-Hagborg**

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*"My work is project driven and my projects generally begin with a question. The questions that intrigue me are philosophical, scientific, political and theoretical. I have long been fascinated by language and speech, by learning and knowledge representation, by algorithmic models and*

*metaphors, by biological and ecological systems, and by the cultural organization of data as information"* — Heather Dewey-Hagborg

Heather Dewey-Hagborg, whose work centers on art as research and critical practice, taught in ATS from 2014 to 2016. Her work *Stranger Visions* (2012-13), explores controversial issues surrounding DNA-based identification. There has been criticism of her process—which constructs facial sculptures of individuals using DNA extracted from hair, cigarette butts, chewed chewing gum and other items found in public places—however, because it cannot be assumed that any such process is valid, her work effectively raises important concerns about forensic uses of phenotyping technology.

## **Lindsey French**

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As an artist and educator, Lindsey French frames her practice around her role as a human in a "respectful collaboration" with the natural world. Drawing on a background of landscape studies and ecological activism, French creates opportunities for communication with the nonhuman. In an era of climate change and ecological crises, French aims to destabilize the human-centric experience by temporarily inverting established hierarchies in order to propose new forms of human-nonhuman relationships. For example, in the body of work *Phytovision* (2016), French invites human viewers to adopt a 'phytocentric' perspective by creating video that has been tailored for plant perception.

## **Lee Blalock**

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With an undergraduate degree in math and chemistry, but interests and work experience in fashion, dance, design, video, sound and photography, Lee Blalock has created a potent individual place in art and technology. After she received an MFA at SAIC, Blalock began teaching in ATS, where, with a spirit that reflects the beliefs of ATS founder Sonia Sheridan, she is currently teaching a new course, *Brave n3w Bod1es*, which she describes as coming directly from her practice.

In a 2016 interview, she said, "*If I were to simplify, I'd say that I don't understand the world. So I'm interested in building worlds, in making images I may not have seen, in describing behavior rather than bodies, or re-designing bodies, and in seeing my reflection through machines or numbers or science fiction*" (Costello).

# **Marla Schweppe, Brenda Lopez Silva, and Judy Malloy**

Women whose creative practice infused their teaching as ATS faculty have also included Marla Schweppe who, currently Professor of 3D Digital Design and Undergraduate Program Director at Rochester Institute of Technology, also taught in ATS; and Brenda Lopez Silva, Director of the Realization Lab at University of Illinois Chicago, who also teaches virtual reality in ATS.

As a part-time ATS faculty member, I teach *Social Media Narratives*, incorporating personal experience pioneering online electronic literature; working in virtual communities at Xerox PARC; as core staff for Arts Wire, a program of the New York Foundation for the Arts; and as Distinguished Fellow in Social Media History and Poetics at Princeton University. I believe that the work of art students is important not only in expanding the boundaries of social media-based creative practice, but also in exploring the potential for building a more art-centered non-profit social media environment. I am privileged to teach social media narrative in ATS and work with SAIC students and faculty.

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Opposite and above: Heather Dewey-Hagborg with her *Bio Art Studio* class, Spring 2016.

Opposite and Below: Anna Yu working with the metal lathe, 2018.



# Code: Shaping Processes

Jacob Tonski



Jacob Tonski, *Balance From Within*, 2012. A 170-year-old sofa which uses an internal robotic mechanism to balance precariously on one leg, continuously teetering, responding internally to external forces. Photo: Jacob Tonski.

Code has been of central concern to Art and Technology Studies since 1977, when John Dunn first assembled and programmed a computer with the stated objective of using it to make art. These encoded sets of symbols that function procedurally or algorithmically to produce a range of desirable results permeate the history of the department and everyone in it. As the department's founding name, Generative Systems, implies, we shape processes that in turn produce things, whether through circuitry, DNA or C++.

This essay is a product of conversations I had with full time ATS faculty Christopher Baker and Shawn Decker. It's a brief discussion of distinguishable modes of thought and practice with code, old and emergent, woven through with reflections on the relationship between the force of our own will and those produced by the processes themselves. While I'm thinking primarily of computer programming, the ideas extend far beyond that.

I see many apparent wills at work when humans develop technology. I have often heard the comment that some art and technology work seems more like a technology demo than art. In many cases I've felt it myself, and the demos can in fact be quite impressive. I notice how the work excites my imagination with expanding future possibilities rather than the immediate experience I am having. My attention is dominated by the potential capabilities of the tools rather than the aesthetic, perceptual or cognitive affect of the work.

In situations like these I have often felt the force of the will of the tools more than the will of the artist—a force some call a technological unconscious. There is an old saying that if all you have is a hammer, everything looks like a nail. At the root of this I find some part of the human condition. A table saw, optimized to cut a straight line, does not induce one to think in curves and it is very difficult to cut a piece of wood with a screwdriver. Each tool, material and process has affordances—those forms and actions which they easily assume versus those which they do not. Without concerted effort to the contrary, we tend to think in terms of the easily actionable vocabulary at our fingertips. A tool expands our thinking and, at the same time, constrains it.

I pay attention to how an artist negotiates between their own will and these forces in their work. I talk to my students about how to direct their will into their work while remaining attentive to the pressure which the will of the tools or processes exert.

While talking about the effects of formal engineering training, Christopher Baker finished a sentence for me recently. I was saying to him, "Sometimes I can't help but see code as anything but..." at which point Christopher interjected, "a hammer?" "Exactly" I replied. I appreciate that I tend to see the tool as an extension of my body, much like a hand tool, but I also feel that this perspective can blind me to the "everything looks like a nail" effect.

One way to see code, and arguably the most ubiquitous one in engineering fields, is as an objective tool which does the bidding of the author. Design and specifications precede technical implementation. I worked professionally as a software engineer and this was the dominant process everyone around me used.

