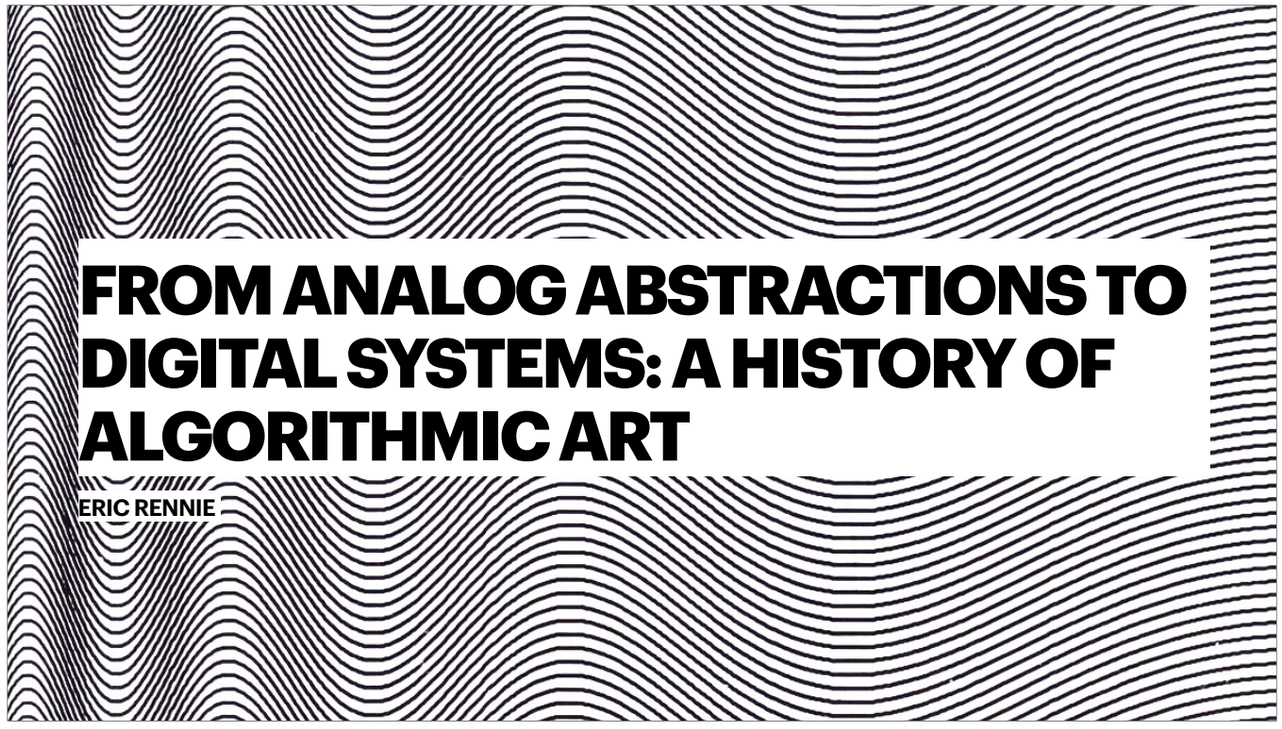
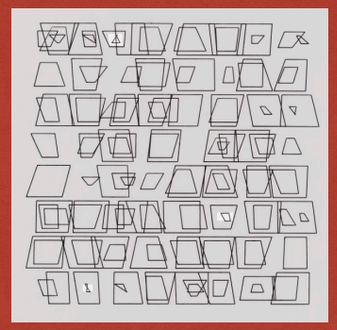

FROM ANALOG ABSTRACTIONS TO DIGITAL SYSTEMS: A HISTORY OF ALGORITHMIC ART
ERIC RENNIE

WHAT IS ALGORITHMIC ART?

- A form of art that uses algorithms and computational processes as a primary medium for creating visual pieces (“Algorithmic art”).
- Combines mathematics, computer science, and creativity to produce the work.
- Artist’s role shifts from direct manual creation to the design of the algorithm and its parameters (“Algorithmic art”).



Untitled (MV457-1-5) Génèse du Trapèze by Vera Molnar

What is algorithmic art?
Algorithmic art is art created through explicit rules, procedures, or algorithms. It combines math, computer science, and creativity. It includes analog mechanical systems, early digital computation, and generative procedures. Here, the artist’s role shifts from direct manual creation of a composition to the design of the algorithm and its parameters (“Algorithmic art”).

