

Fusion

Art & Science



Fusion: Art and Science was produced for Wake Forest University's Year of Science and Technology as a collaboration between the Departments of Art, Biology and Psychology. The seven artists in the exhibition were selected by Dr. William Conner, Professor of Biology, and Victor Faccinto, Art Gallery Director. Dr. Conner, and Department of Psychology faculty members, Dr. Terry Blumenthal and Dr. James Schirillo, contributed text to the catalogue.

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P.O. Box 7232 Winston-Salem, N.C. 27109 (336) 758-5795

Director: Victor Faccinto (faccinto@wfu.edu)

Front cover: Altered photographic detail from:
D-3, 1971
acrylic with altered molecules
by Alyce Simon

Catalog design and production: Victor Faccinto

Fusion: Art & Science

October 8 - December 10, 1999

Curated by
Dr. William E. Conner
and
Victor Faccinto

M. C. Escher
Ned Kahn
John Pakosta
Michael Rudnick
Alyce Simon
Norman Tuck
Jeffrey Wyckoff

Essay by
Peter Richards

website: www.wfu.edu/art

Wake Forest University Fine Arts Gallery

Winston-Salem, North Carolina

What if...?

Doubt, not knowing, playful experimentation, and the excitement of finding out something, is at the heart of both doing science and making art. Throughout history, particularly from the age of enlightenment on, discoveries made by artists and scientists have provided a base for examining the relationship between nature and culture. Things these two disciplines share in common, and also share with children, are playful exploration, experimentation, and the testing of intuitions. These kinds of activities precede and are germane to all scientific and artistic creation and are crucial to the process that children use to establish themselves as individuals. Scientists move from playful, investigative actions to making statements about nature with some degree of certainty. Artists play with an idea, a material, a found object, etc., and then move forward with the intent of expressing or communicating a sense of the human experience in relation to nature. Children, using their powers of curiosity in finding their own place in the world, apply a process of gradually accumulating experiences, insights and understandings. All are operating, if I may be so bold, from a standpoint of not knowing and are continually asking themselves: "What if..?" The physicist Richard P. Feynman proffered that: "If you know that you are not sure, you have a chance to improve the situation."

As silent partners, artists and scientists have worked in complementary ways for hundreds of years - there was a time when it was hard to distinguish one from the other. Leonardo was both and the same. In the 15th century mathematicians and painters both awoke to the power of describing a three dimensional world on a two dimensional plane. The metallurgists of the time were bronze sculptors who were being recruited to make better artillery. Throughout this period - when the world operated under the precise and clockwork-like Newtonian vision, the disciplines of art and science covered common territory, revealing and celebrating nature.

"If nothing in our society or our environment ever changed, we might not need the noticings and syntheses of art and science....." Frank Oppenheimer

To quickly grasp the profound changes in the way the world was seen at the beginning of the 20th Century, one only has to look at the transformation of Picasso's sentimental realism to the fissured planes and evocative lines of his emerging cubism. The scientific order of Copernicus, Galileo and Newton was giving way to the four dimensional world of Einstein. As quantum theory and relativity gained a foothold in the minds of the scientific community, their sensory mechanism for perceiving the world was becoming obsolete and being replaced with theoretical physics. No longer was "seeing is believing" as was evidenced by the revelations of Marcel Duchamp's "Nude Descending the Staircase," Marc Chagall's "I and the Village," and Umberto Boccioni's "Development of a Bottle in Space."

Out of the theoretical view of the world came a greater need on the part of scientists to employ analogy and metaphor as a way of understanding and explaining complex ideas. Translating ideas from one form to another requires a creative ability that is

shared by both scientists and artists. Newton was a poet and an artist; Robert Wilson, founding director of the Fermi Laboratory, was a sculptor; Frank Oppenheimer was a musician, to name just a few. As Robert-Root Bernstein suggests, “The ability to translate between modes of intelligence may be essential. It’s not just that a scientist is an artist, but that he or she works as an artist when doing science.”

