AHST 2331-001 **(21414)**
Understanding Art
Dr. Charissa N. Terranova
Tuesdays and Thursdays 11:30-12:45
ATC 1.102

Thursday April 19

Discussion

The Digital Image in Art – The Backdrop of Virtual Reality

# FINAL EXAM AND NOTEBOOKS DUE

# MAY 1, 2018

# 11:00 AM-12:15 PM

# The Digital Image in Art

# The Backdrop of Virtual Reality

# VIRTUAL REALITY
# its spectrum of experience and meaning

**literal virtual reality**
**replicating reality**
**immersion without distance**
**reproducing nature to best nature**
**cinema**
**market proximity/embeddedness**

**metaphorical virtual reality**
**interpreting reality**
**immersion with distance**
**reproducing nature to comment on reality**
**Expanded Cinema**
**art/autonomy**

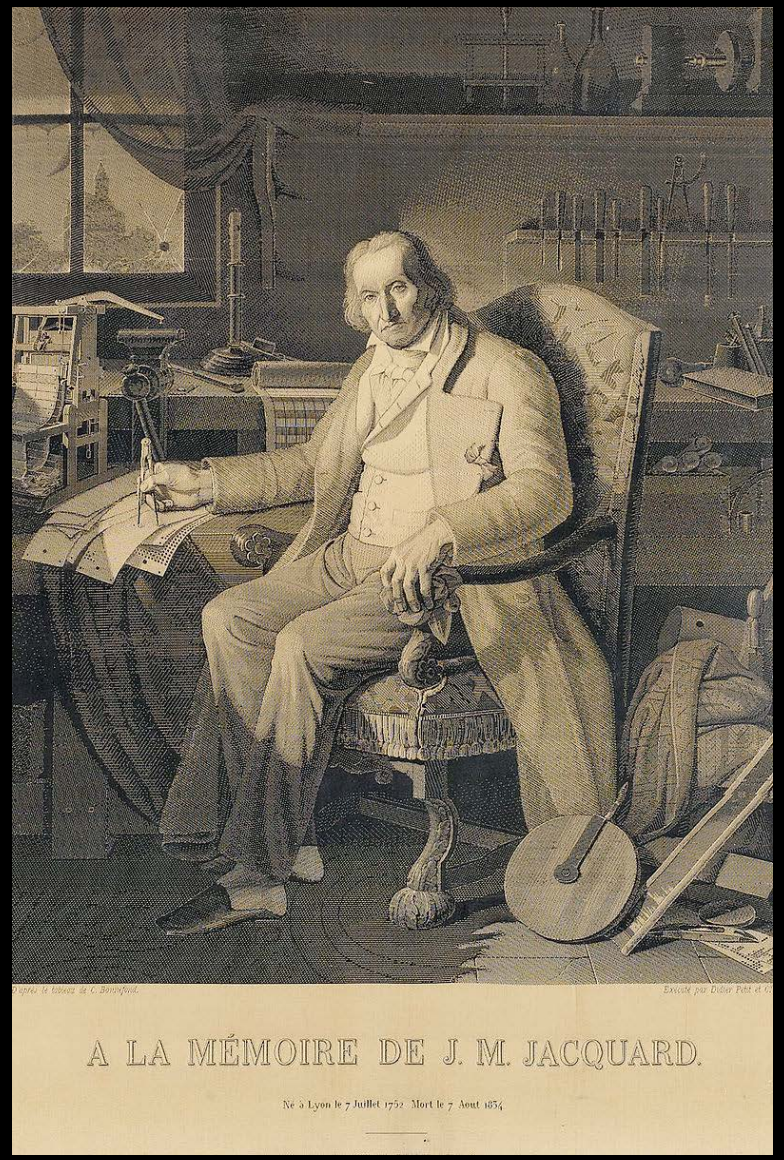
# AUTONOMY

Art is not foremost about making money.

This constitutes a form of autonomy

Beyond art, critical thinking constitutes a form of autonomy

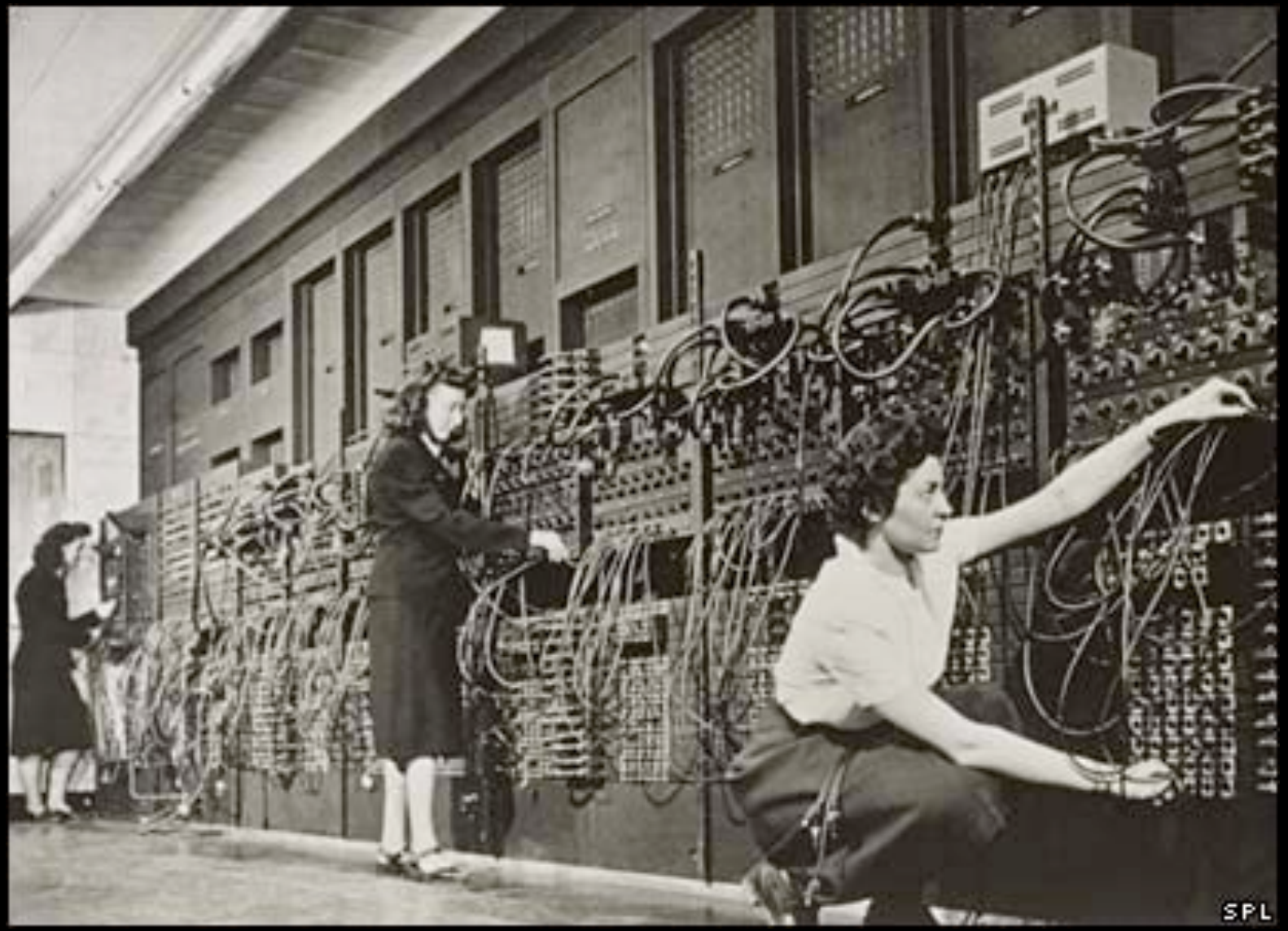
How does digital technology challenge the concept and practice of “autonomy” within art?




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).

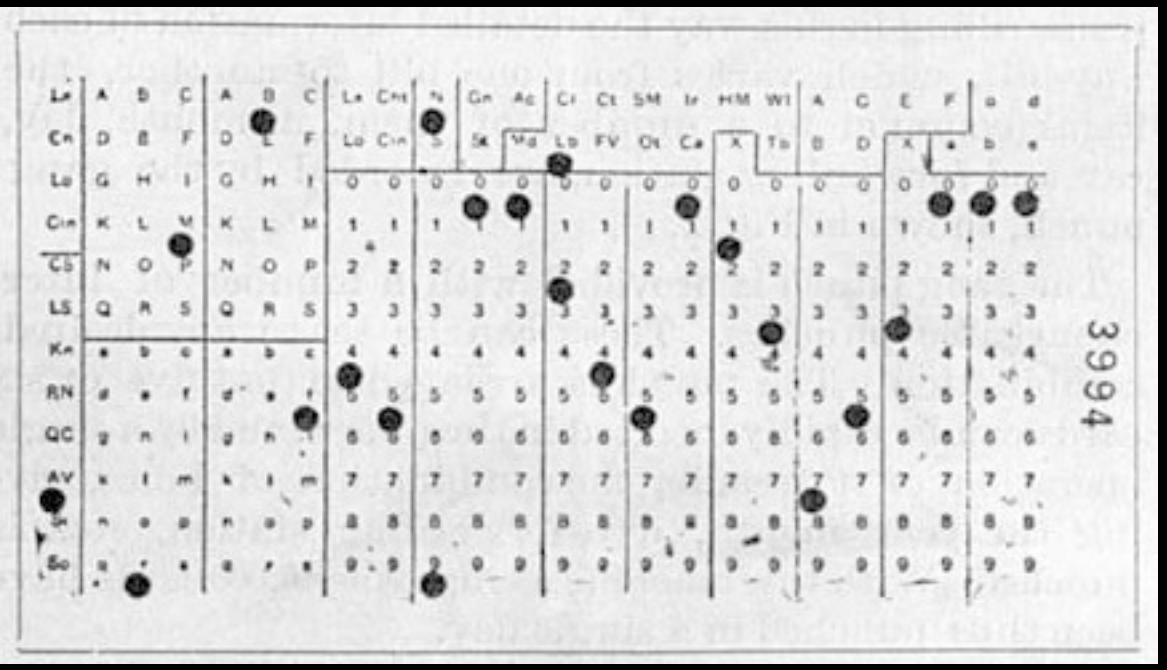
Joseph Marie Jacquard, Jacquard Loom/Punch-Card Loom, 1801