“Algorithmic art.” *Fiveable*, Fiveable Inc., https://fiveable.me/key-terms/introduction-art/algorithmic-art. Accessed 29 Nov. 2025.

BEGINNINGS

- Post World War II
- Collaborations between artists, engineers, and scientists
- No precedent
- No personal computers
- No monitors

Oscillon (1952) by Ben Laposky

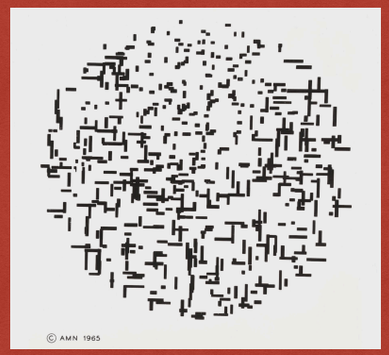
Much of the technology used to create generative art evolved out of the military and war. Many of the earliest experiments in computer imaging were created by artists interested in using the computer as an expressive medium (Caplan et al.). Rarely trained in engineering or mathematics, these artists brought the aesthetics of other art forms circulating at the time, such as Concrete and Op art (Caplan et al.)
Since these artists were using computers in unconventional ways, early digital artists had no stylistic models or inherited tradition, no mentors, and no technical support (Frank). Also, most of these computers were in the hands of educational institutions, the military, and corporations, so artists had to “borrow” computers in order to execute the programs they had written (Frank). Lastly, there were no monitors to preview works in progress and outputs were often printed on paper or plotted (Frank).

Caplan, Lindsay, Jacob Gaboury, and Zsofi Valyi-Nagy. Electric Op. Buffalo AKG Art Museum in association with GILES, 2024.

Frank, Patrick. Coded: Art Enters the Computer Age, 1952–1982. Los Angeles County Museum of Art, 2023.

CHARACTERISTICS OF EARLY ALGORITHMIC ART

- Connections to Minimal, Op, and Conceptual art
- The grid and the vector
- “The grid is at once an abstraction that eschews representation, and the monadic unit that promises total representation (Caplan et al.).”
- “Visual pluralism” - Analivia Cordeiro
- Rough reception by both the art and computer science worlds.



Computer Composition with Lines (1964) by A. Michael Noll

As I previously stated, early algorithmic art had connections to Minimal, Op, and Conceptual Art. These styles emphasized logic and order, seriality, systems and processes, and information as a structural element (Jones). Within this context emerged two principal mid-century digital aesthetics: the grid and the vector (Caplan et al.). The grid is where early generative art’s pixelated quality comes from. The vector is a simple connecting line that bends and curves to create simple shapes and patterns (Caplan et al.). Generative art produces “visual pluralism” which is multiple variations of the same idea. (Caplan et al.). Early computer art was often dismissed by the art world and computer science viewed it as “inessential" to computing. The general public associated computers with the military-industrial complex, institutional power, and control (Arreola et al.).

Arreola, Pita, Corinna Gardner, and Melanie Lenz, editors. Digital Art: 1960s to Now. Thames & Hudson / V&A Museum, 2024.

Caplan, Lindsay, Jacob Gaboury, and Zsofi Valyi-Nagy. Electric Op. Buffalo AKG Art Museum in association with GILES, 2024.

Jones, Leslie, editor. Coded: Art Enters the Computer Age, 1952–1982. Los Angeles County Museum of Art, 2023.

GENERATIVE AESTHETICS

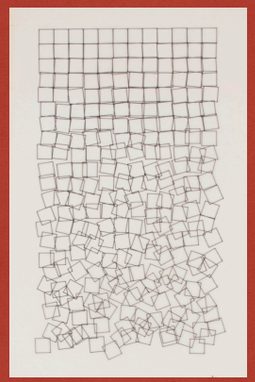
- A combination of operations, rules, and theorems used deliberately to produce aesthetic states.
- Created by Max Bense, a professor at Stuttgart Technical University in Germany who infuenced several generative artists including Frieder Nake and Georg Nees.