Tool making (technology) has been a province of all creative people and has been evolving in a circular fashion since the beginning of history. A new tool suggests new possibilities which, when realized, foster new questions, which again call for a new tool. A noticeable and significant marriage of art and technology came through Billy Kluver’s work at Bell Laboratories in the 60s. As founder of (E)xperiments in (A)rt and (T)echnology, he looked for ways of developing working and collaborative relationships between artists and engineers. A significant number of artists did projects through EAT including John Cage, Andy Warhol, Jean Tinguely, and Jasper Johns. At the same time, Gyorgy Kepes founded the Center for Advanced Visual Studies at MIT. This working laboratory for artists who use technology in their work continues to make significant contributions today. In San Francisco, Frank Oppenheimer started the Exploratorium, a museum of science, art and human perception, which uses the observations of both artists and scientists to help museum visitors learn about nature. Xerox PARC (Palo Alto Research Center) used all three programs as models for its own artist in residence program started in 1993. Teaming artists with research scientists, its ultimate goal is to end up with better scientists and better artists.

Three of the exhibiting artists in **Fusion: Art and Science**, including Ned Kahn, Norman Tuck and Michael Rudnick, have worked in places such as the above-mentioned art and science centers. All three hold or have patents pending on inventions or discoveries they have made. They are actively engaged in using phenomena as tools of expression. Alyce Simon uses a particle accelerator to create dielectric discharge patterns in blocks of acrylic. Jeff Wyckoff and John S. Pakosta, both with science backgrounds, use the tools and methods of science as metaphor for examining the importance of image, meaning, context and the line between reflecting upon and doing science. M.C. Esher is famous for his relentless examination of the eye as an imperfect mechanism, one that beholds the world and tries to make sense of it with tools that fall prey to the subtleties of context, texture, hue, edges, and counter intuitive patterns. All of the artists in the exhibition have asked the question: “What if?” many times and have given us much to behold.

Peter Richards

Peter Richards is the Creative Director of Tryon Center for Visual Art in Charlotte, N.C. Tryon Center is a multi-disciplinary laboratory where artists and scholars are invited to conduct research or create new work. He was formerly the Director of the Arts Program at the Exploratorium in San Francisco, California.

M.C. Escher

Dutch (1898-1972)

Much of Escher's graphic art reflects his systematic investigation of themes common to mathematics and the physical sciences. Interest in Escher's work by scientists and mathematicians is evident by the numerous books and articles they have published about his art. It seems appropriate that the M.C. Escher prints on display were loaned by Dr. Stephen R. Turner of Winston-Salem, NC. Dr. Turner's doctorate is in Chemistry. During the 1960s, he developed an interest in Escher through the articles of Martin Gardner that appeared in *Scientific American*. He currently has over 100 original Escher works in his collection.

In August, 1960 M.C. Escher lectured at the Congress of the International Union of Crystallography in Cambridge, England. He ended his lecture with the following:

"I have come to the end of my lecture. The attention you have so kindly given to my fantasies proves, I hope, that science and art sometimes can touch one another, like two pieces of the jigsaw puzzle which is our human life, and that contact may be made across the borderline between our two respective domains."

Maurits Cornelis Escher was born in 1898, in Leeuwarden, in the Dutch province of Friesland. He attended the School for Architecture and Decorative Arts in Haarlem between 1919 and 1922. His first one man exhibition was in Siena, Italy in 1922. He moved to Baarn, Holland in 1941, where he lived until 1970. His work became well known in the United States after the publication of *The Graphic Work of M.C. Escher* in 1959.

The Use of Escher's "Regular Division of the Plane V" in Psychophysiological Research

We conduct research on the early stages of information processing in humans, seeing how this processing of input is affected by variations in stimuli, situations, and subject characteristics. Our quantification of information processing is derived from several physiological response systems, including skin conductance (peripheral nervous system functioning), startle eyeblink reflex (brain stem functioning), and task performance (higher brain functioning).

In some situations we need subjects to pay attention to either the stimulus used to elicit the responses, usually a sound, or to a stimulus in a different sensory system. This is where the Escher print comes in. When we tell people to "count the animals" in this print, we have found that it holds their visual attention for several minutes. This allows us to look at the impact of distraction on information processing, compared to people who are either told to attend to the sound or told to ignore all stimuli.

These differences in attention result in large differences in physiological reaction to the eliciting sound. Escher's work is so visually captivating that we can be confident that people will attend to the visual stimulus for a period of time, and we have evidence of that "visual capture" in nervous system measurements from these people.