Jacquard Fabric Sample

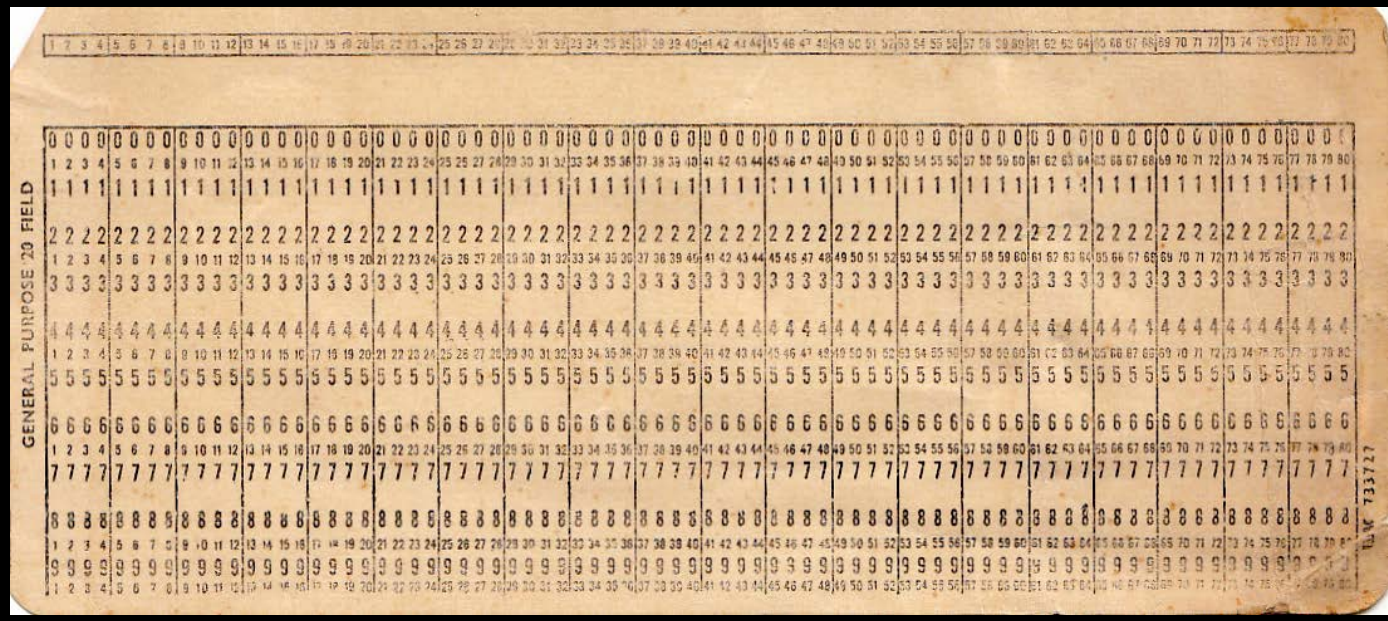



ENIAC [Electronic Numerical Integrator and Computer] Computer at the University of Pennsylvania, 1946, conceived by John Mauchly and J. Presper Eckert

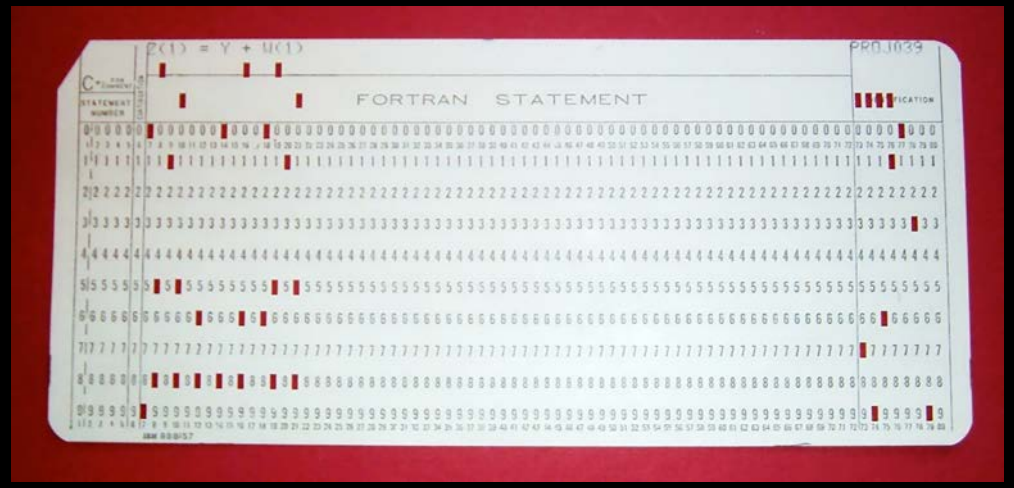
ENIAC vacuum tubes




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

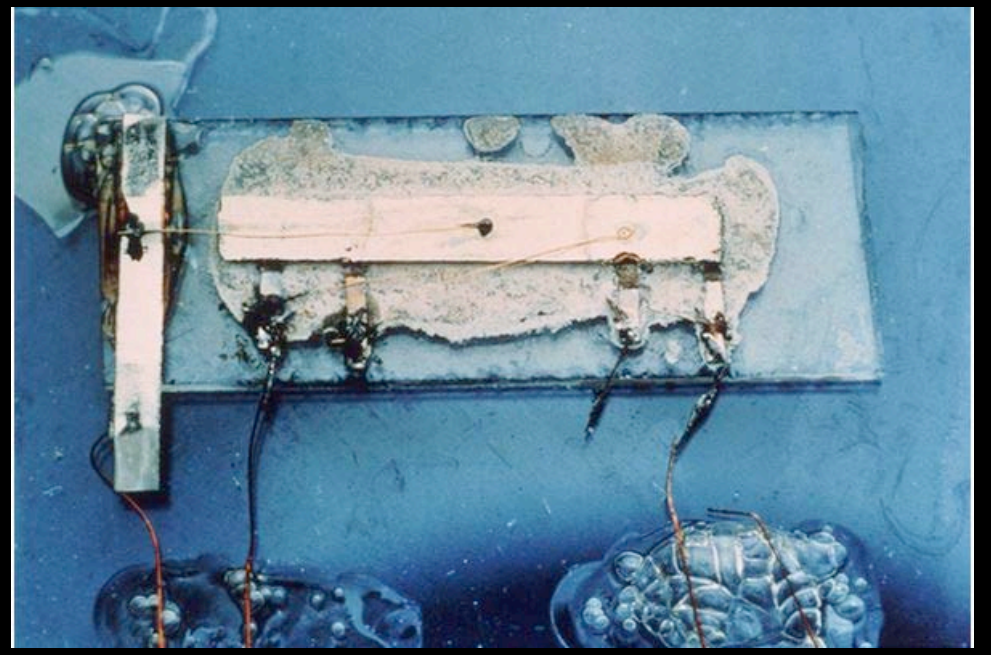



A general-purpose punched card from the mid twentieth century.

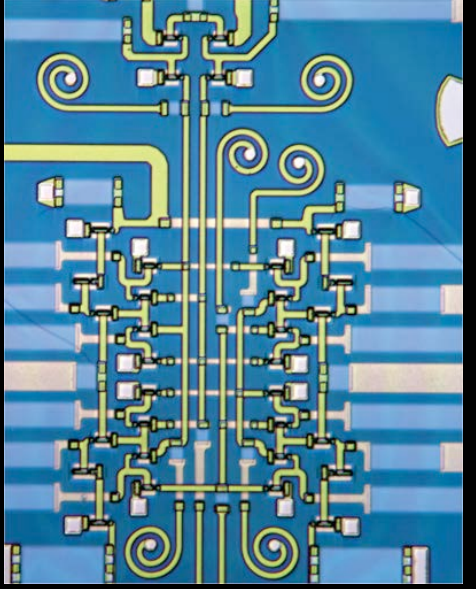



Card from a Fortran program: Z(1) = Y + W(1)

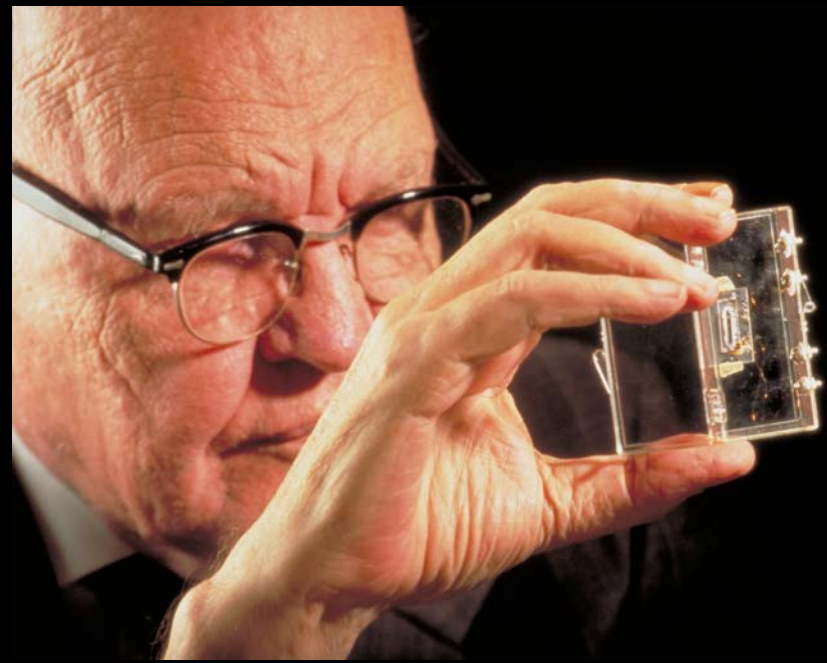
The Bell Labs team of John Bardeen, Walter Brattain and William Shockley won the 1956 Nobel Prize in Physics for their work in developing transistors.



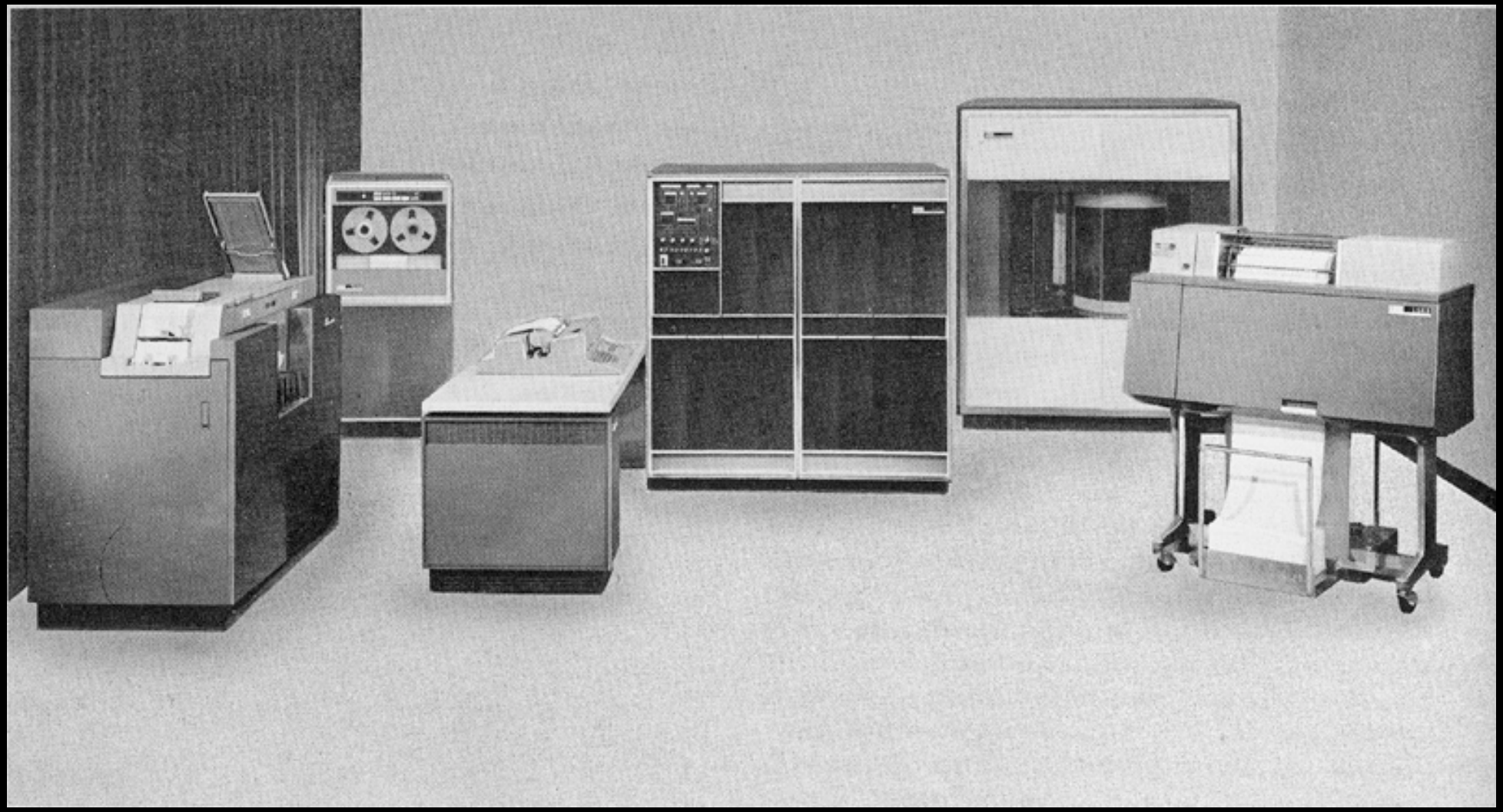
Jack Kilby's original integrated circuit created at Texas Instruments, 1958