Max Bense

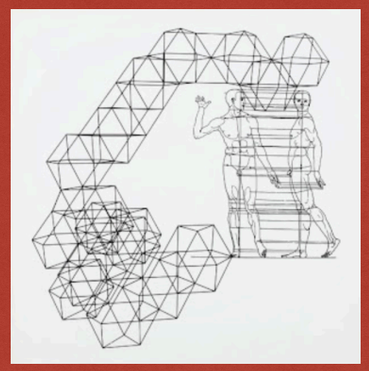
Moving on, a German poet and philosopher named Max Bense who taught at Stuttgart Technical University developed a concept known as generative aesthetics. Generative aesthetics is a combination of operations, rules, and theorems used deliberately to produce aesthetic states. Bense was a major inspiration for renowned generative artists Frieder Nake and George Nees (Frank).

Frank, Patrick. Coded: Art Enters the Computer Age, 1952–1982. Los Angeles County Museum of Art, 2023.

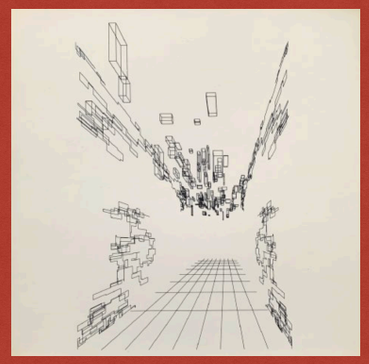
GEORG NEES



Schotter **(1968-1970)**



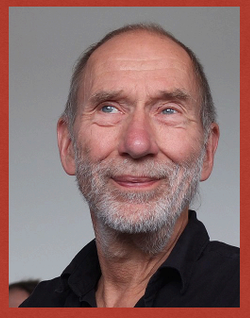
Kubo-Oktaeder **(1971)**

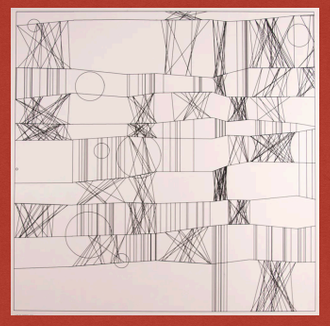


Corridor **(1966)**

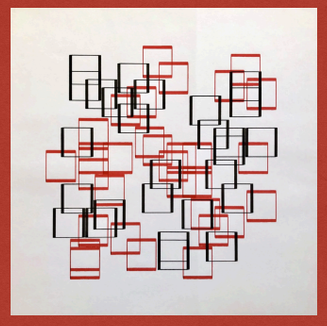
These are a few works from Georg Nees, a pupil of Bense. In *Schotter*, we see a series of squares arranged in a grid-like formation that begin with perfect order and gradually dissolve into disorder. As the composition moves downward, each square becomes increasingly rotated and subtly displaced, creating a visual progression from structure to chaos.

FRIEDER NAKE





Hommage à Paul Klee, 13/9/65 Nr. 2 (1965)



Walk Through Raster Series 7.3.3-1 (1967)

Frieder Nake worked alongside Georg Nees creating works with strong computational aesthetic. His work, Homage to Paul Klee randomly designates eight elements, including changing the widths of horizontal bands, the location of figures per rectangle, and the radius of circles (Jones).

Jones, Leslie, editor. Coded: Art Enters the Computer Age, 1952–1982. Los Angeles County Museum of Art, 2023.

LILLIAN SCHWARTZ

- Worked for thirty years at Bell Labs
- Combined the mediums of programming and fine-art materials, such as paint.
- *Pixillation (*1970)
- *Googolplex* (1972)

Back in the US, Lillian Schwartz combined the mediums of programming and fine-art materials, such as paint, while working at Bell Labs. We see this in her work *Pixillation* (Hoy)*.* In *Pixillation,* Schwartz plotted the coordinates of her images with punch cards, fed the card into the computer, and printed graphic forms on 35mm film. After two months, she only had a few seconds of computer-generated imagery, so she added her own hand-painted animations to the film (Hoy).

Later in 1972, she produced Googolplex with the BEFLIX programming language, which divided the screen into a grid of pixel-like squares that could be addressed and programmed individually. In this work, you can see that the grid is the structuring aesthetic of the work (Gaboury).

As a student in MAT, I'm drawn to how Lillian Schwartz embraces her institutional, artistic, material, and conceptual in-betweenness, using it to show that the boundaries between technological and non-technological mediums are largely artificial (Hoy).

Gaboury, Jacob. Electric Op. Buffalo AKG Art Museum in association with GILES, 2024.