My own process has always been rooted in body-oriented human gestures extended through digital tools. I often

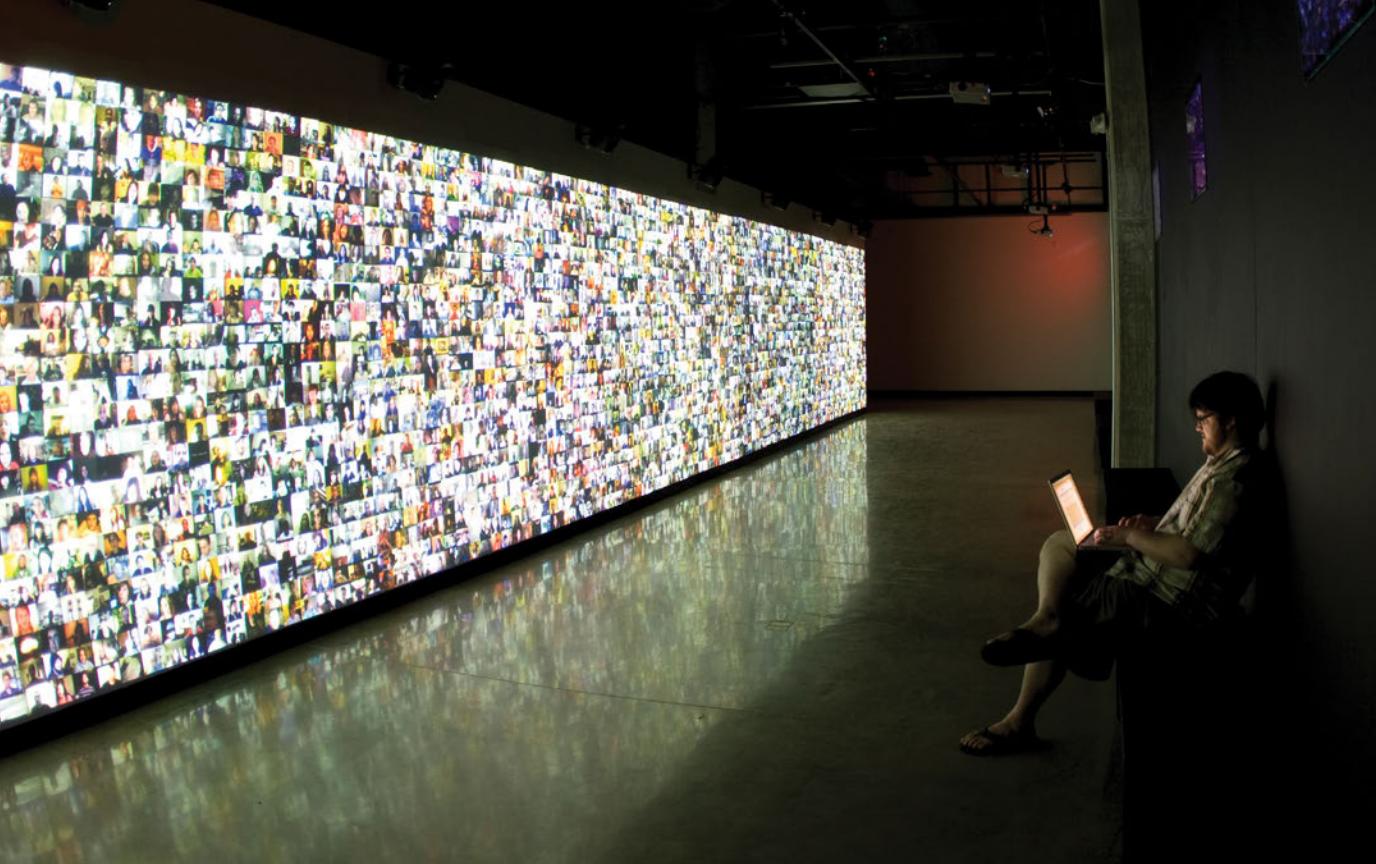
think of the steps I might take with a pencil or a hand tool and then instruct the computer to do the same. This is procedural thinking, much as I was trained to do it in an academic computer science curriculum. Imagination was treated there as a mystical dark art, and the goals of the project were typically dictated from above. Writing code was not taught as a process for exploration or chance. Through art culture and practice, I learned how to use code in an open-ended fashion (more on that below), but those first impressions are difficult to shake. Some days my automatic conception of code is as a hand tool more than a vehicle for discovery. I know what it's capable of and I execute a known process to attain a known outcome.

My own exploration and imagination often happen at an abstract level of meanings, feelings, and perceptions, away from the materials and tools. The craft happens much like implementation, following primary inspiration, strategically, with tools in hand.

Of course, even if I am using my tools in straightforward service to my ideas, I have learned to listen to them while I'm working, as they are a constant source of inspiration as well. The phrase "happy accidents" is often used to describe the moments of inspiration which, while working towards some goal, unexpectedly send the project in new directions.

In professional software engineering environments, the only will anyone ever seemed to take note of was the programmer's, and certainly never even in those terms. We discussed managing "feature creep" (new ideas that occurred during development) but the ideas were still understood to be the programmer's. On optimistic days we discussed the art of our craft, and on pessimistic days we shared that we felt like mere technicians turning wrenches. When we discussed mastery of tools, it always seemed we were speaking of technical knowledge. Looking back now, I wonder if we didn't realize that we were also speaking of how our will could fully control the process.

I spoke with colleague Shawn Decker about how he employs code in his practice. He described his primary mode of work as exploratory. There is no design or specifications phase. One begins without clear, preset end goals, and through experimentation seeks new territory. One picks a heading and embarks with open eyes and ears. A whim might excite a burst of "what happens when



I... ?” The path is filled with unexpected results, some of which excite further exploration and some of which do not. One navigates intuitively, producing a lot of material, identifying the emergent common threads, sifting the extraneous, isolating the underlying hooks and subtle details through careful observation.

The role of will here is more subtle. One learns not to impose destinations, but rather interact with the process playfully, attempting to assemble the conditions for emergence, inviting surprises, using all the senses in critical reflection, constantly allowing the output to function as input to the creative flow, taking part in a feedback loop between human and technology. The author, without question, imparts will, but the affordances of the tools and the forces of circumstance are granted partner status.

In my experience, the principles and practice of exploratory coding are not taught (or even well understood) in mainstream STEM fields of practice. These ways of thinking and making are taught widely in Art and Technology Studies classes, and reflect a widespread embrace of the same in the growing creative coding field at large. In recent years I've seen many people recognize that this way of making is powerfully suited to discovering new areas of both research and aesthetic experience.