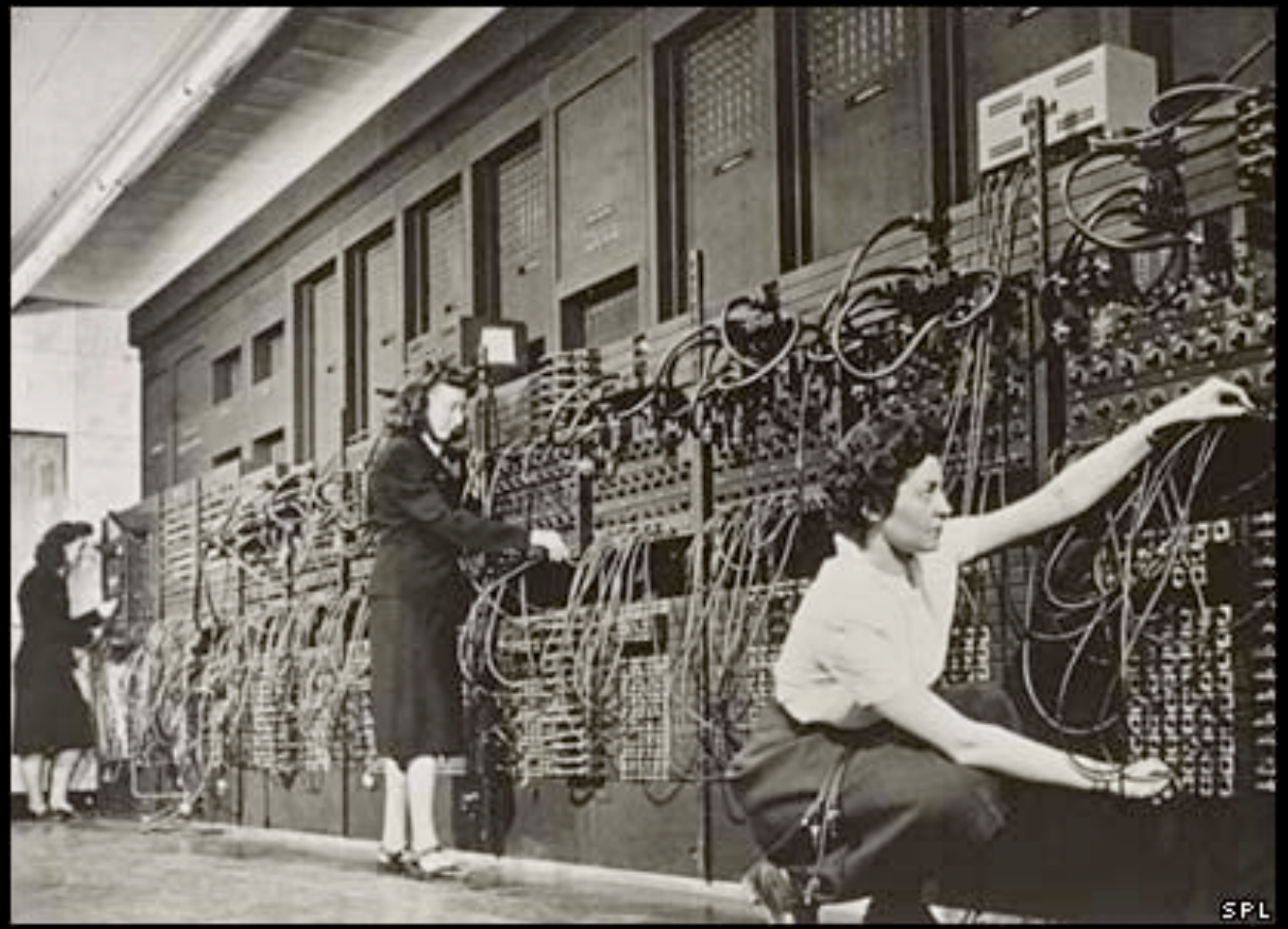
Integrated Circuit 1958




Untitled photographs by Jack Kilby, c. 1955

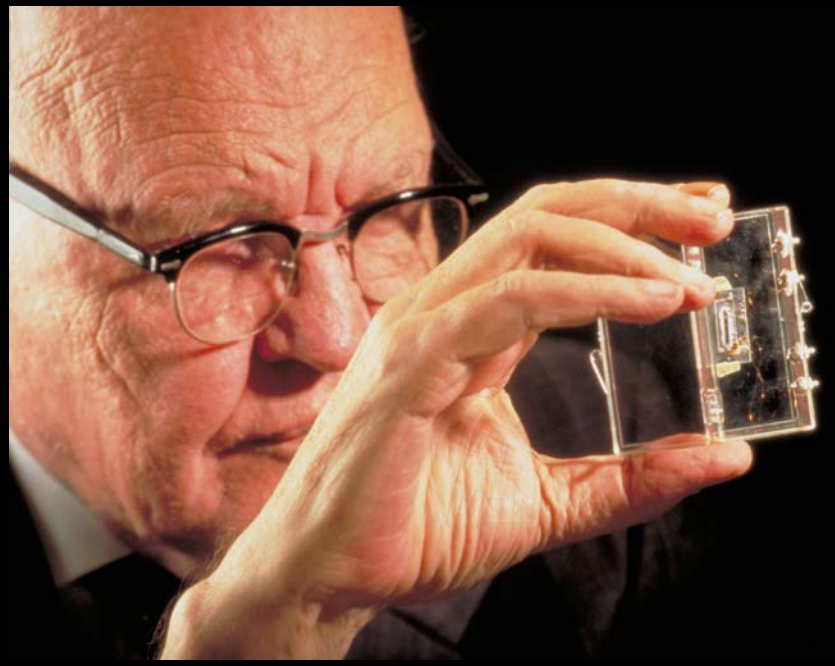


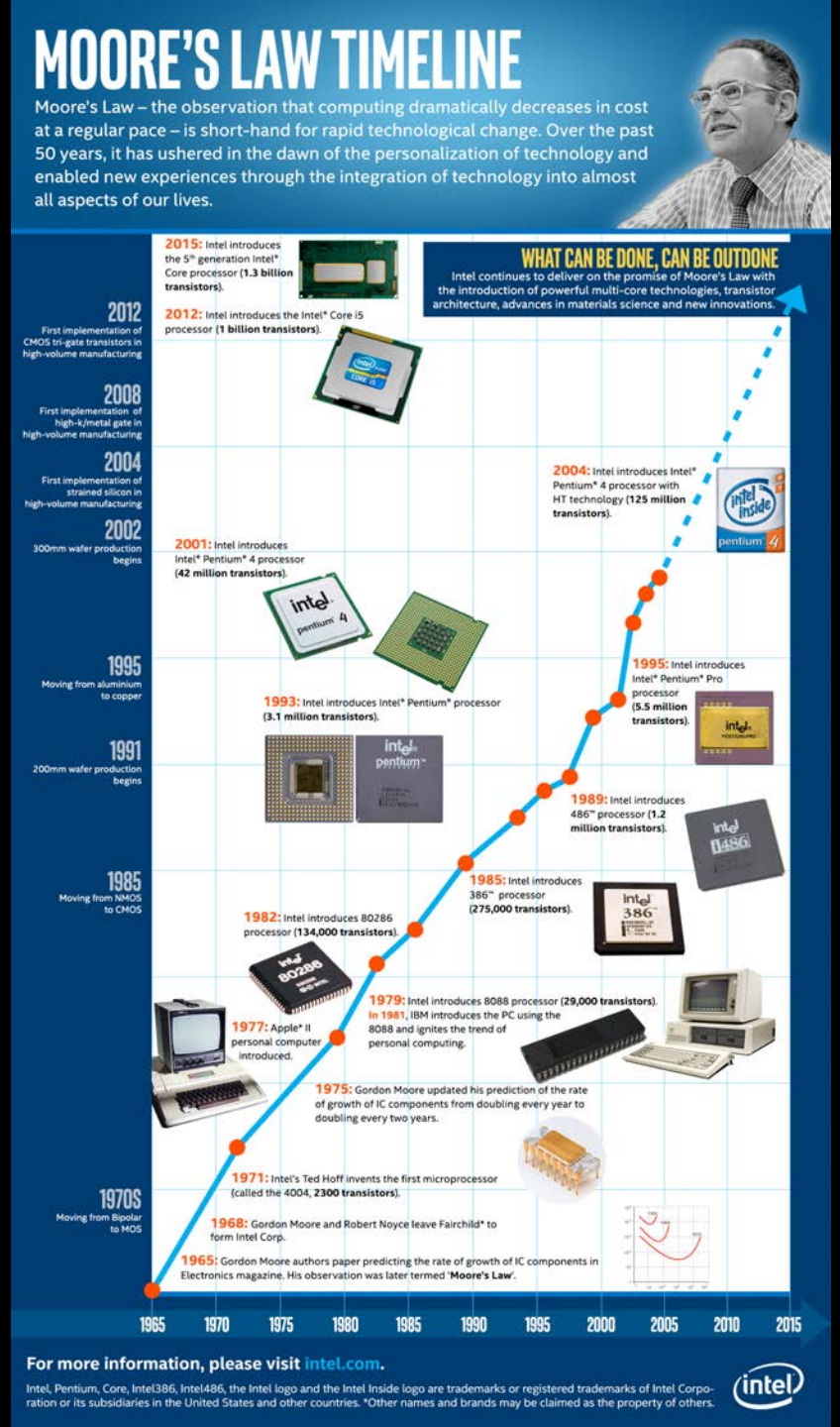
IBM 1401 Data Processing System, 1959




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

Microprocessors and personal computers, 1970s






# MOORE'S LAW

Named for Gordon Moore (b. 1929). It is the idea that the number of transistors in a dense integrated circuit doubles approximately every two years. He developed this idea in a 1965 paper.