Terry D. Blumenthal, Associate Professor, WFU Department of Psychology



Hand with Reflecting Sphere
(Self-Portrait in Spherical Mirror)
January, 1935
Lithograph, 12 1/2" x 8 3/8"

M.C. Escher's "Hand with Reflecting Sphere"
© 1999 Cordon Art B.V. - Baarn - Holland
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Ned Kahn

Sebastopol, California

Ned Kahn received his B.A. in Environmental Studies from the University of Connecticut in 1982. He was awarded NEA Sculpture Fellowships in 1991 and 1994. Three of his sculptures are on permanent display at the N.C. Museum of Life and Science in Durham. Since 1991 he has completed 8 public art commissions, including works for the University of Colorado at Boulder, the San Francisco International Airport, and The Chabot Observatory in Oakland, California.



Ned Kahn is well known for works that harness nature's forces from the swirling winds of a tornado, to the suction of a whirlpool, to devastation of an avalanche, to the formation of sand dunes, to the erosion of a mountain. His works have been featured in exhibits throughout the world. They always invite contemplation and interaction.

In **Intrusion**, Kahn captures the dynamic geological processes that take place within the earth's outer layers. The molten magma percolates toward the surface and cools and solidifies into rock. In this kinetic core sample one can glimpse the upwellings that take place in mid-oceanic ridges and form the great tectonic plates that support our continents.

The five-foot core spans roughly 2000 miles into the earth from the solid rock crust on which humans dwell to the inner molten magma upon which our continents float. The work emphasizes that the construction of the earth's surface is an ongoing process molded by the natural forces of heat, pressure, and gravity.

William Conner, Professor, WFU Department of Biology

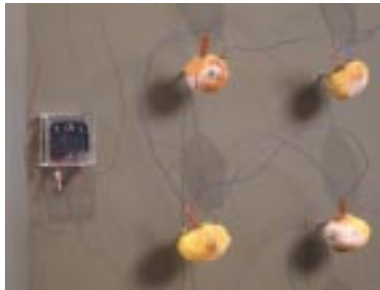
Information on Ned Kahn may be found at the following websites:
www.sculpture.org (find portfolio link)
www.santafe.edu/projects/CompMech/papers/TurbLand.html



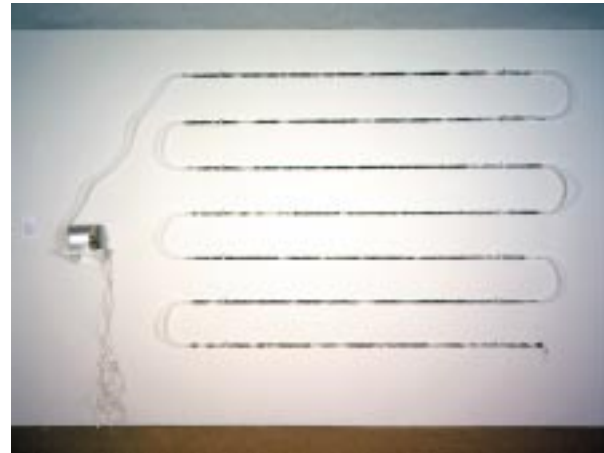
Intrusion, 1999
glass beads, aluminum,
air pump, glass cylinder
5 1/2' high x 8" diameter

John Pakosta

Berwyn, Illinois



Installation detail from **Cell**, 1993
lemons, latex, wood, wire, metal and
electric meter



Extracting Grace, 1994
roses, glass tubes, plastic tubing, glass vial and air blower
7 ft. high x 10 ft. wide

John Pakosta began his career as a microbiology research technician and after obtaining a sculpture MFA degree, shifted his focus to art. His work combines objects with scientific, romantic and artistic attributes in an alliance that brings these two disparate worlds together.

Pakosta's artwork incorporates laboratory apparatus, industrial materials and kinetic machinery to frame botanical specimens in theatres of mock scientific processes. Long glass laboratory tubes, which are used in science to separate molecules, channel a stream of air over lines of roses in **Extracting Grace**. The "experiment" metaphorically collects "grace" from the dehydrated roses as they perish over time. *Lumen* employs a mechanical blower to inflate lozenge-shaped polypropylene bags lined with roses. The blower cycling "on" and "off" mimics a respiratory cycle and bathes the specimens in fresh air, seemingly in a futile attempt to restore their original beauty.