Human languages are stretched, prodded, reconstructed and coerced to all kinds of powerful and evocative

results. Programming languages were conceived so we could embody our desires in machines. Programming languages, with their formal grammar syntax, also make grammar into something which can be formed in the sculptural sense of the word. While some changes of form break meaning, to humans or computers, others soften it and expand its potentials. The text of the code itself is capable of functioning in linguistic and expressive ways, and code's original utility thereby shifts registers significantly. One explores what code can say. The actions performed by the code can be observed through a lens of poetry rather than prose or practical utility. It creates a world and invites one in.

In the last few years, Christopher Baker's research and creative work have been focused on machine learning and artificial intelligence. This has been shaping his creative products in new ways. He describes the experience of working with these techniques as a fusion of the three preceding modes of work.

In machine learning techniques, an algorithm is not a set of instructions but a system which can be trained for a range of tasks, such as recognizing correlations between different patterns of data. ML is ushering in a new paradigm in which one shows a computing system examples of the desired outputs and an algorithm finds a way, loosely speaking, to produce it in future scenarios. Instructions to perform the specific task are never written. The explicit instructions of the code are merely how to identify patterns and make correlations. The inner

workings of those trained systems in operation can be at times mystifying, even to their designers.

In a procedural system, the algorithm has inputs which shape the output, and these can be explicitly designed to control desired features. In a machine learning system, the outputs are still determined largely by the inputs, but these do not necessarily take the form of control knobs. The inputs are largely the choices the human makes about the things with which the system is trained. To adjust the system later might require a complete retraining based on adjustments to the training set.

I see enormous similarities between the choices made in training an AI algorithm and the choices parents make raising their children. To what should the trainee be exposed? Which of those examples are called normal or good? Which are important and which are considered outliers? What histories do we keep secret? The learners identify the patterns but the trainers filter the inputs and the meta-data.

Those who work with machine learning refer to the effect of the creator on the training set as "bias." I think it's worth pointing out that this word suggests an underlying belief that there is an objectively correct, or "unbiased" possibility for a training set. If someone made a claim that there is an unbiased way to parent a child, I think it would attract ferocious criticism. I propose that training a system instead expresses values, or the will (conscious or unconscious) of its creator.

As the system's training increases in complexity, the trainer's ability to exercise their will shifts from authority towards negotiation. If we want to persuade

a seasoned trainee of something, it will take far more examples to shift their opinion, whether human or machine intelligence.

And so I wonder if, sociologically speaking, the will of the tools could be growing? Will the experience of working with AI be less like working with a tool and more like working with an assistant or a collaborator? What will the affordances of these methods prove to be? What will be easy? What will be difficult? Will the technological unconscious begin to exhibit memory and heredity? How will this impact concepts of authorship, of the individual as the locus of creativity? Will algorithms deserve authorship credits?

These are speculative questions, to be sure. But one thing I'm certain of, from experience, is that no matter how we work, processes and tools exert forces on us which are very real and express values which may or may not be our own. In learning to notice and recognize them we are empowered to make more conscious choices about how we negotiate with them.

Opposite: Christopher Baker, *Hello World! or: How I Learned to Stop Listening and Love the Noise*, 2008. Multi-channel multimedia installation, comprised of thousands of video diaries gathered from the internet. Collection Saatchi Gallery, London.

Below: Shawn Decker and Jan-Erik Andersson, *Bird's Nest Evanston*, 2007. Immersive sound sculpture with 40 internal speakers, custom microcontroller, and original C code. Photo courtesy of the artists.



# Bodies in Performance

Lee Blalock



Lee Blalock, *sy5z3n\_4: Medi(a)tation for Virtual Respiration*, 2019. Live performance with 56 modified resin Buddha models, 40 solenoids, 28 LEDs, wood, gold leaf, custom software, video, and sound. Hunter College Art Galleries. Image courtesy of Hunter College Art Galleries.

Happy Anniversary, ATS! Of the many acronyms associated with SAIC, ATS is the voice on the front porch calling me home. Happy 50th Anniversary, to be precise. A milestone of achievement, certainly, but also a 50-year index of perpetual experimentation and radical re-understanding of what it means to live within systems changing at barely perceptible speeds. Google tells me that the gift for a 50th anniversary is gold. Mental hyperlinks bring me to thoughts around alchemical processes, which provide me with a sense of connectivity to the history of the department through my lived experience and evolved relationship with the words body, human and performance.

In 2016, I was asked to contribute to an online forum discussion attended and populated by educators working with new media and emerging technologies. I'd written an emotive piece called *Generative Behaviors* which deliberately placed distance between my practice and the word 'performance.' Just baby steps from being a manifesto, I'd proposed that performance was an oppressive term, used to describe what happens when I leave the solitary environment of my apartment to make a way through the world without much bother. I'd determined that any live work that I chose to put into the world through my practice be seen as body modification by way of behavior. I went on to write approximately 1150 words describing an impossible behavior-based piece that would never (and could never) take place in the physical world. As an artist of the technological ilk, I was responding to the seemingly impossible task of performing hybridity in real time and in real space. It is 2019 now, my relationship to the word has blossomed, and this short essay is a love letter to the endless alchemical process of 'becoming' in a timeline parallel to that of my beloved department, Art and Technology Studies.

In her article "Posthuman Critical Theory," Rosi Braidotti describes (through Deleuze) the present as "...both the record of what we are ceasing to be and the seed of what we are in the process of becoming; it is here and now, but also virtual."<sup>1</sup> Even as I write this, I inhabit multiple bodies: one superimposing recent impressions onto the past memories of another, and yet a third who seems to have a clear bird's eye view of the entire process. While ATS was in its first decade, cybernetics shifted from 1st order to 2nd order when cyberneticians recognized that they, themselves, were part of the systems they were studying. I occupied a body at this time, though any notions of my own participation in any systems would have served only as an imprint on my subconscious. I can attest to seeing quite a bit of *The Six Million Dollar Man* and *The Bionic Woman* and hoping to be better,

faster, stronger. But I was only observing the possibility of LeeBody 2.0 with no practical ideas as to how to induce these upgrades and reconstructions. Meanwhile, Sonia Landy Sheridan founded the Generative Systems department and introduced reprographic techniques that would manipulate and reconstruct images of bodies using equipment previously untouched by artists.