Hoy, Meredith. Coded: Art Enters the Computer Age, 1952–1982. Los Angeles County Museum of Art, 2023.

Pixillation (1970)

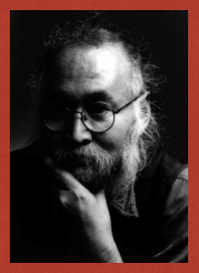
https://youtube.com/watch?v=uPDpCHrOvbE

Googolplex (1972)

https://youtube.com/watch?v=XAlXN-F2vPQ

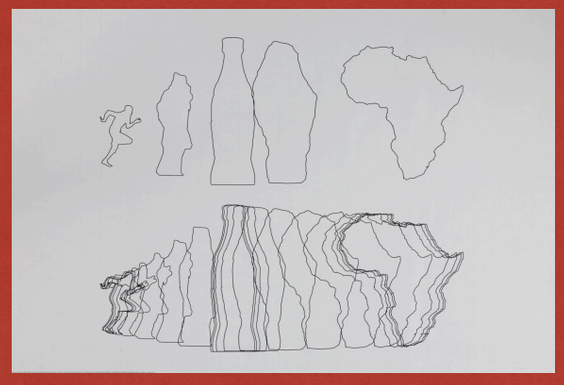
COMPUTER TECHNIQUE GROUP (CTG)

- Founded in Japan in 1966
- Masao Kohmura and Haruki Tsuchiya



Masao Kohmura

Deformation of Sharaku by Haruki Tsuchiya

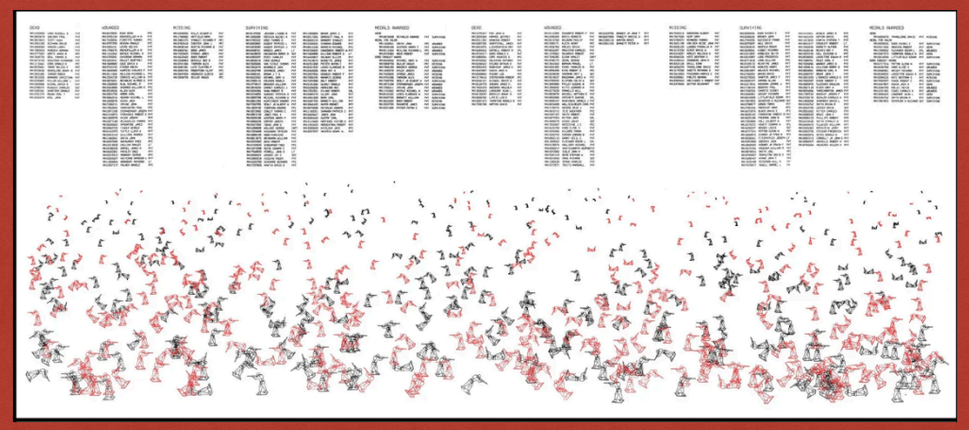


Running Cola is Africa (1967-1968)

During this same period in Japan, the Computer Technique Group was founded. Among its members were Masao Kohmura and Haruki Tsuchiya, who worked together at the IBM Scientific Data Center in Tokyo. One of their most famous and reproduced images is *Running Cola is Africa,* which is a critique of American imperialism (Arreola et al.).

Arreola, Pita, Corinna Gardner, and Melanie Lenz, editors. Digital Art: 1960s to Now. Thames & Hudson / V&A Museum, 2024.

CHARLES CSURI



Random War (1967)

Another political work from this period is Charles Csuri's *Random War.* This work shows two armies of toy soldiers engaged in combat and is a response to the Vietnam War. Included in the work is a computer-generated pseudo-random list of soldiers who were killed, wounded, missing, or commended in battle (Arreola et al.).

Arreola, Pita, Corinna Gardner, and Melanie Lenz, editors. Digital Art: 1960s to Now. Thames & Hudson / V&A Museum, 2024.

JOSEPH NECHVATAL

- 1980s East Village art scene
- Concerned about nuclear proliferation and the threat of atomic warfare
- Transformed some of his drawings into political posters

Untitled 1985

A more modern generative artist is Joseph Nechvatal. Nechvatal was part of the 1980s East Village art scene. The themes of his early works were concerned with nuclear proliferation and the threat of atomic warfare. Some of his drawings were transformed into political posters such as this one from 1985.

