GALLERY GUIDE

COMPLEXITY | *ART AND COMPLEX SYSTEMS*

SEPTEMBER 14 - NOVEMBER 24, 2002

SAMUEL **DORSKY** MUSEUM OF ART

COMPLEXITY

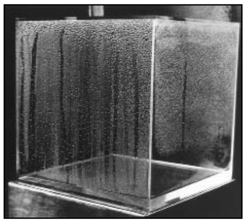
In recent years artists have paid significant attention to a number of now familiar technologies. The World Wide Web, genetic engineering and biotechnology, virtual reality, telepresence, and robotics have all made their mark on the art world, and we have seen an explosion of shows featuring new media, biotechnology/genetics, and digital culture. These topics, while important, seem to us to be only part of the story. A deeper current, one with far reaching implications across the physical, biological, and social sciences, is only now beginning to gain recognition in the public eye and as a unifying theme addressed by increasing numbers of artists. That deep current, that unifying theme, is Complexity. At a time when the term has been weakened due to overuse, complexity as a topic and a world view is truly a new paradigm.

What is complexity? Even among scientists there is some disagreement as to the necessary and sufficient conditions for a system to be deemed "complex." By "complex" scientists do not mean "complicated" or "perplexing." Generally, complex systems include large numbers of components interacting in nonlinear ways, and often leading to surprisingly self-organized behavior. In common language one is reminded of the saying that "the whole is greater than the sum of its parts." For many, complexity is something available in varying quantities. For some, a measure of complexity is the effort needed to describe a system's "effective regularities."

Examples of complex systems are familiar to everyone and include weather prediction, the stock market, the brain (as studied by biologists) and the mind (as studied by psychologists), the predation and population cycles of animals in an ecosystem, the competition of genes and resulting evolution of a given species, and the rise and fall of cultures and empires. These systems exhibit "emergent behavior" which is deterministic (meaning mechanical rather than mystical), and yet dynamic and ever changing. Complex systems develop in ways that can be dramatic, fecund, catastrophic, or so unpredictable as to seem random. Thus complexity science is simply the application of the scientific method in the study of complex systems.

It is important to recognize, however, that art as a distinct discipline offers its own unique approaches and epistemic standards in the consideration of complexity. Artistic approaches to complexity encompass visualization, repetition, sequences, relationships of text to image, and varied methods of transformation. Some artists (e.g., Paul Hertz, John Simon Jr.) are clearly well informed about, and directly apply, complexity science in their work. But they are also critically aware of design and material factors that mediate presentation. For others (e.g., Nancy Chunn, Janet Cohen) it is more important to form a personal, direct response to complex systems apart from the new traditions of complexity science. Jonathan Callan has invented his own artistic methodology, which relates to aspects of complexity science. While Jack Ox engages transformational systems of art, music, and mathematics in her digital prints, collaborators Remo Campopiano, Guy Marsden, and Jonathan Schull stress the emergent behavior of living organisms. Hans Haacke and Steina & Woody Vasulka began working with and focusing on complex systems many years before the phrase "complexity science" was first uttered.

The premise of our exhibition, COMPLEXITY, is that a broad swath of art reflects aspects of complexity and responds to the science of complex systems either intentionally or intuitively. Our belief is that the visual and material aspects of the art works will establish threads of correspondences that the viewer can follow within each work and with other, related works. In fact, the works are largely visually self-explanatory even though the specific methodology of their creation may not be accessible. Many works in this exhibition are time-based or reveal the action of time, including the photographs by David Goldes and the DVD works by Karl Sims and Nell Tenhaaf. Daro Montag's photographs reveal the imprint of the real, such as that caused by the action of bacterial decay upon negatives. Although the structures the artists create are varied, they can tap into natural material processes (e.g., Brian Lytle, Daniel Reynolds) or simulate natural processes through repetitive, simple actions (e.g., Manuel Baez) and invented computer algorithms (e.g., Leo Villareal, Philip Galanter). Ellen K. Levy's approach is to model a complex adaptive system by means of a dynamic database. In this exhibition, the nearby juxtaposition of visually related works by Frank Gillette and Mauro Annunziato highlights art styles, themselves, as complex adaptive systems. Gillette's work resembles an illusory view of Jackson Pollock's studio floor, and Annunziato's work brings Art Deco to mind as readily as fractals.