As ATS was entering its 2nd decade, Donna Haraway's "A Cyborg Manifesto" (1985) was published introducing the idea that boundaries between humans and nonhumans were fluid. In fact, according to Jennifer Parker-Starbucks, Haraway's theory was one of two radical theories which "emerged to challenge the assumptions of totalizing humanist positions."<sup>2</sup> I wouldn't have caught wind of this theory save its obvious influence winding through all things more-than-human. I have no doubt that presentations of the cyborg were created by artist / designers who were carried along with the current of the collective subconscious that created the need for Haraway's text. At the same time, I wouldn't have had to have been a fan of the X-Men or any other superhumans in order to find my way to hybrid bodies.

The term cyborg had been introduced by Manfred Clynes in 1960.<sup>3</sup> I had seen photos of astronauts and their external organs and still find myself fascinated by images of these survival suits. You mean I can just add something to this shell in order to extend its function? Nevermind that Clynes was suggesting that the human itself be altered (from the inside out) to survive the void without an external suit. The point was that this human body could be significantly modified to suggest a form of self-directed evolution. There were different ways to do this. While prostheses were designed to replace what's been subtracted from the body, appendages were additive. They would change the shape of the silhouette, change the gait, change the distribution of weight. These are major alterations to the human animal. Cyberpunks would've enjoyed these alterations as well and would have been a more accessible way to enact the cyborg in this decade. We can't all be space travelers or deep sea divers.

When ATS reached its 30s, I was leaving my teens and performing the painful identity of a college student. It is as if I somehow knew that shape-shifting through variations of self would eventually send me careening toward practices of embodiment, performing an assemblage of personae. Two texts from this decade come to mind. Robert Pepperell first published *The Posthuman Condition* (1995) and four years later, N. Katherine Hayles published *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999). Cognition

was distributed throughout the body and not limited to the space between the ears. The body was being considered down to its cells and was being extended into its technological environment to the degree that they are indistinguishable. In 1995, Peter Gena produced his first piece in a series called *DNA Music* and published "Musical Synthesis of DNA Sequences." In 1997, Eduardo Kac coined the term "Bio Art," in relation to his *Time Capsule* artwork, in which Kac self-implanted a digital microchip live on television and on the Internet; online participants were able to retrieve the digital content from within Kac's body. In 1998, Kac published his "Transgenic Art" manifesto, introducing the world to a new art form in which genetic material is transferred from species to species. Committed to the performance of hybridization, ORLAN created multiple performance-surgeries throughout the 90s. In 1999 Stelarc presented his project *Extra Ear* to a gathering of surgeons at The Grand Round, John Radcliffe Hospital, Oxford University. I would have only been made aware of the art world's interest in hybrid bodies once I arrived in Chicago to attend SAIC. Notwithstanding the remarkable animated film *Ghost in the Shell* (1995), which introduced the world to the most introspective cyborg ever, these new bodies were fantastic. These were bodies bringing visibility to the technology beneath the skin. They planned (and would eventually host) supernumerary body parts, and they used digital space to birth impossible crossbreeds.

ATS was 40 when bodies really mutated. From 2003 to 2008, Kac created *Natural History of the Enigma*, an artwork featuring "Edunia," a petunia with his DNA in the flower's red veins. In 2007, ORLAN created *Harlequin Coat*, a biotechnological coat of petri dishes containing her skin cells mixed with the skin cells of others. In the same year, Yann Marussich performed *Blue Remix*, a dance of stillness where all fluids oozing from the artist's body during the performance (including sweat and tears) revealed an inky blue color. The insides are literally

crossing the threshold of the skin in this decade. Artists were handing performances off to the body's DNA, cells and fluids. In my parallel world, this was the decade of *The Matrix* and all of the accoutrements that were part of the franchise. Life-changing depictions of living programs in a slick cyberpunk setting pulled me from a career in design to an experimental art school. Wasn't this story aligned with the books from the New Thought movement saying that you could construct your own reality?

I was catching up to you, ATS. I had breached my shell and decided to let technology pick up some of the slack that a single identity couldn't carry. I had been introduced to important philosophical threads through the lens of a pop culture phenomenon (and the stack of philosophical books that were published in its name as a result). By now, I could describe my self, my body, my human, et al. In the world of ATS's 4th decade, the body continued to shift and naturally bring the definition of the human into question along with it. If performance inherently suggests a body and if performance primes the observer to expect a human self as its conduit, where does that leave the performer who inhabits a self which could only be described as unfinished? By this time, the natural self isn't the only option available to us.

Until the beginning of my graduate studies in 2009, my own performances had been strictly choreographed or illustrated digitally. At some point in its 5th decade, ATS became my home and my relationship to performance changed to include terms such as behavior and embodiment. There are other terms that locate my practice, some of which suffered from ubiquitous citation and Hollywood overuse. I bring them into my classrooms in an effort to propose a degree of depth that works to generate thought experiments. In fact, the first reading assigned to students in my class *Br4ve N3w Bod1es* comes from artist and scholar Marco Donnarumma by way of his paper, "Beyond the Cyborg: Performance, attunement, and autonomous computation." While introducing an

Eduardo Kac, *Time Capsule*, 1997. Microchip implant, seven sepia-toned photographs, live television broadcast, webcast, interactive telekinetic webscanning of the implant, remote database intervention, X-ray of the implant, dimensions variable. Collection Beep. Courtesy Henrique Faria Fine Art, New York. Photo: Carlos Fadon





Lee Blalock, *Oddity()*, 2014. Live performance. Museum of Contemporary Art Chicago. Photo: Michael E. Smith.

assignment wherein students will propose and produce a body augmentation using physical computing techniques, I introduce students to all of the aforementioned concepts from the perspective of an artist whose practice revolves around “radical embodied experimentation.” Donnarumma writes, “The warm cocoon of human integrity is not broken by transgressing certain limits of the body, but rather by accepting the possibility of mutual affection between oneself and something ‘other.’”<sup>4</sup> In performance with nonhuman bodies, neither of the bodies needs to disappear. An entirely new body emerges through the blurring of boundaries. In her article “Becoming-Animate: On the Performed Limits of ‘Human,’” Jennifer Parker-Starbucks frames performance in a way that reverberates like thunder through my practice now. She writes, “Performance is itself a becoming, a laboratory, pace Grotowski, in which to explore. Never fully fixed, open to all alliances, and mutually dependent upon its components, performance is an obvious area for experiencing and exploring becomings.”<sup>5</sup>