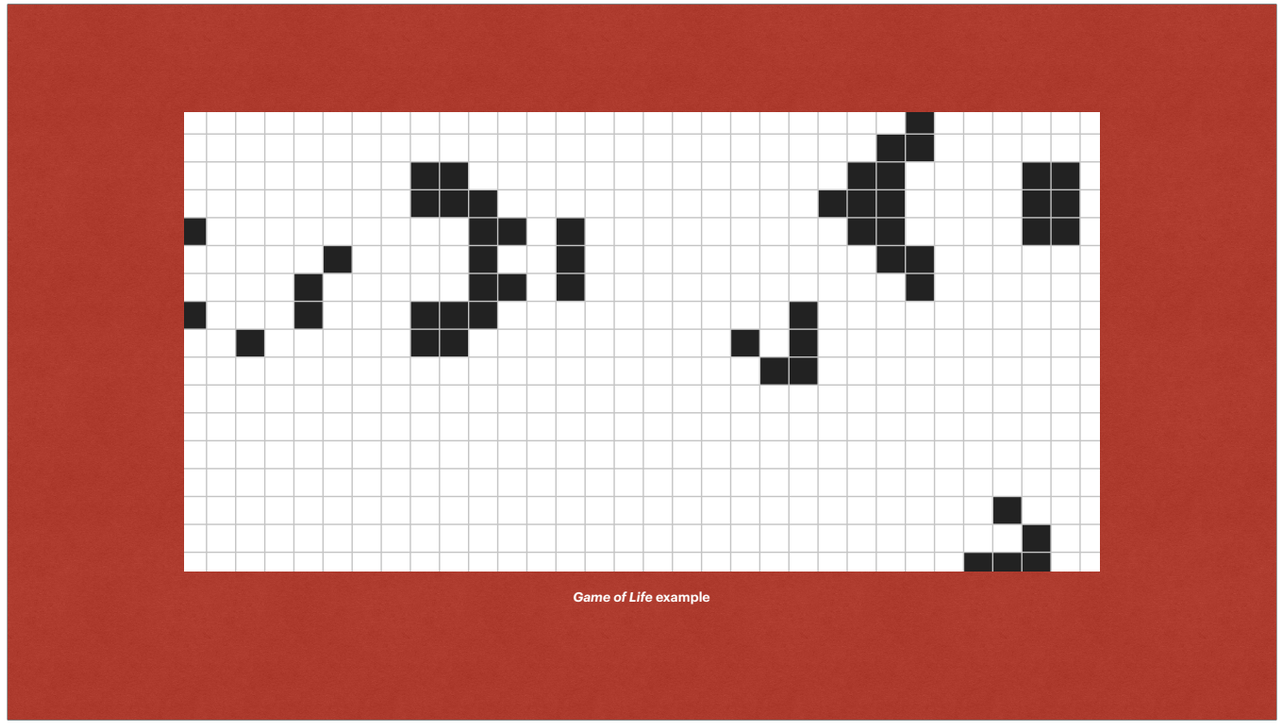
Frank, Patrick. Art of the 1980s: As If the Digital Mattered. De Gruyter, 2024.

CELLULAR AUTOMATA

- A model of computation where a grid of cells changes state, usually on or off, based on the cell's neighborhood
- John Conway's *Game of Life* (1970)
- The rules:
  - Any live cell with fewer than two live neighbors dies
  - Any live cell with two or three live neighbors lives on to the next generation
  - Any live cell with more than three live neighbors dies
  - Any dead cell with exactly three live neighbors becomes a live cell

Before we come back to Nechvatal, I want to introduce the concept of cellular automata. Cellular automata is a model of computation where a grid of cells changes state, usually on or off, based on the cell's neighborhood. A neighborhood is a set of cells that surrounds a specified cell. An initial state is assigned to each cell, and a new generation is created according to a set of rules which determine behaviors. Typically, the rules for updating the state of cells is applied to the whole grid simultaneously ("Cellular Automaton"). A very notable example of this concept is
John Conway's Game of Life from 1970.

"Cellular Automaton." Wikipedia, Wikimedia Foundation, last edited Nov. 2025, en.wikipedia.org/wiki/Cellular_automaton. Accessed 1 Dec. 2025.