Hans Haacke
Condensation Cube
1963/65
acrylic plastic, water, climate in area of display
9" x 9" x 9"

Chaos, fractals, regularities, emergence and other features of the complexity sciences have ramifications for the arts. However we don't view complexity as the basis for an art movement or style. Part of the appeal of complexity science to artists is that it offers an open-ended model for making art. The artistic response to complexity spans a number of media, including painting, prints, photography, drawing, and even living ants. There is also sculpture, video, installation, mixed media, and computer screen-based work. Complexity art is a matter of content, not complicated technique. We see the science of complexity as a field of inquiry that not only creates bridges across many branches of science but also offers a revolutionary intellectual force, which has ramifications for other disciplines such as art and philosophy.

During the 20th century science proceeded by way of ever narrowing specialization. In parallel to this, the scientific method encouraged the practice of reductionism, the breaking down of phenomena into (literal or figurative) atomic parts. The field of complexity has reversed both practices. Encouraged by organizations like the Santa Fe Institute and the New England Complex Systems Institute, there is a new international dialog taking place between physicists, psychologists, biologists, economists, chemists, management and organization experts, and many others.

We find it encouraging that many contemporary artists have followed a similar track, attempting to take on more rather than less and looking outward at the universe rather than inward at an insular vortex of art-world semiotics. In our research we have found that artists engage the realm of complexity in four general ways. Some artists fit into several of these categories.

Portraits - Artists can create presentations of natural complex phenomena that transcend typical scientific visualization, evoking both a visual understanding and an emotive response in the viewer.

Descriptive Systems - Artists also experiment at various levels of abstraction. Artists will often invent innovative, possibly idiosyncratic systems, which describe complex phenomena in a way that does not occur in the sciences.

Commentary – Just as artists have commented on other scientific ideas and technological applications such as computers, genetics, and so on, they are now becoming engaged in commenting on complexity science itself.

Technical Application – The study of complexity offers a new rich toolbox for artists who create works via generative systems. Such techniques include: genetic algorithms, swarming behavior, parallel computational agents, neural networks, cellular automata, L-systems, chaos, dynamical mechanics, fractals, a-life, reaction-diffusion systems, and emergent behavior.

As artists and exhibition organizers we don't see the presentation of this show as a task completed or a chapter closed. Rather we view COMPLEXITY as an open door to a future of further exploration and discovery for artists and scientists alike.

Acknowledgements:

An exhibit like COMPLEXITY requires the combined efforts of many people. We thank the exhibiting artists and the galleries that represent them for the loan of the many works being shown. We also acknowledge Jack Ox for her invaluable contributions in the early planning of COMPLEXITY, as well as Cynthia Pannucci of Art & Science Collaborations, Inc. (ASCI) and Yaneer Bar-Yam of New England Complex Systems Institute (NECSI) for their advice and moral support. We extend our thanks for the institutional support provided by SUNY New Paltz, the Samuel Dorsky Museum of Art as well as the Dorsky family, and in particular the Director, Neil Trager, and the staff of the SDMA, Scott Christie, Cindy Dill, Beth Hill, Wayne Lempka, Shannon McKinzie, and Nadine Wasserman. We thank Shelly J. Smith, David E. Levy, and Laura Abel for their help and kind support throughout this effort. Finally we acknowledge the inspiration provided by the Santa Fe (Complexity) Institute, founded by Murray Gell-Mann, and the Exploratorium in San Francisco, for its exhibition, "Turbulent Landscapes."

—— Philip Galanter and Ellen K. Levy
Exhibition co-organizers

Cover: David Goldes, *Jar,* 1998, gelatin silver print, 24" x 20"

COMPLEXITY ARTISTS

How does our exhibition model complexity and emergence? The artists in COMPLEXITY address issues of complexity through their art works in this exhibition as follows:

Mauro Annunziato is a founding member of Plancton Art Studio where he works with other artists and scientists in the investigation of artificial life and the application of scientific complexity to artistic interests.
Issues: artificial life, chaotic attractors

Manuel Baez explores the interrelationships among form, structure, and generative processes in his architectural sculpture. Using a flexible joint, he constructs Fabrications that generate a wealth of forms and structures through the emergent organizing properties of the integrated assemblies.
Issues: dynamics of tensegrity-like principles, emergence