# 1 The accelerating pace of change ...

Agricultural Revolution ← 8,000 years → Industrial Revolution ← 120 years → Light-bulb ← 90 years → Moon landing ← 22 years → World Wide Web ← 9 years → Human genome sequenced

# 2 ... and exponential growth in computing power ...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years

# 3 ... will lead to the Singularity

**2045**
Surpasses brainpower equivalent to that of all human brains combined

Surpasses brainpower of human in 2023

Surpasses brainpower of mouse in 2015

**Colossus**
The electronic computer, with 1,500 vacuum tubes, helped the British crack German codes during WW II

**UNIVAC I**
The first commercially marketed computer, used to tabulate the U.S. Census, occupied 943 cu. ft.

**Apple II**
At a price of $1,298, the compact machine was one of the first massively popular personal computers

**Power Mac G4**
The first personal computer to deliver more than 1 billion floating-point operations per second

**COMPUTER RANKINGS**
By calculations per second per $1,000

**Analytical engine**
Never fully built, Charles Babbage's invention was designed to solve computational and logical problems

Hollerith Tabulator
IBM Tabulator
National Ellis 3000
Zuse 2
Zuse 3
ENIAC
BINAC
IBM SSEC
EDVAC
Whirlwind
Datamatic 1000
IBM 1620
DEC PDP-4
IBM 1130
DEC PDP-10
Data General Nova
Intellec-8
IBM PC
Compaq Deskpro 386
Pentium PC
Pentium II PC
Dell Dimension 8400
Mac Pro
Nvidia Tesla GPU & PC

$10^{26}$
$10^{20}$
$10^{15}$
10,000,000,000
100,000
1
0.00001

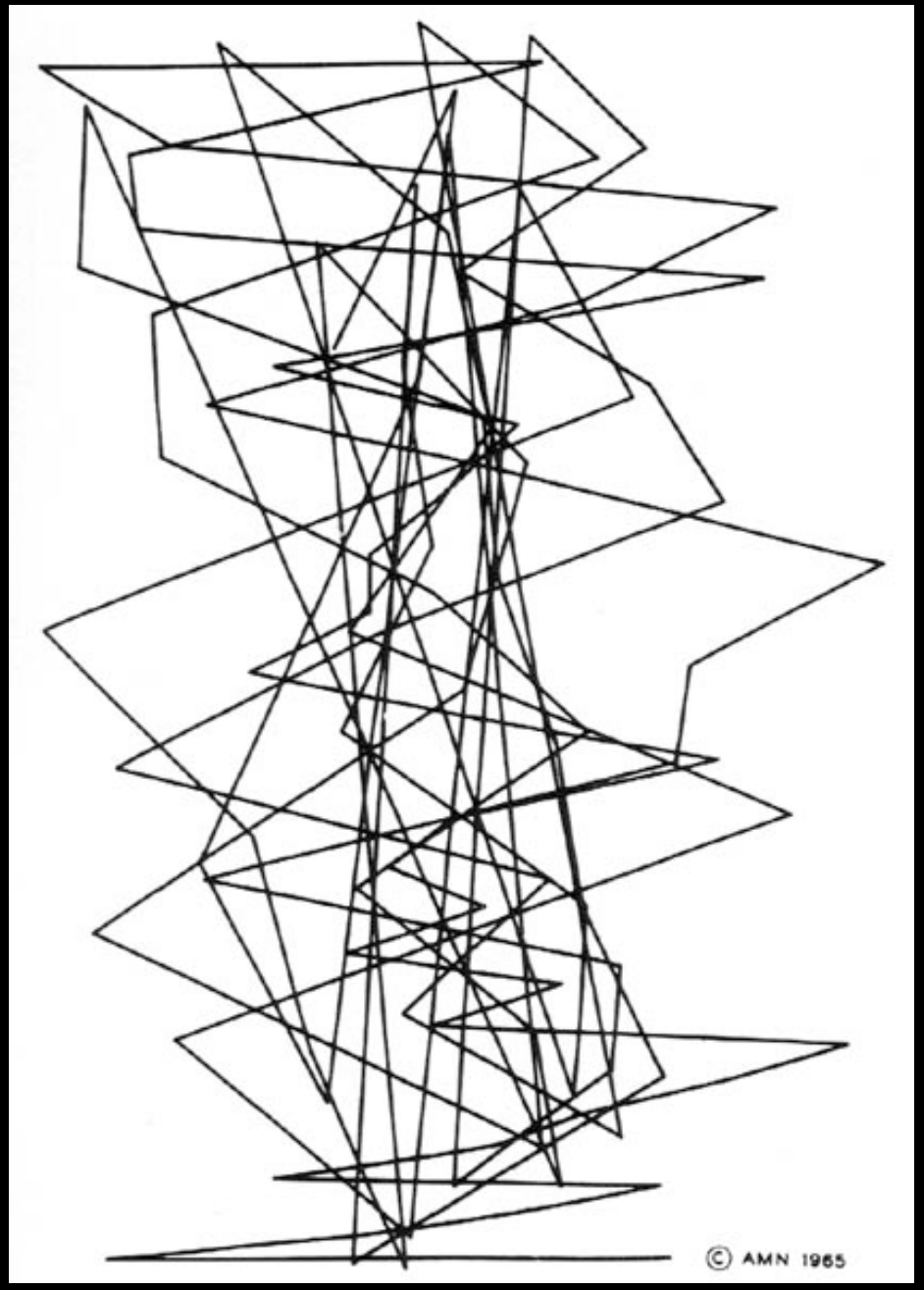
ELECTROMECHANICAL → RELAYS → VACUUM TUBES → TRANSISTORS → INTEGRATED CIRCUITS

1900 1920 1940 1960 1980 2000 2011 2020 2045

If the development of digital technology is fundamentally bound to the market and military industrial complex, how can digital art be “autonomous”?

# AUTONOMY, DIGITAL TECHNOLOGY, AND ART

## DIGITAL IMAGE
## VS.
## DIGITAL PERFORMANCE




A. Michael Noll, Gaussian Quadratic, 1962

**E.A.T.** **PROJECTS OUTSIDE ART**

December 8, 1969 — 235 Park Avenue South, New York, New York 10003

E.A.T. announces an exhibition, PROJECTS OUTSIDE ART – an exhibition of realizable projects in the environment – and requests submission of proposals.

Projects for the exhibition

–deal with such subjects as education, health, housing, concern for the natural environment, climate control, transportation, energy production and distribution, communication, food production and distribution, women's environment, cooking, entertainment, sports, etc.;

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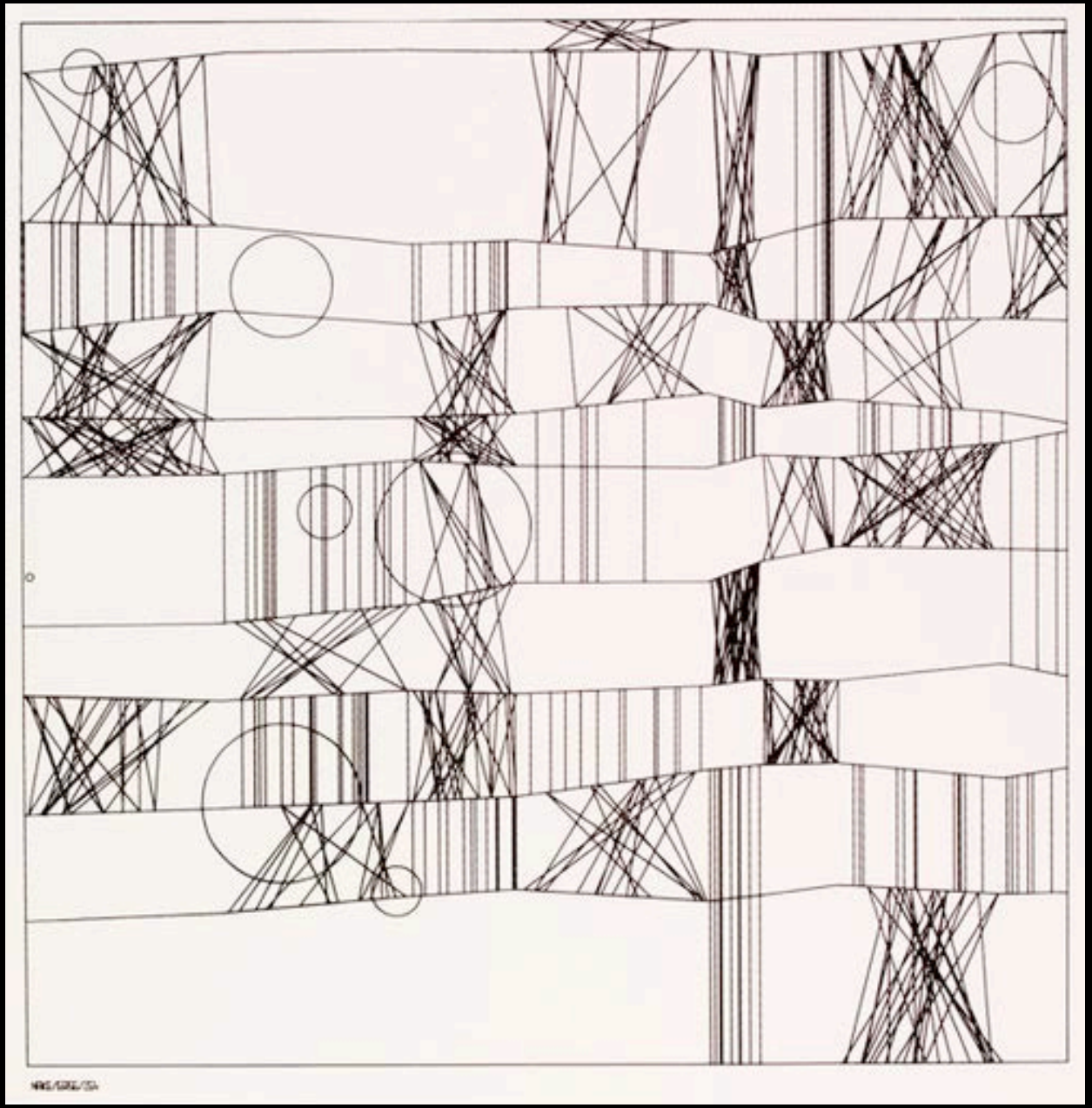
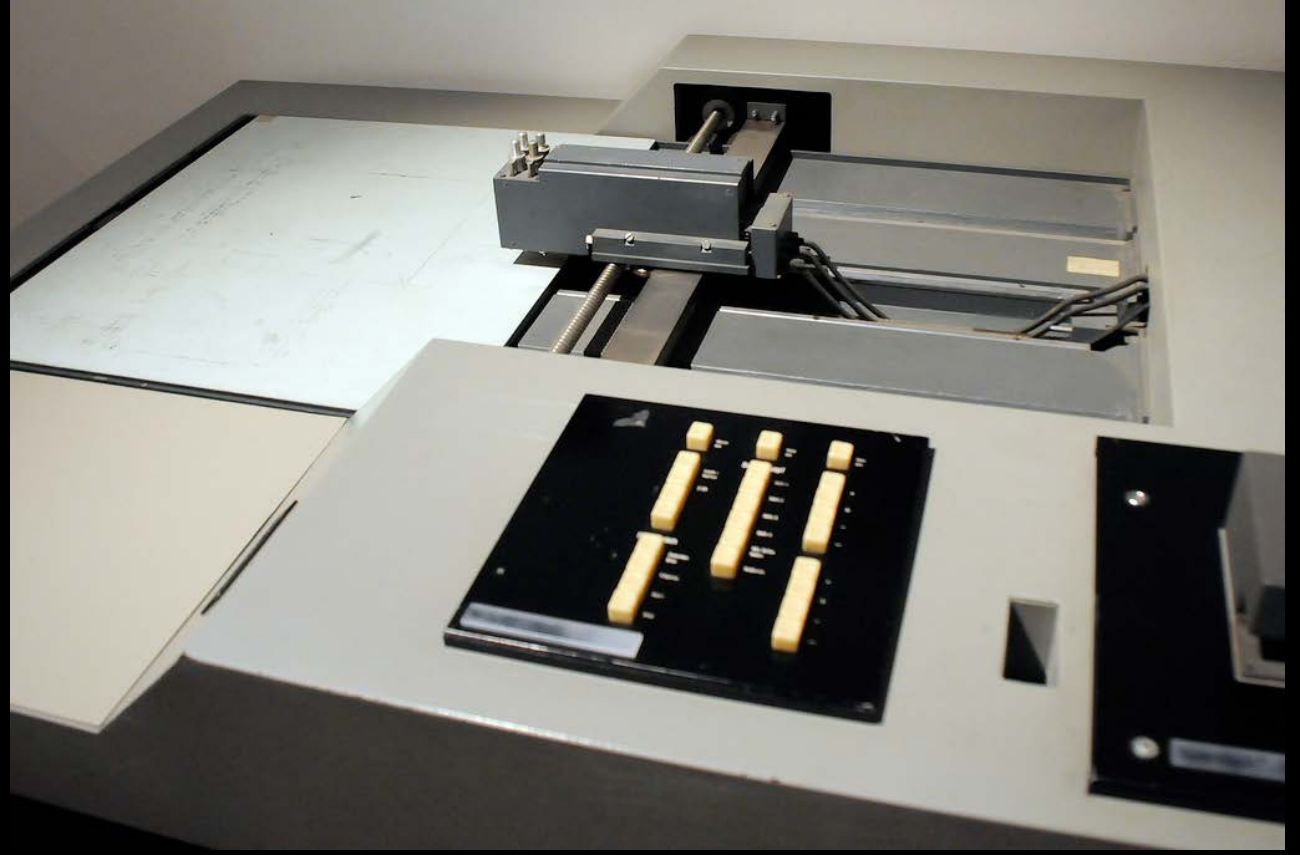


