AHST 4342-501 (27532) History of Media and New Media Art Spring 2018 Dr. Charissa N. Terranova University of Texas at Dallas Arts & Humanities T-Th 1:00-2:15

Thursday 03/29/18

**Early Computer Art** 



Joseph Marie Jacquard [1752-1834] portrait of Jacquard was woven in silk on a Jacquard loom and required 24,000 punched cards to create (1839).



Joseph Marie Jacquard, Jacquard Loom/Punch-Card Loom, 1801





Jacquard Fabric Sample



Babbage Engine 1822/1999 <u>http://www.computerhistory.org/babbage/</u> Charles Babbage [1791-1871]



ENIAC [Electronic Numerical Integrator and Computer] Computer at the University of Pennsylvania, 1946, conceived by John Mauchly and J. Presper Eckert

- ENIAC stands for "Electronic Numerical Integrator And Computer"
- It was the first electronic general-purpose computer.
- It was digital Turing-complete, meaning it worked like a "Turing machine," that it solves computational problems.
- ENIAC was designed to calculate artillery-firing tables for the US Army's Ballistic Research Lab.
- When ENIAC was announced in 1946 it was heralded in the press as a "Giant Brain".
- It boasted speeds one thousand times faster than electro-mechanical machines, a leap in computing power that no single machine had since matched.
- The construction contract was signed on June 5, 1943, and work on the computer began in secret at the University of Pennsylvania
- ENIAC contained 17,468 vacuum tubes.
- This led to the rumor that whenever the computer was switched on, lights in Philadelphia dimmed.
- Input was possible from an IBM card reader, and an IBM card punch was used for output.



ENIAC vacuum tubes



IBM 1401 Data Processing System, 1959





A general-purpose punched card from the mid twentieth century.

Herman Hollerith's Holerith card as shown in the *Railroad Gazette* in 1895



Card from a Fortran program: Z(1) = Y + W(1)



ENIAC vacuum tubes



The Bell Labs team of John Bardeen, Walter Brattain and William Shockley won the 1956 Nobel Prize in Physics for their work in developing transistors.



Jack Kilby's original integrated circuit, 1958



Integrated Circuit 1958



Microprocessors and personal computers, 1970s

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Ferdinand Kriwet, "ZUVERSPAETCETERANDFIGURINNENNENS-WERT OLLOS" (1962) A detail, full-scale.



Max Bense [1910-1990]

Concrete Poetry

Information Aesthetics

# Herbert Franke on Max Bense (1910-1990)

The most influential champion of exact aesthetics is the German philosopher and mathematician Max Bense. In his writings particularly in his work *The Programming of the Beautiful*, Bense already anticipated the principle that was to be fulfilled at a later date in computer art...

**Information Aesthetics**: An aesthetic measure based on complexity and information

Bense justifies the establishment of these historic statements by a comparison with the characteristic state of order in the world. He sees the artistic process as a kind of anti process of natural phenomena, along the line that nature tends to bring forth chaos, whilst art permits emergence of unlikely conditions of order...

Student question and writing:

Is there a formula for creating art?

In the mid-1960s, a number of artist-scientists emerged from Stuggart who deployed computers in order to explore an "information aesthetic." The most influential of these artists was (philosopher and logician) Max Bense, who popularized the idealization of an objective aesthetic based on scientific principles, as well as the usage of a formula for measuring the aesthetic values of art.

Bense adopted this formula from David Birkhoff, who explored similar concepts of <u>aesthetic measurement</u>. The formula defines the aesthetic measurement M as a ratio of order O to Complexity.

M = O / C

### Student writing (continued):

Bense popularized the idea that art and aesthetics seek order as opposed to reality, which trends toward an everincreasing chaos. Instead of nature's process of entropy, art featured the process of negentropy. This formula was perfect for computer-driven art, as "complexity" could be generated in the form of random or pseudo-random numbers, and "order" could be generated in the form of predetermined algorithms and restrictions. Computers are innately capable of trending towards order, which aligns perfectly with Bense's artistic philosophies?