I’m here now, part of the infrastructure of the department, and what of my relationship to performance currently? I’ve performed my medical data, I’ve performed with my post-cyberpunk band, I’ve created conditions for inanimate bodies to perform in my stead and, by the

time you read this, I will have performed a meditation by breathing in time with an electronic shrine to body modification in *sysz3n\_4: Medi(a)tation for Virtual Respiration*. Thank you, ATS, for the histories, the context, the inheritance of distant cousins I’ve yet to meet, and radical experiments that tie this network of ideas together under one constellation. It’s fitting, isn’t it, to speak of outer space in terms of hybrid bodies and shared experiences between human and nonhumans when the world is racing to get our bodies to Mars? Imagine the theories that will make their way through these hallways in the near future as we think of moving bodies away from Earth. Here’s to the next decade...and beyond.

#### Notes

<sup>1</sup> Rosi Braidotti, “Posthuman Critical Theory,” *Journal of Posthuman Studies*, vol.1. no.1, 2017, pp. 9-25.

<sup>2</sup> Jennifer Parker-Starbuck, “Becoming-Animate: On the Performed Limits of “Human”,” *Theatre Journal*, vol.58. no.4, 2006, pp. 649-668.

<sup>3</sup> Manfred E Clynes and Nathan S. Kline, “Cyborgs and Space”, *Astronautics*, September 1960, p.26.

<sup>4</sup> Marco Donnarumma, “Beyond the Cyborg: Performance, attunement and autonomous computation,” *International Journal of Performance Arts & Digital Media*, vol. 13. no.2, 2017, pp.1-15.

<sup>5</sup> Jennifer Parker-Starbuck, “Becoming-Animate: On the Performed Limits of “Human”,” *Theatre Journal*, vol.58. no.4, 2006, pp. 649-668.

# Poetic Media

Judd Morrissey



Above: Anatomical Theatres of Mixed Reality (ATOM-r), *Kjell Theory*, 2016. Mixed-reality performance. Graham Foundation for the Advanced Studies in the Fine Arts, Chicago. Photo: Grace DuVal.

Opposite: Anatomical Theatres of Mixed Reality (ATOM-r), *Kjell Theory*, 2016. Mixed-reality performance. Elevate Festival, the Dance Center at Columbia College Chicago. Photo: Lariel Joy.



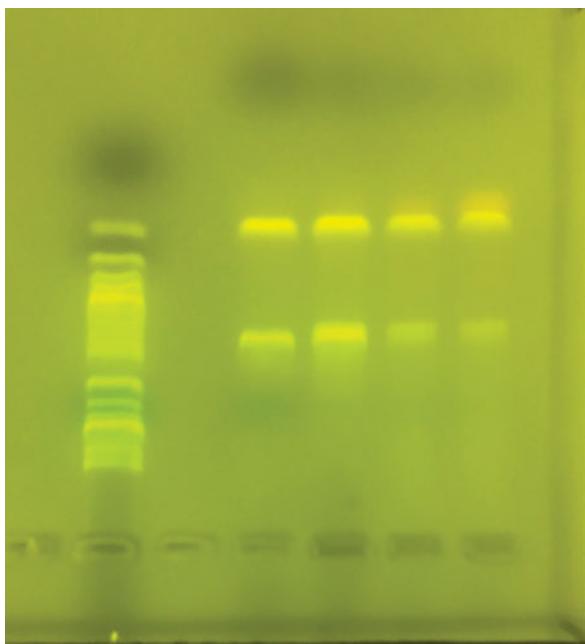
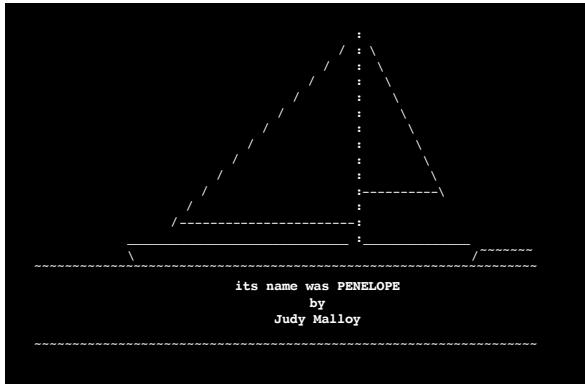
## Language is grown using code

This essay begins with a statement from David Jhave Johnston's *Aesthetic Animism* (2016), a book of criticism that reconfigures digital poetry as a living language by drawing connection between the dynamic qualities of generative and kinetic digital texts and the artistic manipulation of genetic code. "In a hypothetical future," he writes, "digital poets program, sculpt, and nourish immense interfaces of semiautonomous word ecosystems."<sup>1</sup> Jhave's writing represents a larger contemporary shift in characterizing computational texts in the language of the natural, a reversal in perspective brought about by advances in areas such as AI, machine learning, and virtual and augmented reality. However, this futurist vision of poetry actually relies on looking backwards in time to the prescient invention of Bio Art in 1997 by Eduardo Kac and his subsequent application of transgenic art to poetry in the biological mutations of *Genesis* (1999), the *Biopoetry* manifesto (2002), and *Cypher* (2009), a portable laboratory in which the reader gives life to a poem by activating its synthetic DNA.

The history of biopoetry is only one example of why Art and Technology Studies, where Kac established a Bio Art lab in 2003, is an unparalleled environment for experimentation in poetics at the unstable edges of conceptual and technological possibility. Following Kac's example, students in ATS might choose to

create poetry in the context of holography or by engineering an arrangement of scents in the Olfactory Art studio class. While other schools have programs in the digital literary arts, ATS is able to facilitate poetic explorations across a broad interdisciplinary spectrum where artists can compose with materials including language, code, light, or biological matter in an environment where the question of media is an open one and poetic works evade the known genres of contemporary and digital writing.