The artwork undermines the usual sense of trust in the scientific process with an air of romantic folly, presenting a science that serves beauty and little else. The **Cell** installation is an elaborate network of wires connecting a series of lemon batteries. Electricity is miraculously created by piercing the fruits with metal electrodes. A small electrometer at the end of the series indicates the current by a mere flutter of the needle when the bottom on the meter is pushed. There is no motor to run or bulb to light with the fizzle of power. The viewer gazes at the yellow orbs and colored wires, essentially looking at minimalist art.

It is a highly romantic notion to think that dead roses are reborn or some sublime substance is collected from them. What is to be made of an apparatus which squeezes electricity out of a hundred lemons merely to cause a meter to flutter? It is as if the work nostalgically harkens to another era - a time when art and science flourish together to shape a better world.

John Pakosta received his Master of Science from Arizona State University, Tempe in 1976 and his Master of Fine Arts from the Chicago Art Institute in 1987.



Lumen, 1993
roses, plastic sheet, silk suture, metal, air blower
120" x 27" x 27"

Michael Rudnick

San Francisco, California

My approach towards 3-D art comes from a somewhat unique perspective, that of a film artist turned motion picture sculptor, borrowing historically not only from art but also from cinema. After receiving my M.F.A. from the San Francisco Art Institute in 1975, I focused entirely on motion pictures until the late 1980s, producing fifty films. Then, with a conscientious effort to present my art in alternative venues, my films began to take a 3-dimensional shape.

Michael Rudnick

Michael Rudnick is currently an Artist in Residence at the Exploratorium in San Francisco, California, and a Visiting Artist at the San Francisco Art Institute where he teaches filmmaking.