Frieder Nake, Homage to *Paul Klee* 13/9/65 No. 2, 1965

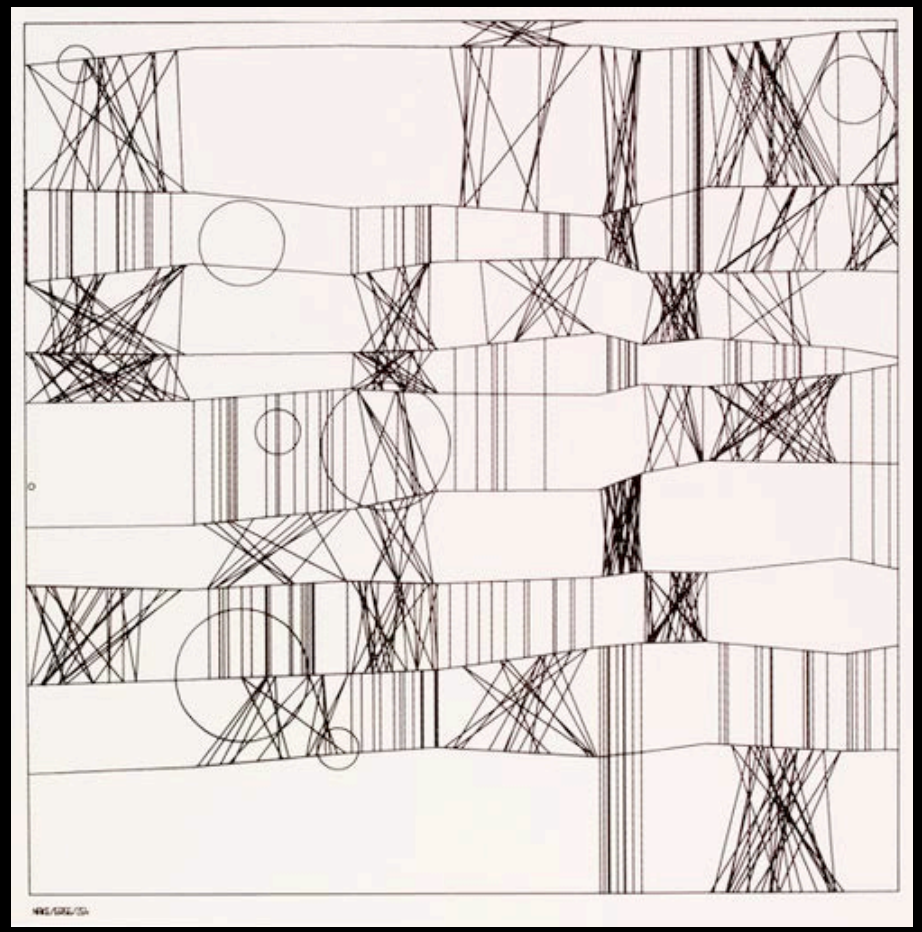


## ZUSE Graphomat Z 64

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

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

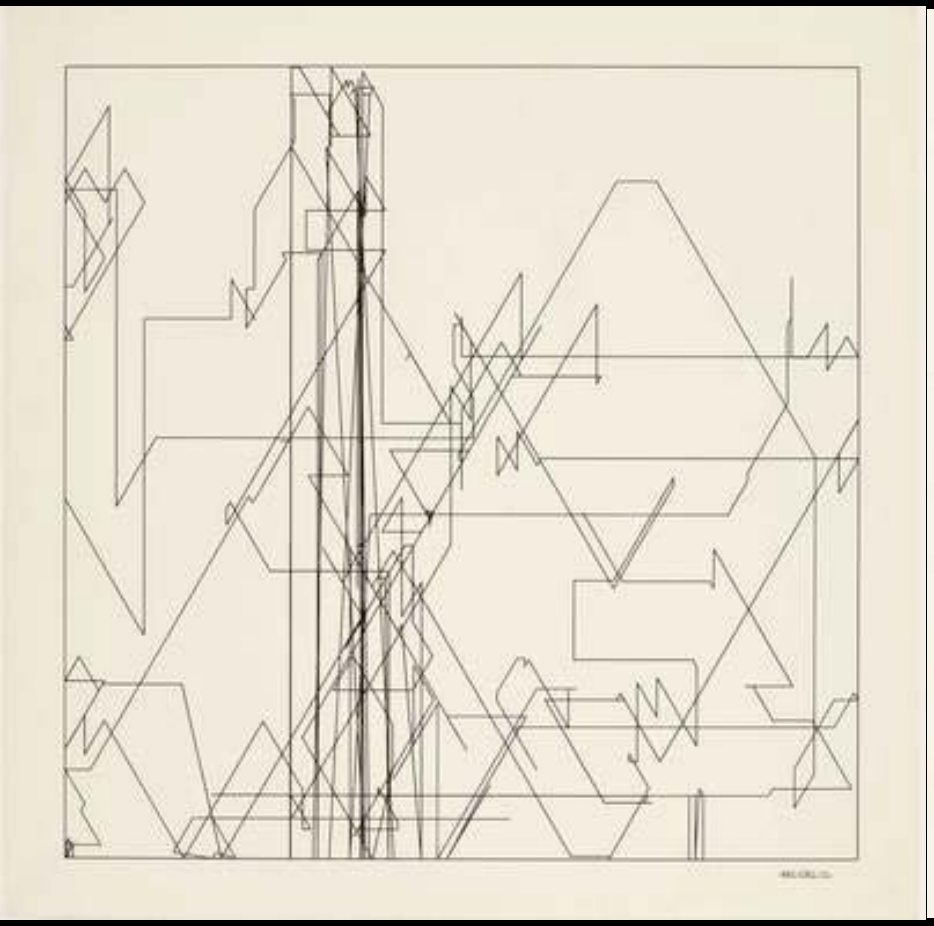


Frieder Nake, Hommage to *Paul Klee* 13/9/65 No. 2, 1965

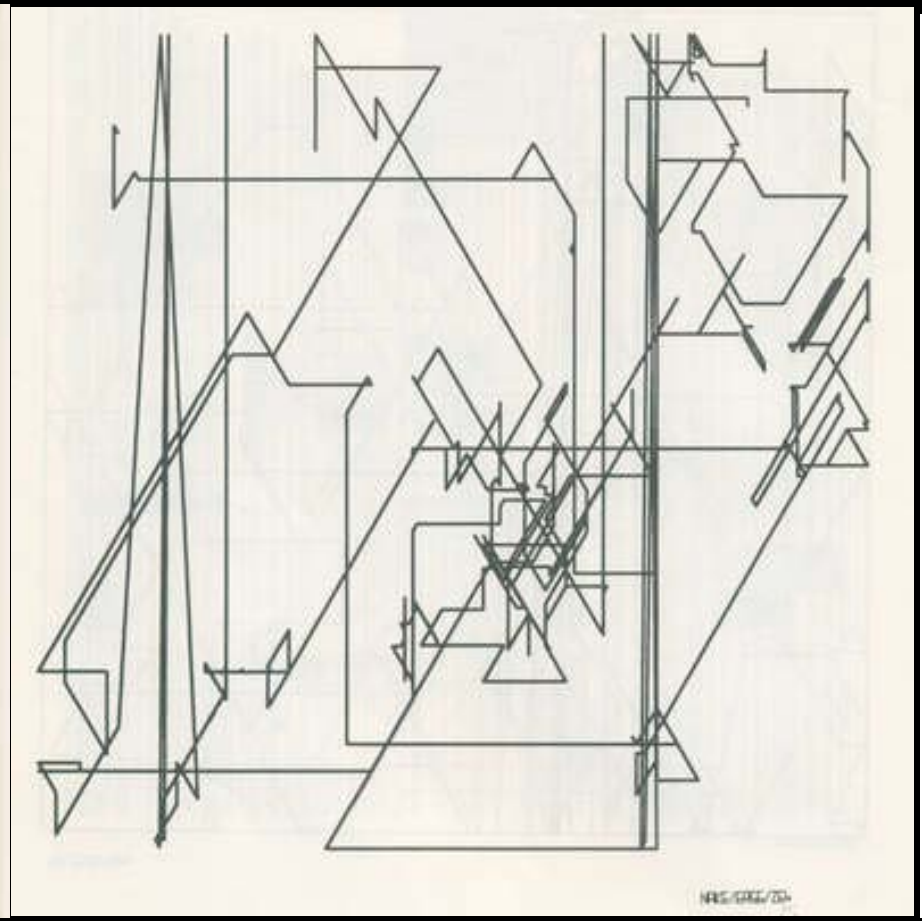
# Algorithms and Constraints in Art

algorithm, noun: a procedure for solving a mathematical problem in a finite number of steps that frequently involves repetition of an operation; *broadly* : a step-by-step procedure for solving a problem or accomplishing some end especially by a computer

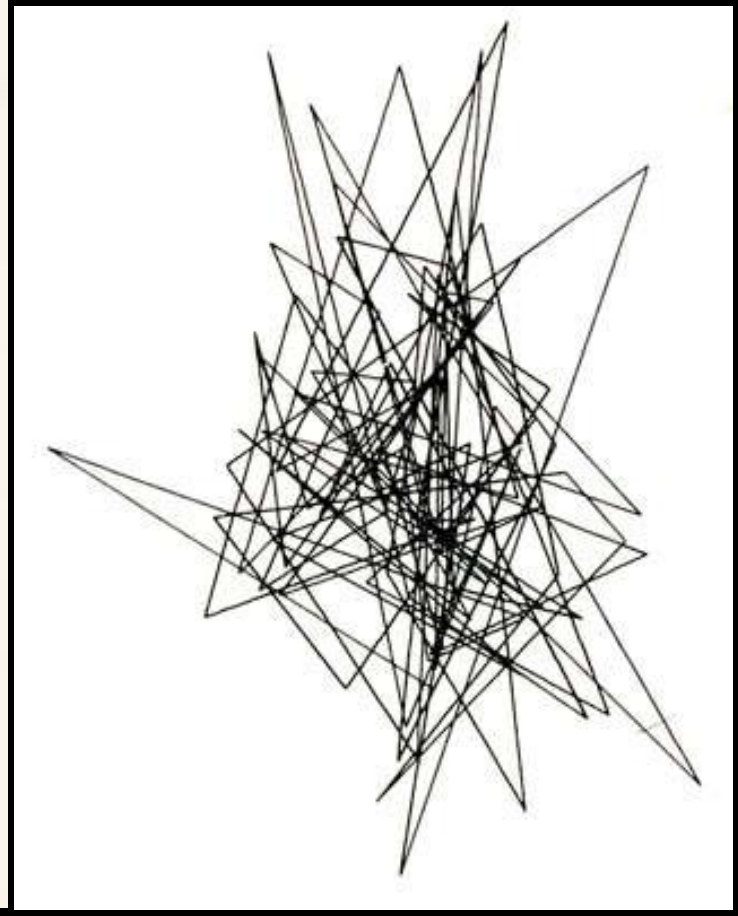
Etymology: 1690s, "Arabic system of computation," from French algorithme, refashioned (under mistaken connection with Greek arithmos "number") from Old French algorisme "the Arabic numeral system" (13c.), from Medieval Latin algorismus, a mangled transliteration of Arabic **al-Khwarizmi** "native of Khwarazm" (modern Khiva in Uzbekistan), surname of the mathematician whose works introduced sophisticated mathematics to the West