Kac, in his 2007 book, *Media Poetry: An International Anthology*, articulates the importance of not limiting poetic media experimentation to the digital and screen-based. A reissue of a 1996 volume, *New Media Poetry*, Kac dropped the word "New" from the title, explaining that "while "new media" is often associated with digital technology, "media" is broad enough to also encompass photonic and biological creative tools as well as non-digital technologies e.g., analogue electronic technologies and poetic experiments in zero gravity."<sup>2</sup> That this reference to zero gravity appears ten years before his Space Poetry project came to fruition only reinforces the diligence and foresight with which Kac has continually grasped, through poetry, what is beyond the horizon of the ephemeral or fashionably new to discover something unprecedented. Kac's unique trajectory has left in its wake a series of unanticipated forms including holopoetry, biopoetry, and space poetry, while also creating a body of digital poetry.



Top: A screen capture of *its name was Penelope* by Judy Malloy (Eastgate Systems, 1993; Narrabase Press, 1990; exhibition version, 1989). Published in 1993 on 3.5-inch floppy disk for both Mac and PC formats.

Bottom: David Hale, *Affliction 11*, 2017. Genetic poem.

## Deep Roots

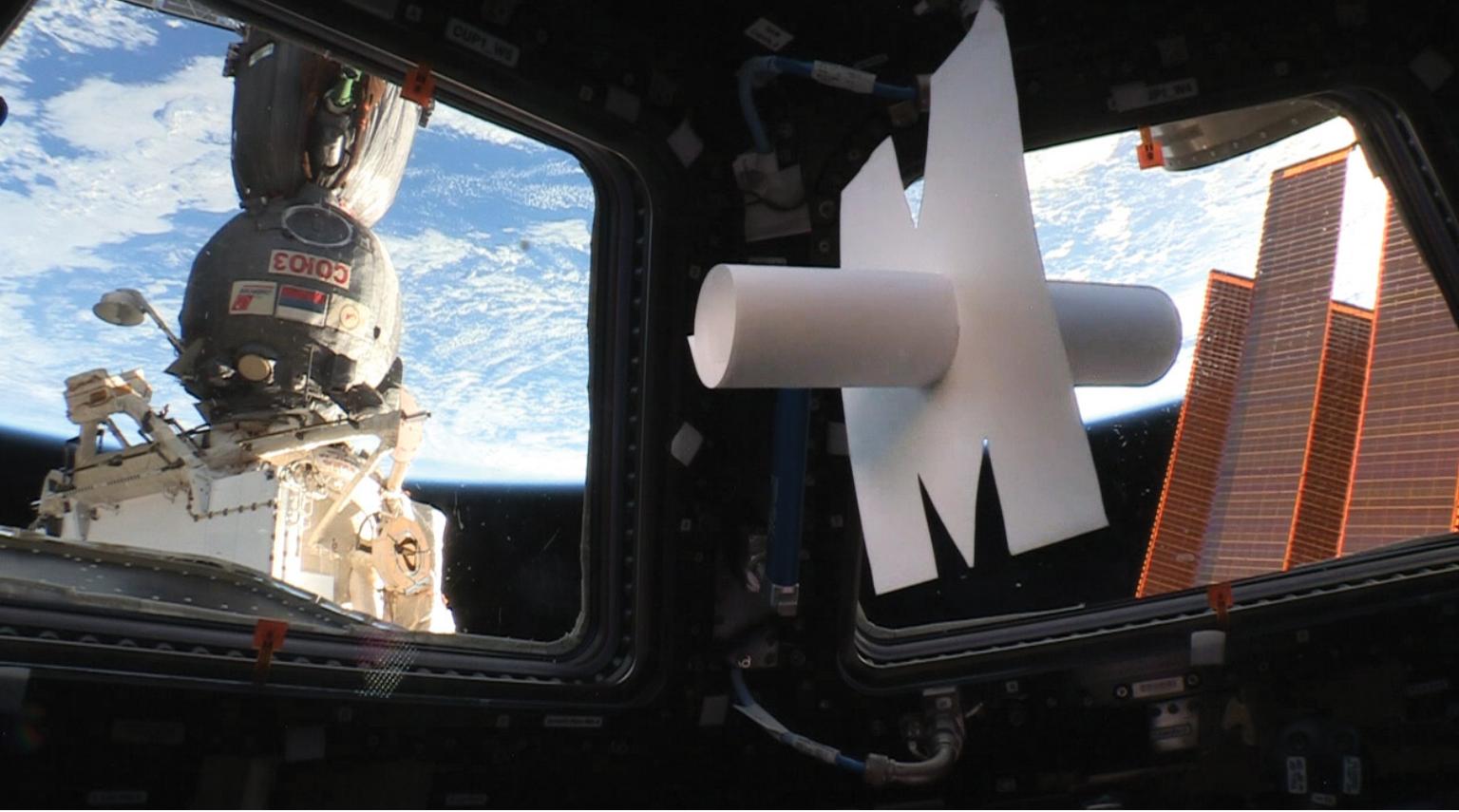
Kac's impact makes clear that the emphasis on poetic media in ATS has deep roots in the history of post-print literary production. I came onto the scene of media writing in the late 90s when, as a graduate student at Brown University, I was exposed to the early historic hypertext labs led by postmodern novelist Robert Coover. It was here that many of the most notable pre and early internet pieces of computationally-mediated language were created, leading to the scholarly and artistic field of electronic literature. I created seminal works of electronic writing including *The Jew's Daughter* (2000) and *My Name Is Captain, Captain* (2002) around this time, before expanding my practice to emphasize embodied performance and complex systems where

code, language and augmented bodies and spaces are co-generative elements in new poetic experiences.

In 2018, another historic media writer, Judy Malloy, joined our faculty to teach a course in social media narrative. Malloy was one of the earliest writers to create novel-length works of electronic writing in the '80s and '90s including *The Yellow Bowl* (1993), a work of 800 interlinked sections created in the BASIC language and which provided a groundwork for the movement of hypertext literature. Known for her hyperfictions *Uncle Roger* (1986-1988) and *its name was Penelope* (1989), she recently completed the trilogy of new media writing, *Paths of Memory and Painting* (2008-2010). Malloy and I both published with the first significant press for electronic writing, Eastgate Systems.