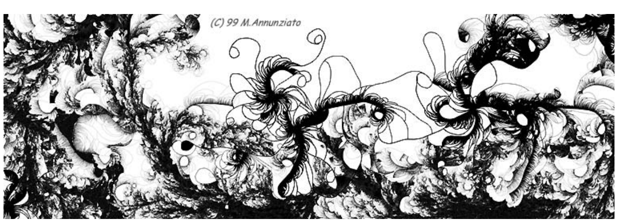
Jonathan Callan establishes conditions of unpredictable accommodations to displaced matter in his collages. He punctures books and maps and infuses the resultant network of holes with silicon. The displaced matter is subject to forces analogous to shifting plate tectonics. Callan relates his concerns to that of the philosopher, Austin, who likened language to a net with which we capture parts of experience. Callan seeks to capture the parts that fall through the net.
Issues: generative, time-based dynamic activity to develop a portrait of complexity

Remo Campopiano, **Guy Marsden**, and **Jonathan Schull** worked collaboratively using sophisticated computer technology engaging aspects of robotic and mechanical engineering. In their work the social behavior of an ant colony drives the mechanical display creating a complex mapping of the organic into the inorganic.
Issues: time-based dynamic activity, emergence, swarm behavior

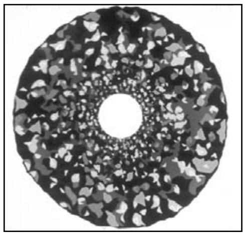
Nancy Chunn annotates the front pages of the New York Times over the span of a year, locating patterns of interacting systems (e.g., political, socio-economic). Time shows the emergence of recurrent patterns.
Issues: time-based dynamic activity descriptive of and a commentary on complexity and emergence

Janet Cohen tracks chance and probability through clusters of pencil marks in drawings that record baseball games. By portraying the great variety inherent in patterns of action and response, she systemizes the world of gamesmanship. She incorporates the symbols of scoreboard notation in her drawings, designating the home team as black and the visiting team as red.
Issues: chance, clustering, time-based dynamic activity descriptive of complexity

Philip Galanter creates various kinds of generative software and hardware systems. For this show a (virtual) reaction-diffusion system creates a chemical substrate of varying concentrations. Various objects/marks are formally determined by their genetic structure, including L-system and gradient tracking behavior. Various gene types take root and grow based on the local concentration of the substrate, resulting in clusters and border markings.
Issues: generative art, L-systems, reaction-diffusion systems, genetic programming



Mauro Annunziato, *Chaos Revenge*, 1999, digital print, 21" x 61"



Paul Hertz
Gravity Swings
2001, digital print
44" x 48"

David Goldes creates photographs that portray seemingly straightforward scientific experiments. He generates conditions of turbulence and then captures these phenomena in gelatin silver prints. He investigates the physical properties of the elements, especially water. For example Goldes has created a miniature vortex in a glass jar by using a magnetic stirrer.
Issues: creating conditions for turbulence to achieve a portrait of complex behavior

Frank Gillette creates chromogenic prints through a transformative process. He applies several different computer programs to his scanned nature drawings. He brings a sense of the organic to the technological, capitalizing upon chance procedures to yield unanticipated results. His working method favors the production of repetitive forms.
Issues: chance procedures to create a portrait of complexity

Hans Haacke has created works in which simple physical systems exhibit complex behavior. His interest in interdependent systems, instability, and ephemerality led to later work providing an analysis and critique of complex social systems.
Issues: time-based dynamic systems, pattern emergence, systems commentary

Paul Hertz creates fine art prints as well as computer based interactive multimedia installations. This work utilizes an underlying tiling pattern and a competitive cellular automata mechanism, which results in patches of bright color in a self-organizing pattern.
Issues: generative art, cellular automata, artificial life, tiling theory

Ellen K. Levy focuses on interdependent systems of economics and technological innovation. Among other images, she uses a dynamic database as a source of patent images, which insures that unpredictability and emergence are inherent to her digital prints. Her prints reflect the history, ongoing changes, and adaptation within a complex system.
Issues: time-based dynamic activity, descriptive of complex adaptive systems, emergence

Brian Lytle uses a patent-pending process utilizing finely ground pigments supported by the surface tension in large water baths. The pigments interact locally generating fractal patterns, which extend across microscopic and visible scales.
Issues: generative art, fractals, material property driven dynamic systems