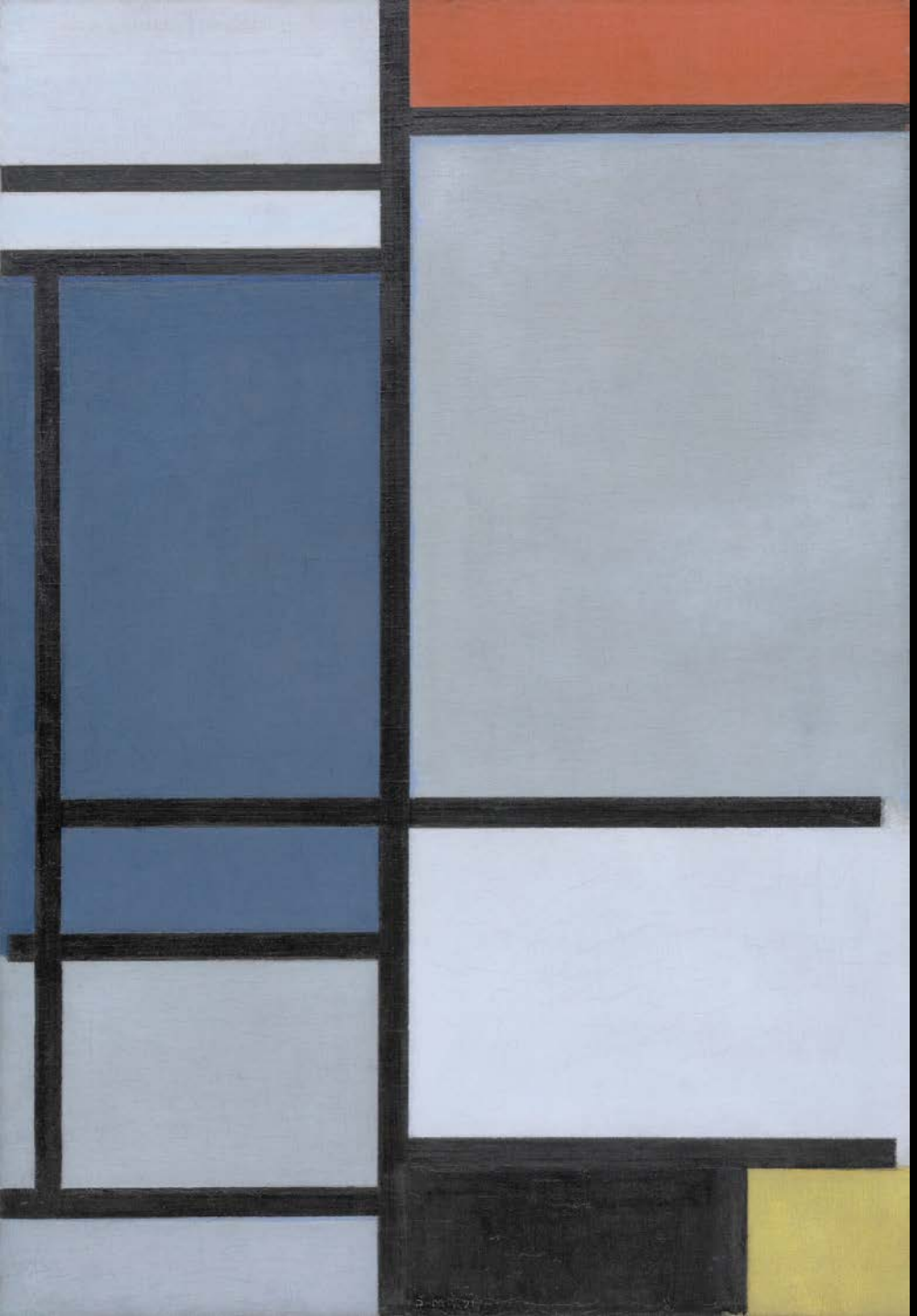
Frieder Nake, Random Polygon, 1965



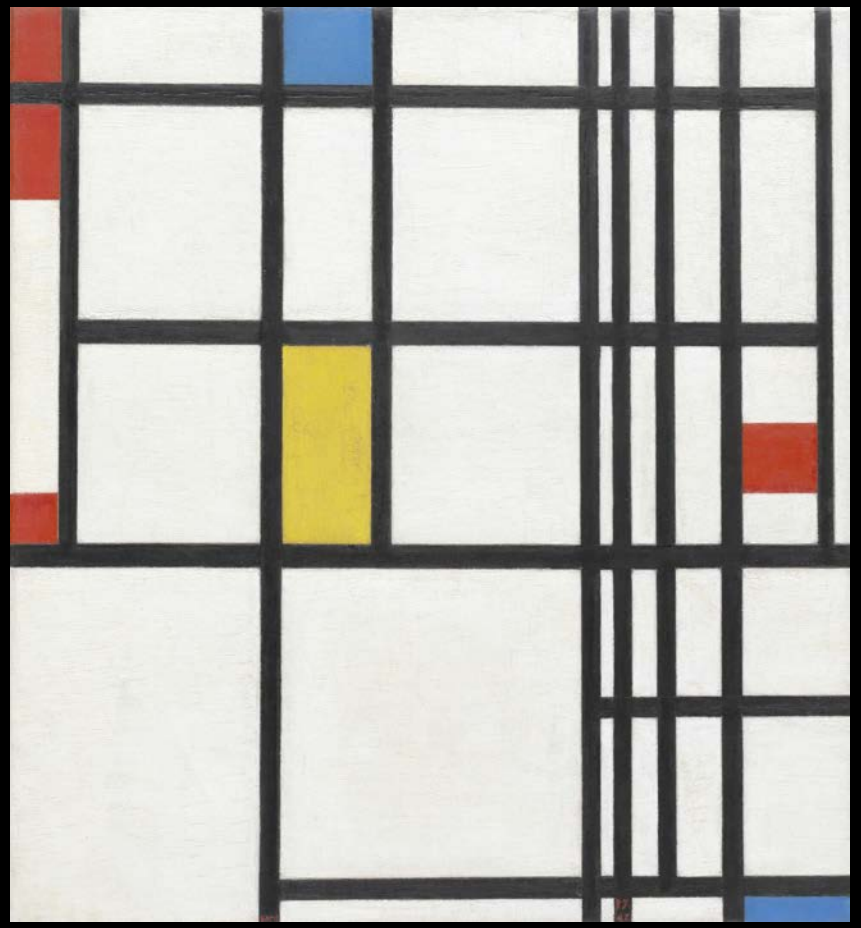
Frieder Nake, Polygonal Course No. 7, 1965



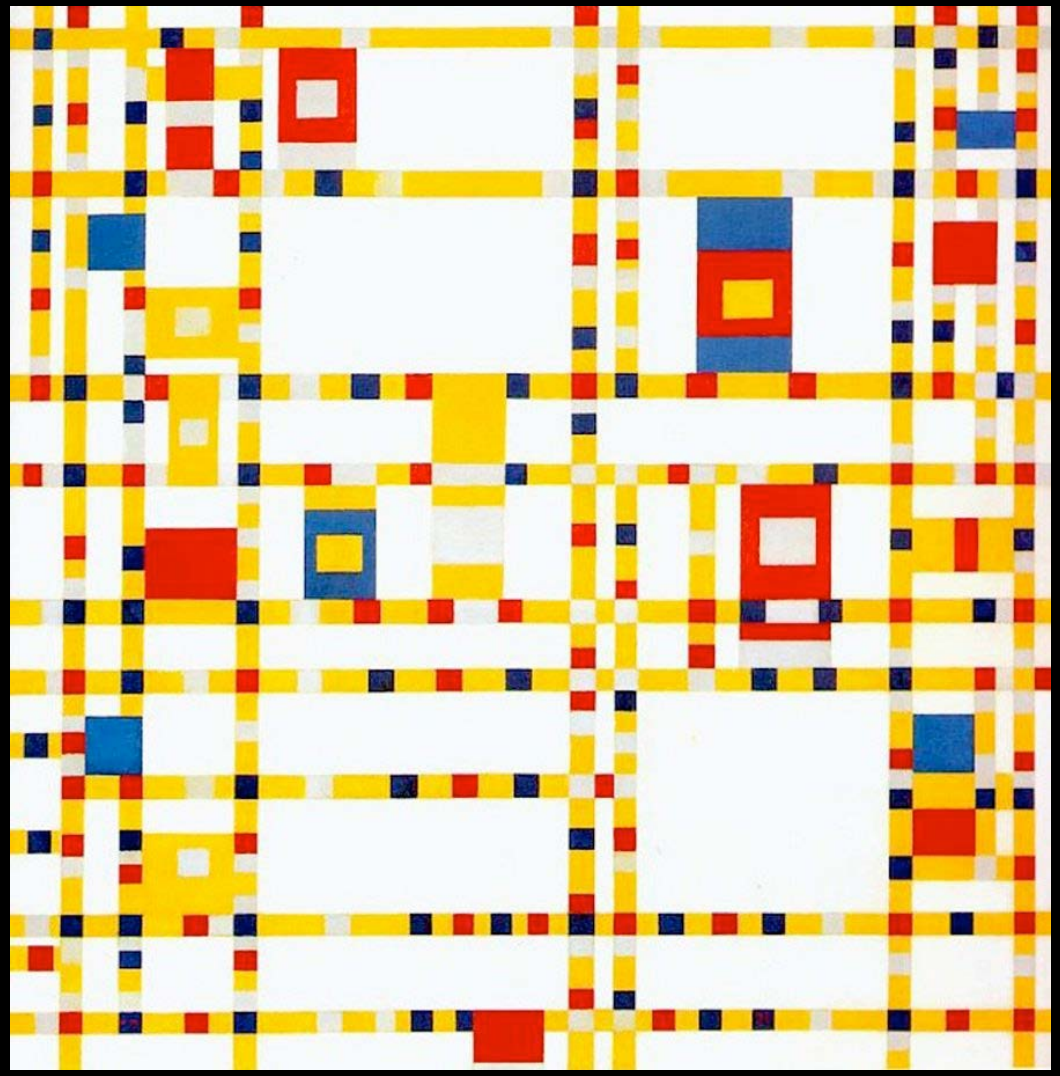
Frieder Nake, Polygonal Course No. 20, 1965