Professor's question: How do we understand the use of computers to sow social chaos?

Student question and writing:

Could Max Bense's aesthetic values inadvertently dehumanize art?

In their efforts to make the evaluation of art more objective, Bense and Moles stripped art into its smallest components. In this process of simplification, they neglected to account for one thing -- humanity. Their equations focus solely on order and complexity. They fail to define what makes art art, and to account for the emotion that sometimes goes into its creation, or the emotional response it can elicit. Bense and Moles' aesthetic values reduce and constrain art to black and white.

Professor's related question: Why is there a tendency to polarize emotions and complexity? After all, are not emotions and thinking together a form of complexity? Are not emotions unto themselves a mode of complexity?

Student question:

## Does emotion have a place in computer art?



A. Michael Noll, Gaussian Quadratic 1962/65 ink on paper, computer print

任何何为时的同学能量为国生中 北上生命了四年四月四年几日日 걸린티뮬러FF 티 티 - 9 E - 1 E 品画曲を唱曲部合曲中世品 a D 医出明白 国产卫血局 月日 四日日 DEEB OLEBE VADE 谅는육만固한미상*於*固터ය며& 名的出现的现在分词是 母山周田山寺 兴趣打印明会出产 A. 中华西国的中国的国际中国 可也可要自己的自己的问题。 中国现成明识理管理已是明朗的 夏阿思昂口动足民国印色中国



Frieder Nake, "Polygon Drawing," 1965, ink on paper, computer drawing

Georg Nees, "23-Ecke, 1964, ink on paper, computer print



Georg Nees, "Schotter," 1965

"Schotter" is a computer graphic from the 1960s, produced by a structured operation by random generators that lead to the discovery of new images. This graphic visually displays the relationship between order and disorder, and the effects of change. Georg Nees (1926-2016)



Georg Nees, Images in GrKG vol.5 Nr 3/4, 1964

- Nees started to work at Siemens in 1951 and learned programming in Algol on Siemens 2002 computer in 1959. He was assigned to the new Siemens research center in 1960. In the winter of 1963-64, a Siemens colleague gave Nees the first seven issues of the new journal Fundamental studies of Cybernetics and Humanities (GrKG) and he found Max Bense's papers. In those days Bense had mentioned the idea of pictures as a subject for his information aesthetics, but his primary interest was in texts.
- In 1964, the computer center bought the Zuse Graphomat drawing table. This was used for the simulation of cutter paths for NC machines, but it provided Nees with the opportunity to make abstract drawings. His first drawings were produced in the fall of 1964.
- Nees had the name of the editor of GrKG, Helmar Frank, a professor at the university of education in Berlin. With his drawings, Nees asked him for supervision of his doctoral dissertation. It was not possible at the university, but Professor Frank introduced him to Bense in Stuttgart and recommended him as a doctoral student on November 20th. The December issue of GrKG included his drawings.
- On December 20, 1964, Nees wrote a letter to Bense including about a dozen computer drawings. Bense invited him to a colloquium at his institute. Two surprises were waiting for Nees in Stuttgart. A publication dated February 1965, rot 19, edited by Bense and Elisabeth Walther, included six drawings by Nees with his note, and a statement by Bense inaugurating the generative aesthetics. Second was the exhibition of his drawings at the Studio Gallery at the Technical University of Stuttgart. This is generally acknowledged as the first exhibition of digital computer graphics. A colloquium with known invited artists from the Stuttgart area on February 5th aroused much controversy.

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Georg Nees, Images in GrKG vol.5 Nr 3/4, 1964

## Georg Nees (1926-2016)



Georg Neees, Sphere in a Sphere, offset lithography after plotter drawing, 1970; Idea and program by Nees, generated around 1969 with Siemens 2002, programmed in ALGOL and drawn on a ZUSE-Graphomat plotter



#### ZUSE Graphomat Z 64

The ZUSE Graphomat Z64 was a flatbed drawing machine of high precision. Its engineer, famous computer pioneer Konrad Zuse, had originally intended it to be used for the production of maps and for land registration purposes. Both Georg Nees and Frieder Nake did their first computer art pieces on the Graphomat. This historic fact may be seen as a case of an unintended use of a technical innovation. 'The Graphomat Z64 was fully based on transistor technology. It was controlled by a code that had to be input on punch tape or punch cards. The machine was first presented in 1961 at the Hannover Fair. Even though the first set of machines was ordered within a relatively short period of time, it did not become a great financial success.

http://dada.compart-bremen.de/item/device/5

# Student question: What is a teleological epistemic process?

Student question: Is digital art the only avenue on which one can achieve perfection?