Daro Montag leaves pieces of organic matter on color negatives. Rather than using a camera, the photographs are "developed" (e.g., chemically altered) by living organisms undergoing emergent behavior. His works become the indexical traces of living substances breaking down protein. His alliance with issues of complexity (e.g., emergence and randomness) challenges conventional photography.
Issues: emergence, time-based dynamic activity

Jack Ox engages transformational systems in her intermedia work, involving art, music, and mathematics. The digital prints in this show re-present data sets including patterns of melodic lines, changes in dynamics such as volume, and patterns of notes, their rhythms and their articulations. She then reconfigures the visual units as a combinatory structure of syntactical elements.
Issues: information visualization, time-based dynamic activity

Daniel Reynolds courts chance and creates fractals in his painting. He does this through the skillful application of immiscible media on a large scale. At every level, repeat patterns and veining keep the eye moving through a colorful field.
Issues: chance, generative, time-based dynamic activity

Marianne Selsjord uses both traditional and digital media to explore the emergence of biomorphic form and primitive life. The video shown in this show is an excerpt from a multi-screen immersive environment.
Issues: swarming behavior, artificial life, time-based dynamic activity

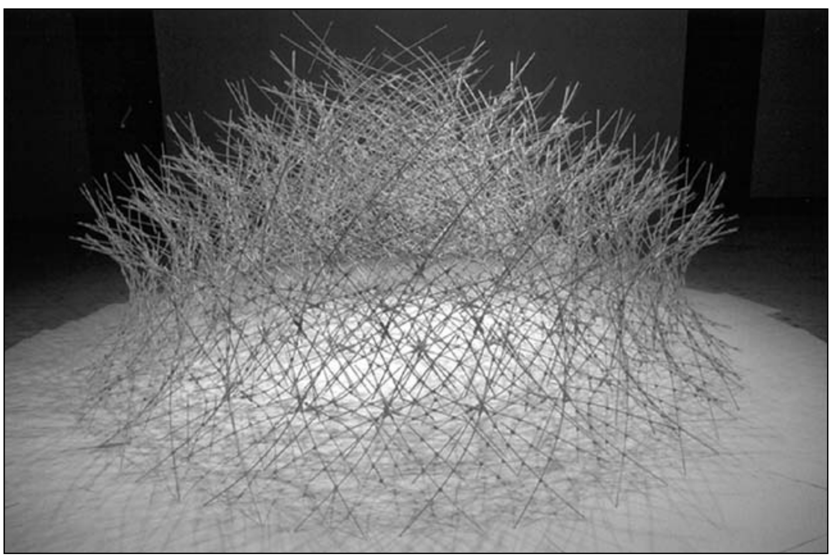
John F. Simon, Jr. uses original software drawing from numerous complexity related algorithms, recycled Macintosh Powerbooks, and plastics cut by a digitally controlled laser to create playful screen based artworks. His interests include the gathering and dispersing of patterns, especially those based on symmetry and tiling, and cellular automata.
Issues: generative art, cellular automata

Karl Sims engages complexity by implementing related algorithms such as genetic programming, L-Systems, particle systems, and swarming behavior. In addition he explores related issues regarding connectionist models on the hardware level by using massively parallel computers such as those from Thinking Machines Inc.
Issues: artificial life, genetic programming, connectionist models

Nell Tenhaaf shows a DVD that is relevant to COMPLEXITY because it shows how behaviors at different scales (dancers and DNA model) can resemble each other organizationally.
Issues: descriptive, time-based dynamic activity

Woody and Steina Vasulka count among their many accomplishments some of the earliest and most innovative use of video feedback as a generative system. Video feedback is now cited in scientific textbooks as a canonical example of deterministic chaos, and the early explorations by the Vasulkas anticipated contemporary science by many years.
Issues: chaotic systems, feedback systems

Leo Villareal is an artist who works with light as a medium in various scales including very large architectural installations. In his work for this show he has adapted Conway's Game of Life, a classic implementation of cellular automata, as an aesthetically compelling display of blood red light.
Issues: generative art, cellular automata



Manuel Baez, *Cubic Complexity*, 2001-2002, bamboo sticks and rubber bands, 3' x 3' x 3'