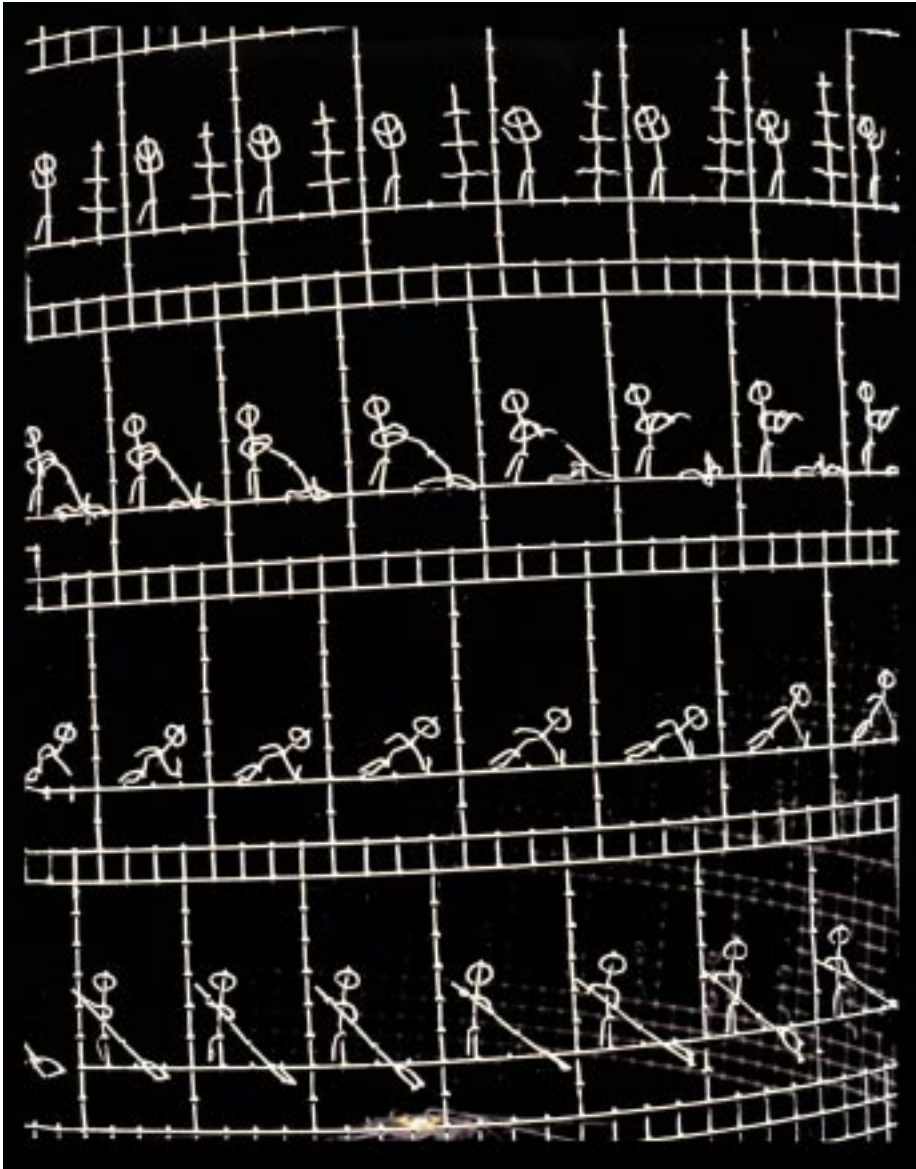
Persistence of Vision

You blink your eyes for 1/3rd of a second about every four seconds. Half of this time the lids are completely closed. Why is it then, that you never notice the blackout that is caused by a blink?

Your eye and brain retain a visual impression of an image until the next image is seen to form what appears to be a single continuous view of the world. This persistence of vision accounts for our failure to notice that a motion picture screen is dark about half the time, and that a television image is just one bright, fast, little dot sweeping the screen. Motion pictures show one new frame every 1/24th of a second. Each frame is shown three times during this period. The eye retains the image of each frame long enough to give us the illusion of smooth motion.

The mechanical shutter in **Michael Rudnick's** work regulates when a light will flash on a revolving wire structure. As the structure rotates slightly different images are seen at the same location over time, creating the same type of effect that movies generate due to the phenomenon of visual persistence.

Jim Schirillo, Assistant Professor, WFU Department of Psychology



Description of **Ecology**

In **Ecology** a human figure prepares soil with a hoe, plants a seedling, waters it, stands back to watch it grow into a tree, and then experiences the disastrous results of using an ax to chop it down.

"I use hardware cloth, a wire mesh fence material, to construct a cylinder 36" high by 24" in diameter. With wire cutters and pliers, I cut and bend a series of figures spiraling from the bottom to the top of the cylinder. This cylinder is then placed on a motorized horizontal bicycle wheel which enables it to spin. A light with a mechanical shutter illuminates the piece, bringing it to life. As the animated wire figures go through their paces on the spinning cylinder, their silhouettes are projected onto the wall behind the sculpture."
M.R.

Ecology, 1992

from the "Wirework" series

36" x 24" motorized wire cylinder

Alyce Simon

Santa Fe, New Mexico

Although high energy radiation from nuclear reactors or high voltage accelerators is hazardous, in the hands of Alyce Simon it has become a creative tool. In a preconceived and pre-designed manner, she bombards acrylic with electrons from a high-voltage particle accelerator, changing its molecular structure. When mono-energetic electrons stop in polymer, a negative space charge builds up in a plane perpendicular to the incident beam. The depth of penetration is controlled by varying the accelerator voltage. After irradiation, the space charge is discharged by passing a sharp metal object close to the electron plane. This discharge produces the unique pattern of cavities and channels captured within her sculpture.

Alyce Simon began contemplating the possible effects of an electron beam on various materials in the early 1960s. After several years of experiments and testing, and with the cooperation of nuclear scientists at Radiation Dynamics in Westbury, N.Y., she developed the technique used to create her "atomic energy sculpture". The initial results of this new art technique were exhibited at the Smithsonian Institution in 1969.



M7, 1971
acrylic with altered molecules
11" x 7" diameter



Alyce Simon and Dynamitron Accelerator at
Radiation Dynamics, Inc., Westbury, NY, 1971



Peacock, 1971
acrylic with altered molecules
9 1/2" x 10" x 2 1/2"

Norman Tuck

San Francisco, California

One thing that I have never been able to demystify is electricity. **Alchemy** is about the mystery of electricity. It generates the energy which it consumes and consumes the energy which it produces.

Alchemy is a battery or, more correctly, a primary cell with an anode of copper, a cathode of zinc and an electrolyte of salt water. It continuously generates about 3/4 volts of electricity.

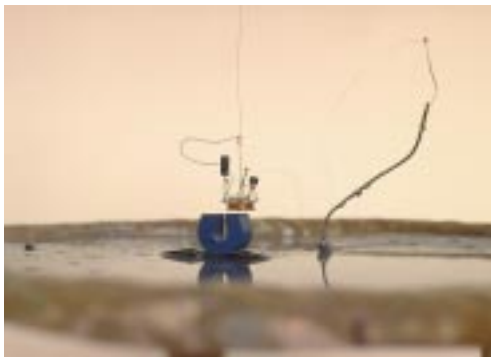
The platform of **Alchemy** is a copper plate which I pounded into the shape of a pizza pan. This pan holds about two quarts of sea water taken from the Pacific Ocean. Immersed in this little pond of water is a metal disk made of zinc. Small stones support the disk and insulate it from the pan.