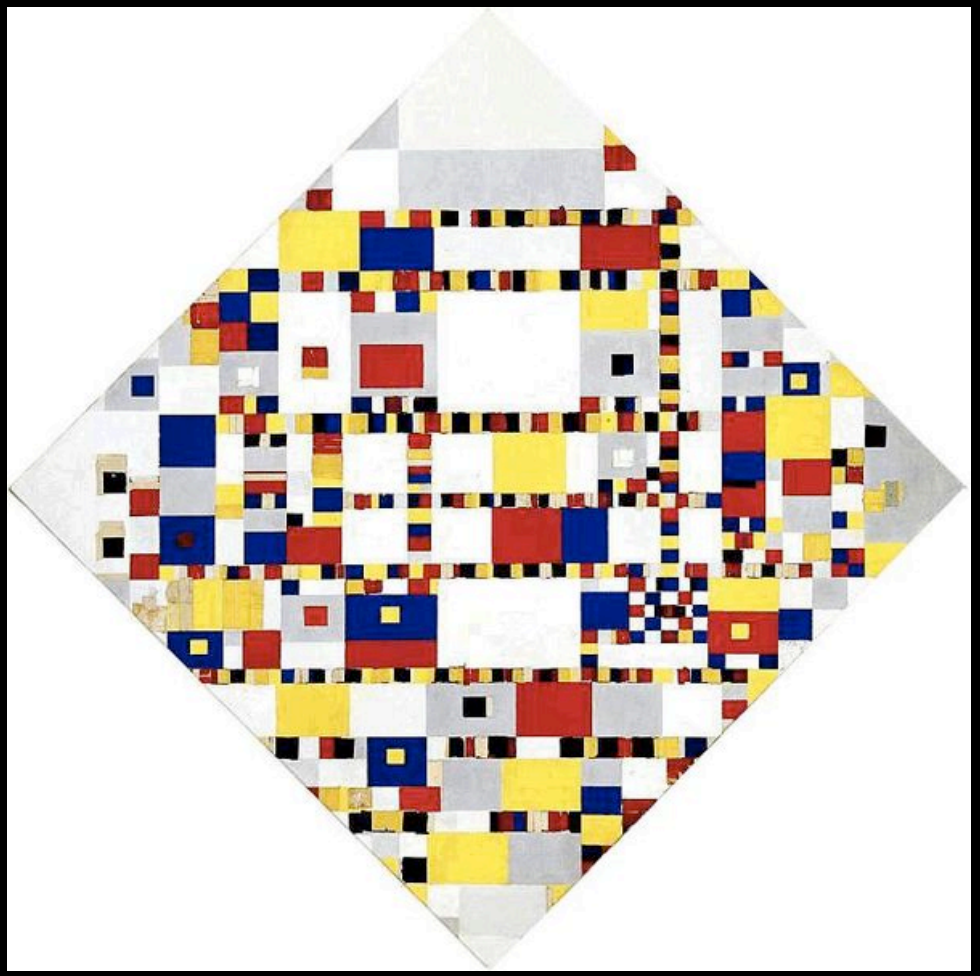
Piet Mondrian,
Composition
with Red, Blue,
Black, Yellow,
and Gray,
1921



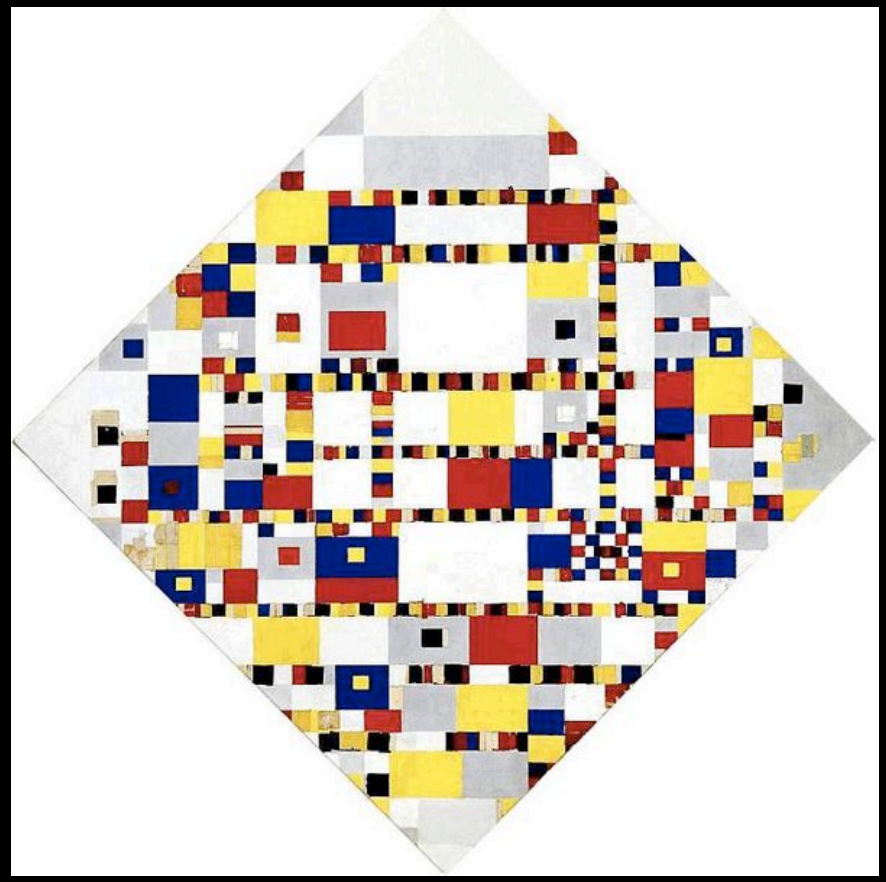
Piet Mondrian, *Composition in Red, Blue, and Yellow,* 1937-42



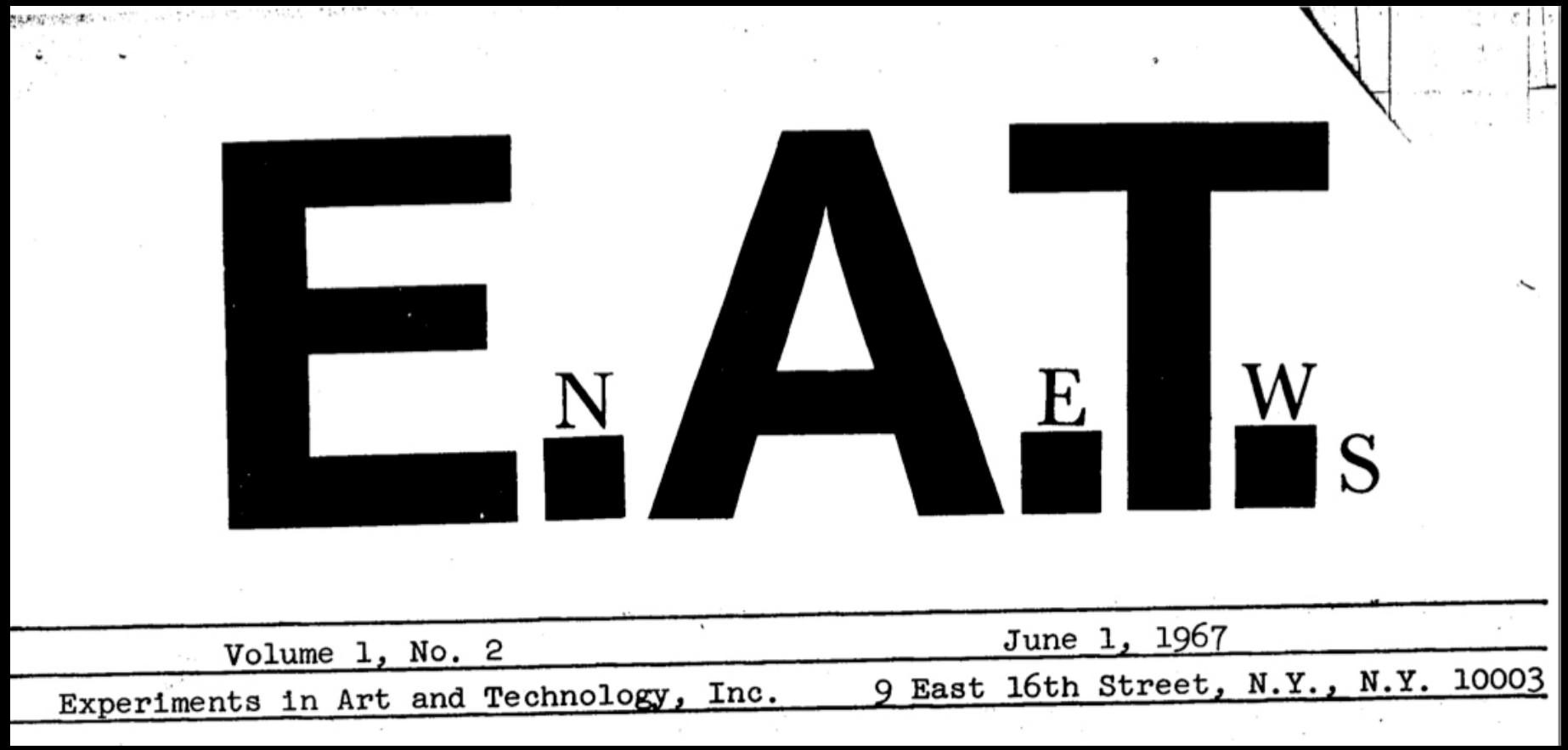
Piet Mondrian, Broadway Boogie Woogie, 1942-43



Piet Mondrian, Victory Boogie Woogie, 1943-44



Piet Mondrian, Victory Boogie Woogie, 1943-44




Experiments in Art and Technology was founded in 1966 by engineers Billy Klüver and Fred Waldhauer and artists Robert Rauschenberg and Robert Whitman.

Billy Klüver, Fred Waldhauer, Robert Rauschenberg, John Cage, David Tudor, Yvonne Rainer, Deborah Hay, Robert Whitman, Steve Paxton, Alex Hay, Lucinda Childs and Öyvind Fahlström

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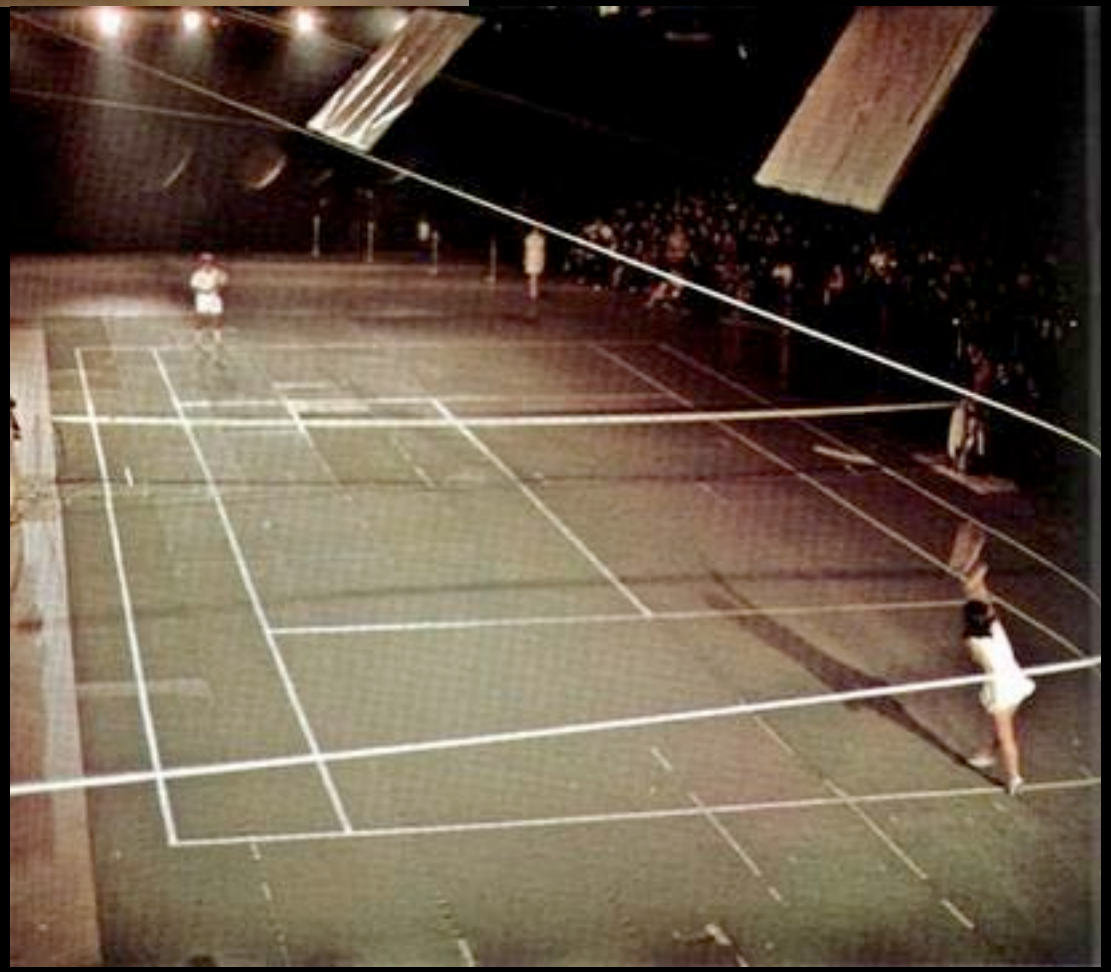
EAT/Robert Rauschenberg, Open Score, 1966