## Student writing:

One major question is: how is a human being supposed to be able to compete with the organization and pure range of possibilities a computer has, even a computer from the 1960s (much less a current operating system)?...Searching for a perfect piece of art leads to the development of "perfection." Is it as simple as order and complexity? If that is the case, then the logic and algorithms of a computer are the only conceivable way to create something 'perfect.' Does this disqualify any art made before the time of computers from being considered perfect?



Left: Georg Nees, Sculpture 1, 1970 – Offset lithography after photograph of wood

Right: Georg Nees, Sculpture, 1968 – Screenprint after a computer milled aluminium plate

Idea and program by Georg Nees; Sculpture generated between 1965 and 1968 with a Siemens-system 2002 and 2004 programmed in EXAP-1 for a Sinumerik milling machine.

The first computer-generated sculpture in 1968 using a computer aided milling machine.



COMPLETERGRAPHE MET SIEMENS-DISTEM 4004 generatives on 2006 GRAPHOMAT



Georg Nees, 4SPAL Concept Sculpture, 1968



Computer in der Baugestaltung



Left: Siemens Exhibition Hall, 1970 Center: Poster for Computer Art Exhibition in Hamburg, 1972-73 Top Right: Modular City Structure Bottom Right: Cuboctaehdron (polyhedron with 8 triangular faces and 6 square faces) Structure Architecture-Computation collaborations between Georg Nees and Ludwig Rase







Student question: Does the democratization of art necessitate its mathematization?

## Frieder Nake (1938-)





## Frieder Nake, Homage to Paul Klee 13/9/65 No. 2, 1965



Frieder Nake, Homage to Paul Klee 13/9/65 No. 2, 1965



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http://dada.compart-bremen.de/item/device/5

Student question: Do generative aesthetics deskill the work of computer art?





Frieder Nake, Hommage to *Paul Klee* 13/9/65 No. 2, 1965

Paul Klee, Haupt- und Nebenwege [Main and Sideways], 1929



Frieder Nake, Random Polygon, 1965

Frieder Nake, Polygonal Course No. 7, 1965

Frieder Nake, Polygonal Course No. 20, 1965



Bell Labs, Murray Hill, NJ



A. Michael Noll (1939-)







Exhibition of works by A. Michael Noll and Bela Julesz at the Howard Wise Gallery in New York City in 1965





BY A. MICHAEL NOLL

Student questions: What is CP Snow's definition of "communication" between two cultures? Is his rejection of the fusion of the humanities and natural sciences anti-avant-garde?



The same sectors

THE TWO CULTURES AND THE SCIENTIFIC REVOLUTION

C. P. SNOW

THE REDE LECTURI

CAMBRIDGE

#### Student writing:

Attempting to break down a creative work in a scientific way would require a program that could accurately take into account the current state of society that the work will be shown in at the time of the exhibition. Using scientific methods to create a piece, however, can work wonderfully, as precise methodology can in and of itself carry meaning. A common theme with the artists in *Mainframe Experimentalism* is that they do not adhere to digital art forever. This can be attributed to the difficulty of working with machines at this time, but it can also be because the meanings associated with computer art change over time. Computers of this era were mostly tied to the government or the military. However, as computers became more common, this association weakened, and the meaning audiences read from these kinds of works shifted as well.

CP Snow's thesis that the humanities are incapable of communicating with traditional sciences goes too far in the opposite direction. Assuming that science is incapable of informing artistic choice has been proven wrong countless times since his original lecture. However, the humanities do not directly inform scientific understanding. The humanities do influence science in regard to what areas are researched, since funding and public interest are largely based on the cultural environment. Space travel used to be important when it was culturally important to be leaders in the space race, however once that ended, public interest eroded, and art began moving in a different direction.