A small blue horseshoe magnet sits in the center of this pond. A bobbin unit, hanging like a plumb bob, swings mysteriously back and forth, passing closely above the magnet. A small electronic circuit is mounted on the plastic bobbin.

Two independent coils of thin wire are wound together around the bobbin. One coil acts as the sensor for the circuit. As it passes through the magnetic field of the horseshoe magnet, the coil generates enough current to “switch on” a small transistor. The transistor then passes the current generated within the sculpture through the second coil. The current flowing through this coil creates a magnetic field which repels the magnetic field of the blue magnet. This momentary repulsion gives the bobbin the impulse to continue swinging.

I am pleased with this piece. The look of the corroded elements, the presence of water drawn directly from the sea, and, of course, the magical movement of the pendulum without an external energy source, combine to speak of alchemy, an art that led to science.

Norman Tuck



Detail from **Alchemy**

Norman Tuck's history with Wake Forest University includes serving as Art Gallery Director (1982-1983) and teaching sculpture in the Art Department (1987-1988). In 1991 his large-scale *Mindless Mechanisms* exhibition filled the galleries of the Southeastern Center for Contemporary Art in Winston-Salem. Since that time the installation has continued to evolve and travel extensively, including exhibitions at the Exploratorium in San Francisco and the Technorama Museum in Winterthur, Switzerland.

Website: www.normantuck.com

Norman Tuck received his B.F.A. from the University of Florida, Gainesville in 1967, and his M.F.A. from Pennsylvania State University in 1972.



Alchemy, 1995
copper, zinc, sea water, electronic circuit and pebbles
6 ft. x 2 ft. x 2 ft.