Each time Frank Stella and Mimi Kanarek hit the ball the vibrations of the racquet strings were transmitted to the speakers around the armory, and a loud BONG was heard.

https://www.youtube.com/watch?v=kWadsDX1UxA



# AUTONOMY, DIGITAL TECHNOLOGY, AND ART

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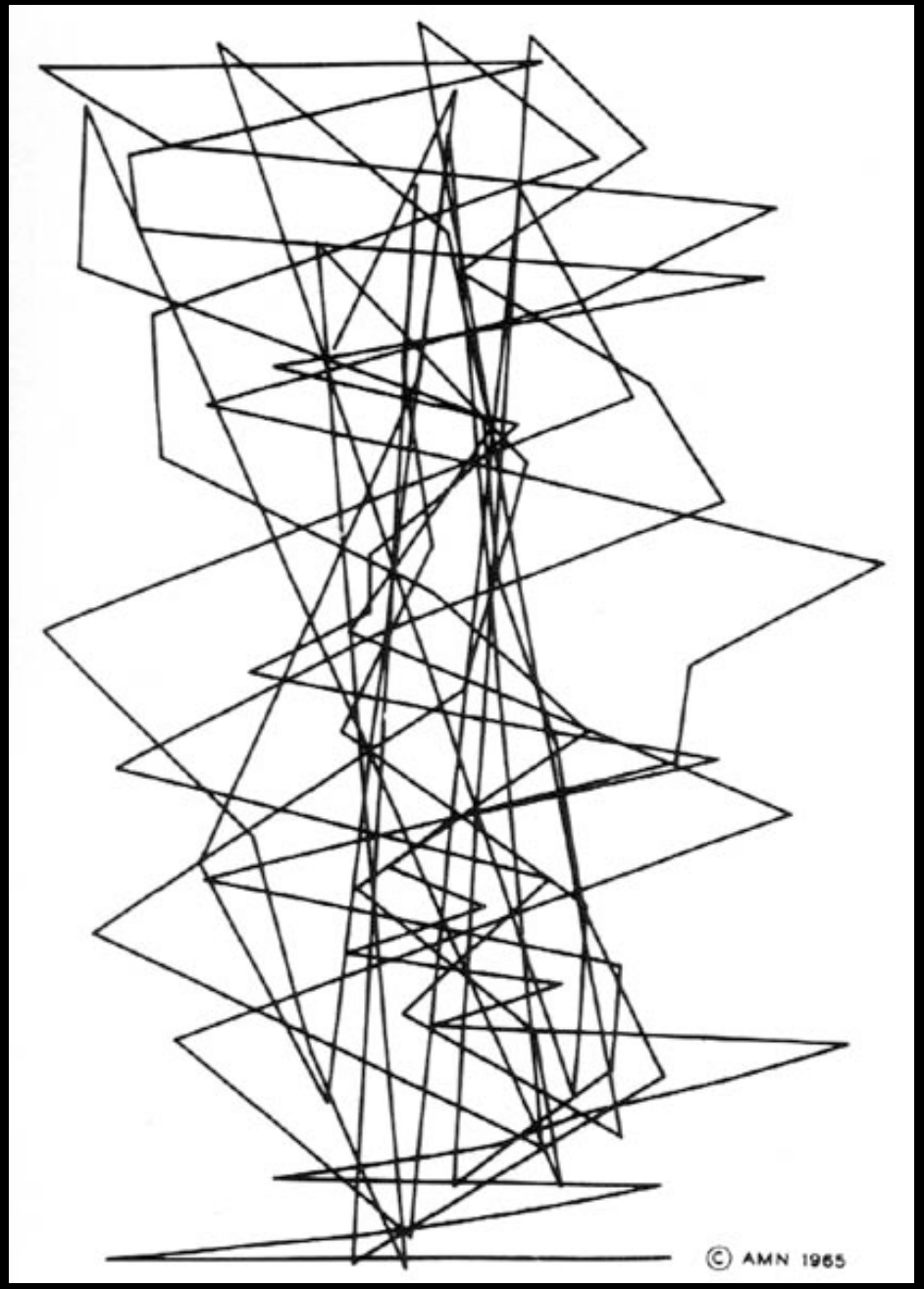


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THE NEW YORKER



BRAVE NEW WORLD DEPT. APRIL 2, 2018 ISSUE

# ARE WE ALREADY LIVING IN VIRTUAL REALITY?

*A new technology—virtual embodiment—challenges our understanding of who and what we are.*

By Joshua Rothman

Joshua Rothman, "Are We Already Living in Virtual Reality," *The New Yorker,* April 2, 2018. Available through DOCUTEK and here: https://www.newyorker.com/magazine/2018/04/02/are-we-already-living-in-virtual-reality

Who is Thomas Metzinger?

What is “O.B.E.” and what role does it play in the article?

In terms of writing style, what is the tone of this essay?

Thomas Metzinger (b. 1958) is a German philosopher of mind and professor of theoretical philosophy at the Johannes Gutenberg University of Mainz.

Metzinger argues that no such things as selves exist in the world: nobody ever had or was a self. All that exists are phenomenal* selves, as they appear in conscious experience. He argues that the phenomenal self, however, is not a thing but an ongoing process; it is the content of a "transparent self-model."

*Phenomenal: perceptible by the senses or through immediate experience.

Metzinger “begun to wonder whether reality, as we experience it, might be a mental stage set—a representation of the world, rather than the world itself. Having an O.B.E. could be like visiting the set at night, when it wasn’t being used. Metzinger started to think about how such a model might be constructed. Some internal mental system must function as an invisible, unconscious set dresser, making an itch feel like an itch, coloring the sky blue and the grass green.”

# What are Metzinger’s “self-models” and what are their relationships to VR?

It isn’t just that we live inside a model of the external world, Metzinger wrote. We also live inside models of our own bodies, minds, and selves. These “self-models” don’t always reflect reality, and they can be adjusted in illogical ways. They can, for example, portray a self that exists outside of the body—an O.B.E.

Metzinger and Blanke set about hacking the self-model. Along with the cognitive scientists Bigna Lenggenhager and Tej Tadi, they created a virtual-reality system designed to induce O.B.E.-like episodes. In 2005, Metzinger put on a virtual-reality head-mounted display—a headset containing a pair of screens, one for each eye, which together produce the illusion of a 3-D world. Inside, he saw his own body, facing away from him, standing in a room. (It was being filmed by a camera placed six feet behind him.) He watched as Lenggenhager stroked its back. Metzinger could feel the stroking, but the body to which it was happening seemed to be situated in front of him. He felt a strange sensation, as though he were drifting in space, or being stretched between the two bodies. He wanted to jump entirely into the body before him, but couldn’t. He seemed marooned outside of himself. It wasn’t quite an out-of-body experience, but it was proof that, using computer technology, the self-model could easily be manipulated. A new area of research had been created: virtual embodiment.

# What is embodied virtual experience?

Embodied virtual experience is the name given to the study of consciousness and cognitive science through VR.

Where does virtual embodiment fall within the spectrum of virtual reality we have developed in this class?

“We have the illusion that our body model is very stable, but that’s only because we’ve never encountered anything else,” Sanchez-Vives said. People who are extremely aware of their bodies—dancers, athletes, yogis—can find the adoption of a virtual body difficult, because they have trouble “letting go.” “But the more you do it the easier it becomes. After you’ve experienced it once, twice, you click into it.” In the past few years, Slater, Sanchez-Vives, and other virtual-embodiment researchers have discovered therapeutic and educational uses for the technology. Meanwhile, Metzinger, along with the philosopher Michael Madary, has drafted a virtual-reality “code of ethics” focussed on embodiment, which he believes makes V.R. fundamentally different from all other media. Embodied virtual experience, the philosophers write, can change us profoundly. It can affect us in ways we barely understand, redefining “the very relationship we have to our own minds.”

# How is virtual embodiment different from VR as represented in movies such as the *Matrix* and *Ready Player One*?

Virtual embodiment has a different goal [than these films]: convincing you that you are someone else. This doesn’t require fancy graphics. Instead, it calls for tracking hardware—which allows your virtual body to accurately mirror the movements of your real head, feet, and hands—and a few minutes of guided, Tai Chi-like movement before a virtual mirror. In Slater’s lab, at the Universitat de Barcelona, I put on a V.R. headset and looked into such a mirror to see the body of a young woman wearing jeans, a T-shirt, and ballet flats. When I moved, she moved.

Why are researchers using this variation of VR?
For what purposes are they using it?

It has therapeutic functions, bringing critical self-consciousness and self-awareness to individuals.

Since 2011, the regional government of Catalonia has collaborated with the lab to use this simulation in rehabilitation programs for abusive men. In a controlled study performed in Sanchez-Vives's lab by the psychologist Sofia Seinfeld, and recently published in *Nature Scientific Reports*, the men who experienced the simulation got significantly better at recognizing fear in the faces of women. (Domestic abusers tend to be deficient in this regard.) In the past three years, hundreds more abusive men have experienced the simulation outside the lab, as part of a larger rehabilitation program. Preliminary data, which Sanchez-Vives and Slater are hesitant to publish because of the small sample size, suggest that the men's recidivism rates are lower. ("I felt identified with my ex-wife," one man recalled. "I thought he was going to hit me, so I covered my face with one of my hands," another said.) Men who have merely watched a video, or experienced a V.R. simulation without undergoing the embodiment process, report fewer such epiphanies.

# What role does empathy play in virtual embodiment?

With a team of various collaborators, Slater and Sanchez-Vives have created many other-body simulations; they show how inhabiting a new virtual body can produce meaningful psychological shifts. In one study, participants are re-embodied as a little girl. Surrounded by a stuffed bear, a rocking horse, and other toys, they watch as their mother sternly demands a cleaner room. Afterward, on psychological tests, they associate themselves with more childlike characteristics. In another, white participants spend around ten minutes in the body of a virtual black person, learning Tai Chi. Afterward, their scores on a test designed to reveal unconscious racial bias shift significantly.

# What are the potential drawbacks of virtual embodiment?

In their V.R. code of ethics, Metzinger and Madary predict that the “risk of users suffering psychological trauma will steadily increase as V.R. technology advances.” Metzinger believes that virtual killing and sexual violence should be prohibited. He also worries about scenarios that encourage the character traits that psychologists refer to as “the dark triad”: narcissism, Machiavellianism, and psychopathy. He fears the effects of a V.R. “Westworld.”

# According to Metzinger, what does VR tell us about ourselves?

Our mental models of reality are like V.R. headsets that we don't know we are wearing. Through them, we experience our own inner lives and have inner sensations that feel as solid as stone. But in truth:

> Nobody ever *was* or *had* a self. All that ever existed were conscious self-models that could not be recognized as models. . . . You are such a system right now. . . . As you read these sentences, you constantly *confuse* yourself with the content of the self-model activated by your brain.

# How are we to understand the relationship between reality and virtual reality with respect to the following comments from the article made by metzinger?

"It's a big question, when the word 'real' makes sense," Metzinger said. His brow furrowed. "An interesting possibility is that the whole distinction between real and unreal is misguided." He gestured toward the flame of the candle on the table between us. "In Buddhist metaphysics, there is the idea of 'emptiness.' To realize the emptiness of things is to say, 'This is neither real *nor* nonexistent.' Our perception of the candle refers to something real, in the real world. But *this* candle—the one we see—it's mental content. And yet it's also not true that the experience, the model in our minds, is unreal. It's 'empty.' 'Empty' may have been their way of saying that it's just a virtual model. 'Emptiness' could be 'virtuality.' "

# VIRTUAL EMBODIMENT

# AND

# EXTENDED MIND