## Poetic Media Curriculum

ATS presents a rich context for poetic experimentation to take place within its broader curricular areas, including creative coding, electronics, holography, bio and olfactory art. The department also has a focus on digital poetry and expanded media poetics. Since joining the faculty in 2002, I have developed a series of courses including *Electronic Writing* and *Poetic Systems*, intensive studio contexts that explore a range of possibilities for new forms of poetry informed by creative coding, augmented reality, machine learning and live media performance. ATS Graduate students are also able to advise one-on-one with faculty to pursue independent poetic projects. Recent examples of notable work created in consultation with Kac and myself include Abraham Avnisan's *Collocations* (2015), an experimental mobile app exploring and performing the disruptive implications of quantum mechanics for science, philosophy and literature. David Hale's DNA poem *Affliction 11* (2017) was covered by the newspaper Chicago Reader (December 13, 2018), along with an image from Kac's work, *Genesis*. Other multidisciplinary poetic media artists who have worked in ATS include Ian Hatcher, Lindsey French, Igraine Grey and David Hall. It is striking that the works of these artists extend well beyond the presence of language on a page or screen. For example, French's *seductiveness the which issued by the whole person* is a rewriting of Virginia Woolf's *Orlando* generated by algorithmically interpreting the vibratory responses of an oak tree to which the original text is read. In the context of poetic media, the whole person may be seductively expressed as a hybrid plant-human-machine body, issuing forth both natural and synthetic responses.



## Natural Language

In his book, *The Marvelous Clouds: A Philosophy of Element Media* (2015), John Peter Durham reminds us that “well into the nineteenth century, when one spoke of media, one typically meant the natural elements such as water and earth, fire and air.” “The body,” he writes, “is the most basic of all media, and the richest with meaning.”<sup>3</sup>

It is worth noting that in Art and Technology Studies, there has never really been a typical distinction between the pre-digital, digital, and post-digital, but rather a history of experimental engagement with the forces of organic, synthetic and hybrid media. The artist Mary Flanagan writes this about Sonia Landy Sheridan, the founder of the Generative Systems area in 1970:

*“Unlike artists of the era such as Agnes Martin, Eva Hesse, and Sol LeWitt—for whom abstraction, formulae, serial drawings, and the grid were conceptual forms for both categorization and exactitude—Sheridan uses those tools to expose the living aspects, the dynamic aspects, of a system, even one that is unfinished. For her, a grid is not just a structure for calculating combinations but a conceptual premise of ongoing experiments. It is useful to consider her practice, like Marcel Duchamp’s, as “laboratory work,” though it is delimited differently. Likewise, while LeWitt’s work is mathematical and conceptually deterministic (a visual prescriptive equation*

*that is executed), Sheridan’s work cultivates colorful, energetic, organic systems that are simultaneously forgiving and generous—a very different perspective from those conceptual artists who favored the geometry, form, and abstraction provided by the grid.”<sup>4</sup>*

In reflecting on 50 years of ATS, we can consider poetic media as laboratory work in the multifaceted spirit of Sheridan as we discover, sculpt and nourish the previously unimagined lives of poetic forms.

### Notes

<sup>1</sup> Johnston, David Jhave. *Aesthetic Animism: Digital Poetry's Ontological Implications*. (Cambridge: MIT Press, 2016), 4.

<sup>2</sup> Kac, Eduardo. *Media Poetry: An International Anthology*. (Bristol: Intellect Books, 2007), 7.

<sup>3</sup> Peters, John Durham. *The Marvelous Clouds: Toward a Philosophy of Elemental Media*. (Chicago: University of Chicago Press, 2015), (2,6).

<sup>4</sup> Mary Flanagan, “The Impact of the Work of Sonia Landy Sheridan, accessed June 30, 2018, <https://maryflanagan.com/wp-content/uploads/SoniaEssay-release.pdf>

Above: Eduardo Kac, *Inner Telescope*, video, 12min, color, sound, 2017. Collection Frac Occitanie, regional collection of contemporary art, Les Abattoirs, Musée d'art moderne et contemporain, Toulouse. *Inner Telescope* was produced by L'Observatoire de l'Espace, the cultural lab of the French Space Agency, with support from the European Space Agency and the Carasso Foundation. Courtesy Galerie Charlot, Paris.

# Bio Art

Eduardo Kac



Eduardo Kac, *Genesis*, 1999. Transgenic work with artist-created bacteria, ultraviolet light, internet, video (detail), edition of 2, dimensions variable. Collection Instituto Valenciano de Arte Moderno (IVAM), Valencia, Spain. Photo: Otto Saxinger. Courtesy Galerie Charlot, Paris.



Adam Zaretsky, *Errorarium*, 2013. Custom interactive terrarium with transgenic zebrafish embryos. Photo: Thomas Lenden.

Since I first coined the term Bio Art in 1997, originally in relation to my artwork *Time Capsule*, an art movement has evolved into a mature art form and a research discipline. It goes without saying that the world has changed dramatically from the late 1990s—when a small group of artists travelled the globe to exhibit, lecture and discuss Bio Art, facing what amounted to mostly adversarial audiences—to the present time, when biotechnology is clearly understood to be a creative medium and a cultural force. Today, Bio Art is moving into its third generation of practitioners and is finding its way into private and institutional collections. This innovative art form is studied and practiced in art schools and art departments at universities, analyzed and debated in colloquia, the subject of numerous books and special issues of journals and magazines, and researched by scholars worldwide.

While the transformation of a revolutionary art movement into an accepted form may suggest that Bio Art is fully understood, the scholarly challenge to analyze Bio Art in its own terms (that is, without falling into the temptation of trying to reduce it to more familiar territory) remains largely unmet. Similarly, while kinetic and digital art currently benefit from the efforts by major museums towards the creation of restoration and preservation protocols, the same

cannot be said about Bio Art. The real challenge lies in the fact that Bio Art is truly (not metaphorically) alive and, as a result, is often sentient and responsive. Its responsiveness prompts our responsibility. It is wonderful to be able to teach Bio Art in an art school, where students can also study other disciplines, such as philosophy, literature and history, that help them grasp the larger social and cultural implications of this work.