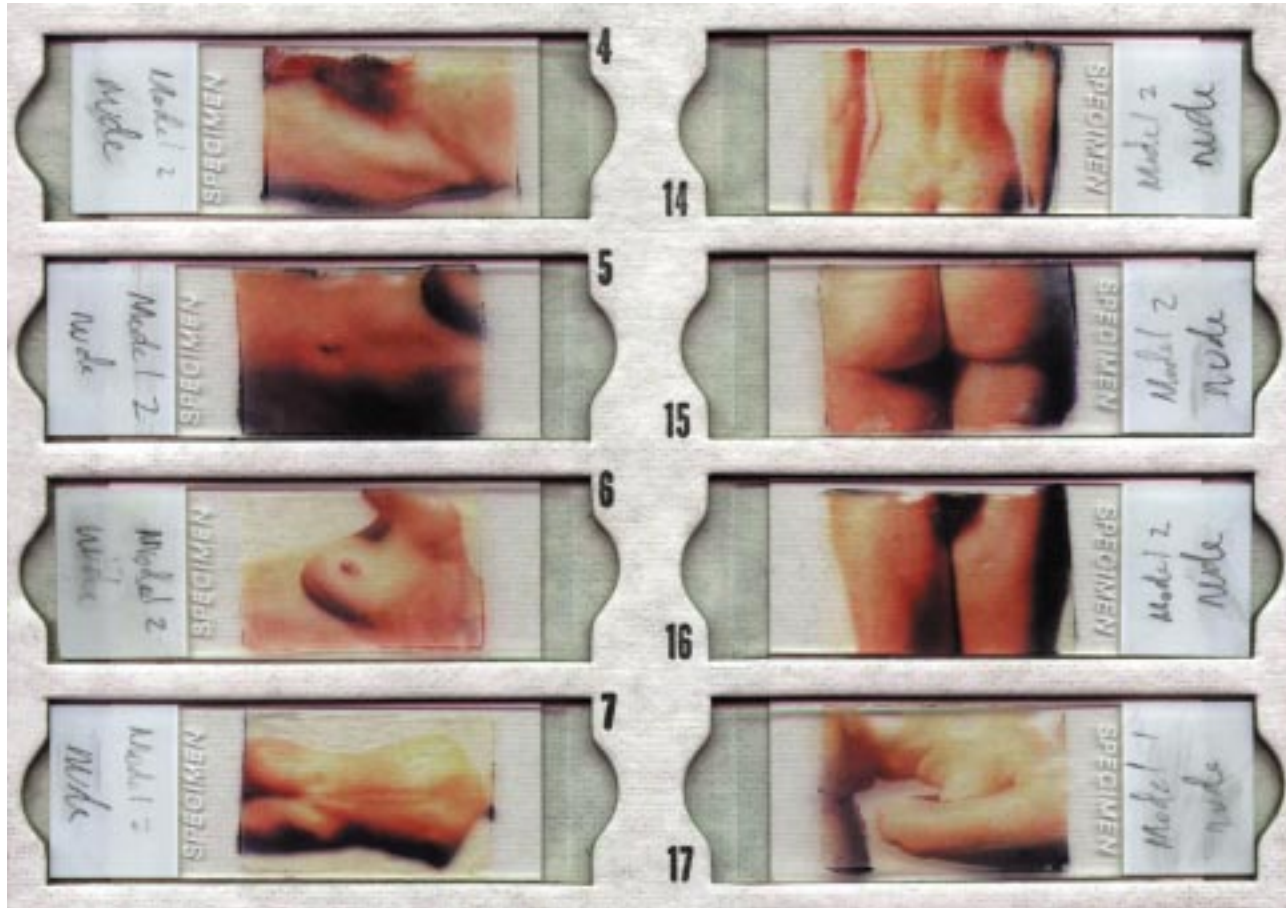


OscylinderScope, 1999
wood, powder coated welded steel,
guitar, nylon string, plastic engraving
material and formica
5' x 24" x 37"

The **OscylinderScope** is an interactive artwork which explores the nature of sound by directly translating the vibration of musical strings into visible waves.

Jeffrey Wyckoff

City Island, N.Y.



Female Nude, 1996 (detail)
20 microscopic glass slides in case
photo-transfer on glass

Jeff Wyckoff received his B.S. in Biology from UCLA in 1985, then went on to get a B.F.A. from California State University, Northridge in 1993, and a M.F.A. from Pratt Institute, New York in 1996.

A Pendulum Motion between Art and Science: Jeffrey Wyckoff's Mastery of Excess

Jeffrey Wyckoff uses his own scientific findings as a medium to make works of art. Science to him is a tool. It is the smallest common denominator out of which grows an extremely varied artistic production. When he employs traditional artistic media such as those of drawing, painting, sculpture and photography, science is used as their subject matter. Conversely, when Wyckoff works with scientific materials like microslides and petri dishes, the images that are transferred onto them contain references to the history of photography and of art in general. The particular richness of Wyckoff's work comes forth out of this permanent oscillation and interchange between two very different systems in our society: science and art. Fascinated by the chaotic beauty of the microscopic, the artist translates these impressions to macroscopic images. On that ordered level, the blown up scientific elements operate as art and become part of a different system of meaning: they inscribe themselves into a pictorial history of art. For example, in earlier work, the silkscreens representing enlarged cells obtain the subtle coloristic effect of an abstract painting.

Not only is science experienced as art, but art also is seen as a science. In other words, Wyckoff virtuosically explores all available artistic media as a kind of laboratory to his disposition. Thus, the traditional contents attached to the names of science and art are permanently questioned and transposed. The photographic images transferred on the microslides are easily identifiable as such to the bare eye. But put under the microscope, they are reduced back to their structural components and reappear as cellular shapes. What was science became art, and what was art became science again. The presentation of the slides in the thereto-appropriated scientific boxes only reinforces this blurring of interpretations.

Wyckoff's work constantly displaces meanings. For example, the beauty of the polaroids turns out to be particularly disturbing when one realizes that its subject matter is actually blown up cancer cells. This awesome contradiction between our feelings and knowledge comes close to a defiance of our imagination and its finally being overpowered by a gradual raise towards an unrepresentable infinity. That sublime strategy seems to fit Wyckoff perfectly: the excess in representation (the repetitive and obsessive artistic display of similar elements) is caused paradoxically by the necessity to find a means of representing the excess (the microscopic world). In that delicate control of chaos, Wyckoff is no less than a master.

Hilde Van Gelder

Hilde Van Gelder is a Research fellow at the Belgium National Fund for Scientific Research (NFWO). She is currently working on her doctoral dissertation "Temporality and the Experience of Time in the Art of the 1960s" at the University of Leuven, Belgium.