***Game of Life* example**

The rules Conway gives the cells are as follows:

“

1. Any live cell with fewer than two live neighbors dies, as if by underpopulation.
2. Any live cell with two or three live neighbors lives on to the next generation.
3. Any live cell with more than three live neighbors dies, as if by overpopulation.
4. And any dead cell with exactly three live neighbors becomes a live cell, as if by reproduction.

”

(“Conway’s Game of Life”).

“Conway’s Game of Life.” Wikipedia, Wikimedia Foundation, last edited 7 November 2025, https://en.wikipedia.org/wiki/Conway%27s_Game_of_Life.

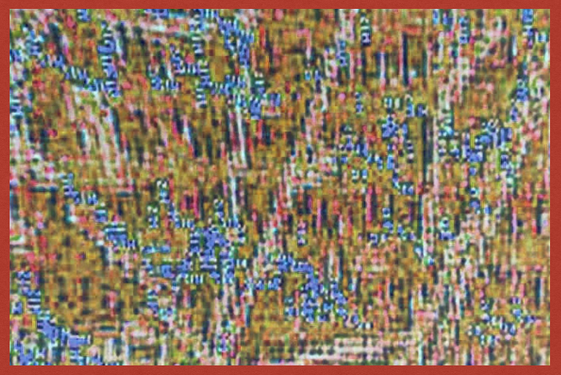
JOSEPH NECHVATAL

- *Computer Virus Project* (1991-1993)
- Political theme: AIDS
- When he felt that the image had evolved enough from the virus, he stopped the process and saved the file.

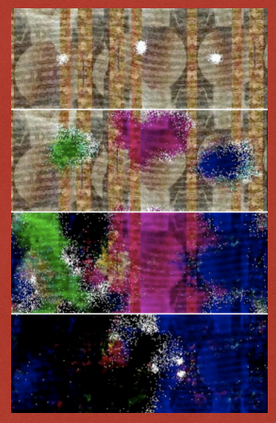
viral attaque : passiOn pluS (1993)

Coming back to Nechvatal, in the early 90s, he produced the *Computer Virus Project.* With the help of computer programmer Jean-Philippe Massonie, this body of work used computer viruses to invade Nechvatal's imagery. Massonie wrote the virus using seventy-seven lines of code written in BASIC, in the style of cellular automata. The virus "navigated through the contents of [Nechvatal's] digital image, comparing each pixel to all of its neighbors, and then altered that pixel based on the difference that it finds, before proceeding to the next pixel" (Frank). This process reduces the differences between each subject pixel and its neighbors. When Nechvatal felt that the image had evolved enough from the virus, he stopped the process and saved the file. Nechvatal used his virus-infected imagery as a commentary on the AIDS pandemic that was devastating the world at that time (Frank). Separate from Nechvatal, political commentary on AIDS also appeared in the works of other New York based artists, David Wojnarowicz and Keith Haring.

Frank, Patrick. Art of the 1980s: As If the Digital Mattered. De Gruyter, 2024.



***viral attaque : passiOn pluS,* detail (1993)**



***Computer Virus 2.0* (2001)**

On a closer look of *viral attaque*, we see that the virus has enlarged and elongated the diagonals of the V. We also notice the blue virus cells moving across the image in constellations. Other works by Nechtaval show other configurations of the virus, like this one on the right (Frank). In Computer Virus 2.0, three colonies of viruses are injected into the picture. These viruses are programmed to survive by consuming the colors contained in the image. When different colors meet, the combination of the viruses actions consumes all resources, leaving the work predominantly black (Sikora).

Frank, Patrick. Art of the 1980s: As If the Digital Mattered. De Gruyter, 2024.

Sikora, Stéphanie. Balancing Art and Complexity: Joseph Nechvatal's *Computer Virus Project*, www.eyewithwings.net/nechvatal/Balancing/Balancing%20Art%20and%20Complex.htm. Accessed 1 Dec. 2025.

CONCLUSION

Algorithmic art teaches us to value where systems meet creativity, and where new forms of expression emerge. It’s been shown as a means to critique society, embrace chance, and create new visual languages. What fascinates me most is the complexity that arises from the simplicity - how compositions built from just a few lines of code, grids, and vectors produces such intricate works.

Algorithmic art teaches us to value where systems meet creativity, and where new forms of expression emerge. It’s been shown as a means to critique society, embrace chance, and create new visual languages. What fascinates me most is the complexity that arises from the simplicity - how compositions built from just a few lines of code, grids, and vectors produces such intricate works.

WORKS CITED

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