In 1998, I submitted my *Art & Biotechnology* course to SAIC's curriculum committee and started to teach it in the Spring of 1999. I had a group of extremely curious students that included Adam Zaretsky, who would eventually pursue his own quirky style of Bio Art. *Art & Biotechnology* is a recurring graduate seminar in which I address a series of fundamental issues that inform the theory and practice of Bio Art. In 1999, I premiered my first transgenic artwork, entitled *Genesis*, at the international Ars Electronica Festival for Art, Technology and Society, held annually in Linz, Austria. To produce this work, I consulted with scientist Buck Strom, who had taught genetics at SAIC upon the invitation of Peter Gena, who composed DNA music for *Genesis*. The three of us went to Linz for the premiere of *Genesis* and engaged in productive dialogue with an intrigued audience. *Genesis* was the first work in my *Creation Trilogy* and was followed by *GFP Bunny* (2000) and *The Eighth Day* (2001), which completed the trilogy.

Interest in Bio Art and its potential influence in other fields increased. In 2000, I hosted, together with architect and SAIC professor Anders Nereim, a symposium on *Tissue Culture, Art and Architecture*, that also included the participation of Jeffrey Miles, Oron Catts and Ionat Zurr. It was open to the entire SAIC community and took place in the MacLean Ballroom, one of our largest spaces. The full house confirmed the growing interest among students and faculty from multiple departments across the School. As time went by, I continued teaching my *Art & Biotechnology* course and, by 2003, felt that I had established the necessary level of literacy among the students and had built enough of a following to warrant the creation of a dedicated Bio Art lab. I hired grad student Yutaka Makino to assist me, and we started to build the lab with basic tools (such as petri dishes, incubator, refrigerator), that enabled simple processes, including plant growth and transformation of *E. coli* bacteria with GFP—Green Fluorescent Protein. (On a side note, Yutaka is now a successful, Berlin-based artist who creates performances and installations that render the processes of human perception tangible to viewers). To build and run the lab, I obtained the support of Steve Waldeck and the approval of Carol Becker, who was the Dean at the time. Carol supported the development of Bio Art at SAIC and didn't impose any restrictions; she only asked that I consult with her if in the future I planned on working with mammals on campus. Her support was essential and, by then, had already manifested itself in two fundamental ways. First, in 2000 she had put SAIC's lawyer in contact with the

lawyer from the French lab where Alba, my GFP rabbit, was born. This was in order to facilitate Alba's arrival in Chicago. The second way in which Carol showed her support was in the form of an article about my work *GFP Bunny*, which she originally published in the Fall 2000 edition of the *Art Journal*, published by the College Art Association. She also included the article in her book *Surpassing the Spectacle: Global Transformation and the Changing Politics of Art* (Rowman & Littlefield, 2002). Undoubtedly, our dialogue on Bio Art was well underway by the time I started to build the lab.

The lab was located in a very small room on the back of MacLean Center's fourth floor. It was just a few steps from water sources but it did not have running water, itself. This, and other limitations, made it clear that, while useful, this room was a temporary home for the lab. A new one would have to be found.

Contributing to the larger scholarly discourse, I published the book *Signs of Life: Bio Art and Beyond* (MIT Press, 2007), capturing the birth and development of Bio Art, as well as its core historical and theoretical issues. In 2009, I created the *Bio Art Studio* class and trained graduate student Patrick Cunningham to teach it. Patrick taught the undergraduate class from 2010, the year he graduated, to 2013. Patrick was always very interested in relational art and collaborative projects. While a student, he organized numerous hackathons and curated exhibitions of work by fellow grads. When teaching the *Bio Art Studio* class, he brought his collaborative spirit to the classroom and encouraged the undergraduates to work with one another.

Finally, in 2014, the opportunity presented itself to build a dedicated Bio Art Lab, with a sink and proper exhaust system, and eventually to hire Lynika Strozier as lab coordinator. It is important to be clear that the Bio Art Lab is exclusively an art studio and not at all a science lab; the latter is a different facility located in the Liberal Arts department and solely devoted to the teaching of science. The Bio Art Lab, which is located in the basement of the MacLean Center, and is an integral part of the Art and Technology Studies department, is a biosafety level 1 (BSL-1) facility, the lowest of the four levels. This means that we typically work with DNA strands, mycelium and low-risk microbes, such as nonpathogenic strains of *E. coli*. Essentially, the CDC stipulates that, in BSL-1 labs, "standard microbiological practices are followed; work can be performed on an open lab bench or table; and personal protective equipment (lab coats, gloves, eye protection) are worn as needed." *Bio Art Studio* classes have been taught by Heather Dewey-Hagborg, Hunter Cole, and Andrew Scarpelli. In addition, we have also offered



Bio Art Lab Coordinator, Lynika Strozier. 2018. Photo: Michael Powell.



ATS Bio Art Lab, 2018. Photo: Ziv Cohen.

other classes, such as *Synthetic Futures*, which allowed ATS students to participate in the annual Biodesign Challenge Summit in New York, where they presented and defended their work before a live audience. The *Olfactory Art* class, taught by Tedd Neenan, also takes place in the Bio Art Lab.

Throughout the years, ATS has hosted individual lectures and presentations by leading names in Bio Art, including George Gessert, Oron Catts, Paul Vanouse, and Marion Laval-Jeantet & Benoit Mangin. ATS has also hosted lectures by curators, philosophers and scholars with a focus on, or stated interest in, Bio Art, such Jens Hauser, Annick Bureaud, Dominique Lestel, Lori Andrews, and Zhang Ga, to name a few. Students interested in Bio Art also benefit from parallel opportunities at SAIC, such as the ongoing lecture series *Conversations on Art and Science*, which brings noted artists, designers, and scholars to campus, and the *Scientist-in-Residence* program, an initiative that brings a scientist to campus for an extended period, thus enabling students to have a sustained dialogue with specialists in different fields.

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**ISBN:**

978-0-578-51202-0

Published by the School of the Art Institute of Chicago, 2019.

**Cover Image:**

Lee Blalock, *Solenoid mask instr/augment*, 2018.

Photo: Sophia Barr Hayne.

**Back Cover Image:**

Jan Tichy, *Artes in Horto*, 2018. 11 min, video projection on  
the facade of the Merchandise Mart, Chicago.

Photo: Jan Tichy.

**Acknowledgments:**

Funding for this publication was provided by the Office of  
Admissions. Funding for ATS@50 events was provided by the  
Provost Council and by a generous donation from George J.  
Still Jr.

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