Mondrian Noll



In the late 1960 and early 1970's, he constructed interactive threedimensional input devices and displays and a three-dimensional, tactile, forcefeedback ("feelie") device that were the forerunners of today's virtualreality systems. He also was one of the first researchers to demonstrate the potential of scanned displays for computer graphics.

From A. Michael Noll's website http://noll.uscannenberg.org/

Student questions: Will computers eventually be able to generate art without human input? If so, what ramifications does this have on the existence of humanity?



Kenneth Knowlton and Leon Harmon, Studies in Perception 1, 1966







Studies in Perception #1. Computer-produced mural, as shown in the 10/11/67 New York Times, and the 1968 MOMA Machine Show, 5x10 feet, © Leon Harmon & Ken Knowlton, 1966.

In order to create the original version of this image, Leon Harmon and Ken Knowlton scanned a photograph of the choreographer Deborah Hay and converted the greyscale values into symbols. The resulting printout was 12 feet wide and was hung in a colleague's office at Bell Labs as a prank.



## Art and Science Proclaim Alliance in Avant-Garde Loft

#### By HENRY R. LIEBERMAN

In a sound-drenched Lower Manhattan loft building that was enlivened by revolving painted disks, film projections, floating pillows and miniskirted girls in paper smocks, representatives of industry and labor joined a number of artists and scientists yesterday to proclaim a "working alliance" between art and technology.

This modest and uncertain merger seeks to bridge the gap between the two worlds. It is intended to bring modern technological tools to the artist for creating new art forms and fresh insights and viewpoints to the engineer for creating a "people-oriented" technology.

The event was celebrated at a news conference "happening" in the six-story loft building at 381 Lafayette Street used for studio purposes by Robert Rauschenberg, the avant-garde artist.

#### Kheel's 'Biggest Mediation'

Mr. Rauschenberg, along with Dr. Billy Klüver, an electronics engineer who is specializing in laser research at the Bell Laboratories, and Theodore W. Kheel, the lawyer-labor mediator, are prime movers in the art-technology merger.

er with a device operating like at a television camera.

The information on the transparency was then stored on magnetic tape in the form of pulses standing for digits, with the brightness level of the picture elements represented by numbers ranging from 0 to 7. After processing all the numbers, the computer printed a drawing of micropatterns formed by clusters of symbols used in electronic design.

Visitors at the studios were intrigued by a sculptural representation of a woman taking a shower. As droplets of water dripped from the shower-head in a white stall, moving-picture images of the woman were registered by a projector behind the stall on a sand-biasted Plexiglass panel.

#### Rauschenberg's 'Oracle'

Another sculptural construction was a sound-emitting assembly consisting of a tire, truck door, window frame, bathtub and air vent. This is Mr. Rauschenberg's "Oracle."

Five radios are used, with the tuning dial of each being rotated by motor. Thus, each radio picks up snatches of the broadcasts of all the local

#### Drawing of nude above was generated by a computer under direction of L. D. Harmon and K. C. Knowlton, engineers. Black square encloses the detail shown.

contribution dollar that goes
to the arts."

"Along with its obligation to be a profit-maker for its owners, the modern business corporation has an obligation to be a good citizen in the community," he said. "As a basic part of this obligation, the corporation must examine carefully its responsibility to

es dividuals in seeking to make "valuable contributions."

He noted that union members were also consumers, members of audiences and citizens concerned with the quality of society.

the The event served to dramas a tize a drive to win organizaon, tional support for the artine technology merger and to to mark the transfer of Experiwith human problems caused by automation --- notably the problem of individual "isola-

tion." Dr. Brodey, who heads M.I.T.'s science camp for underprivileged youngsters, noted that new technologies had opened large new areas of creativity. While the in-



The image found fame when it featured in a press conference in Robert Rauschenberg's loft and subsequently appeared in the New York Times on 11 October, 1967.