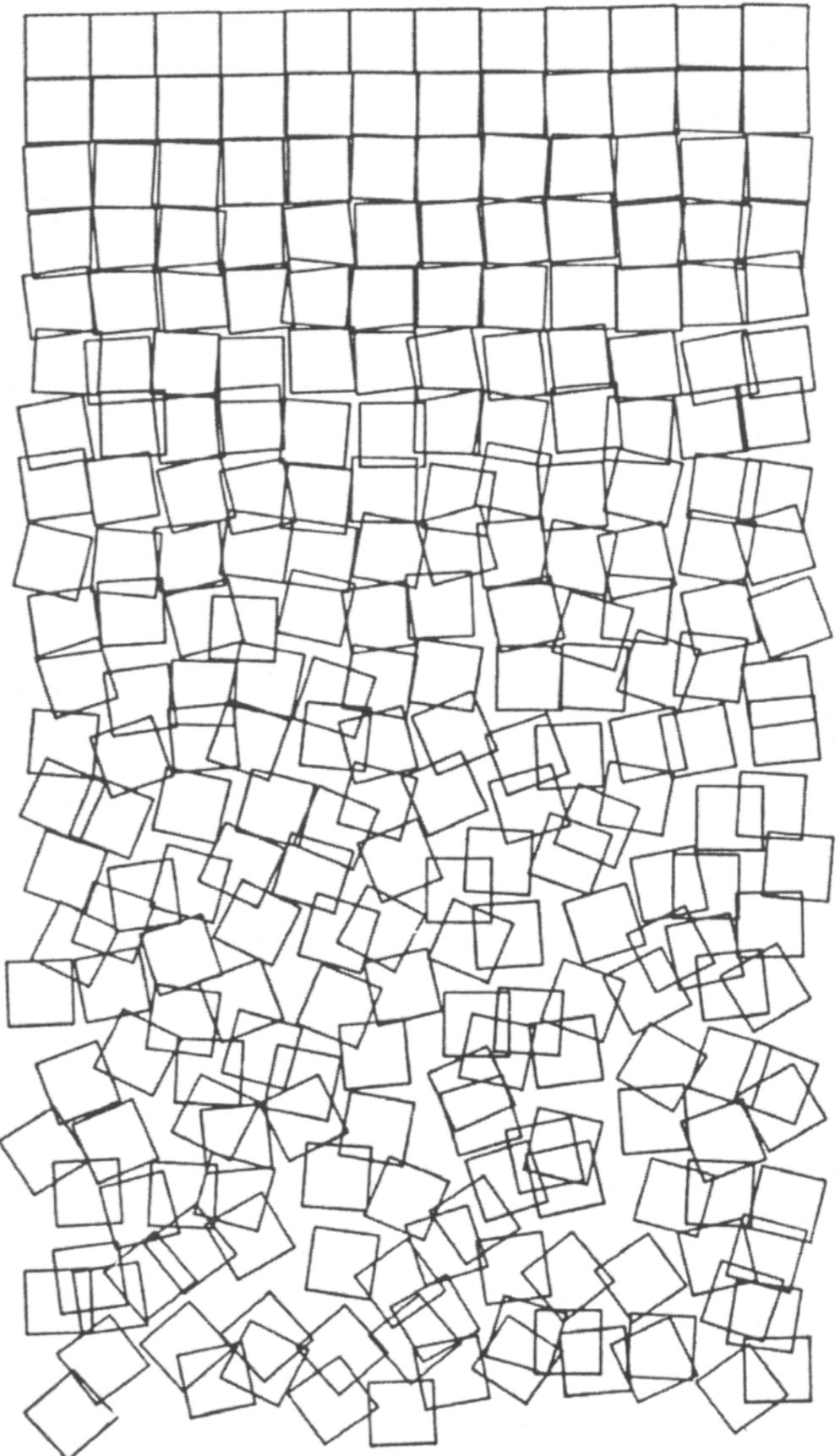


RANDOMNESS & CREATIVE CODE

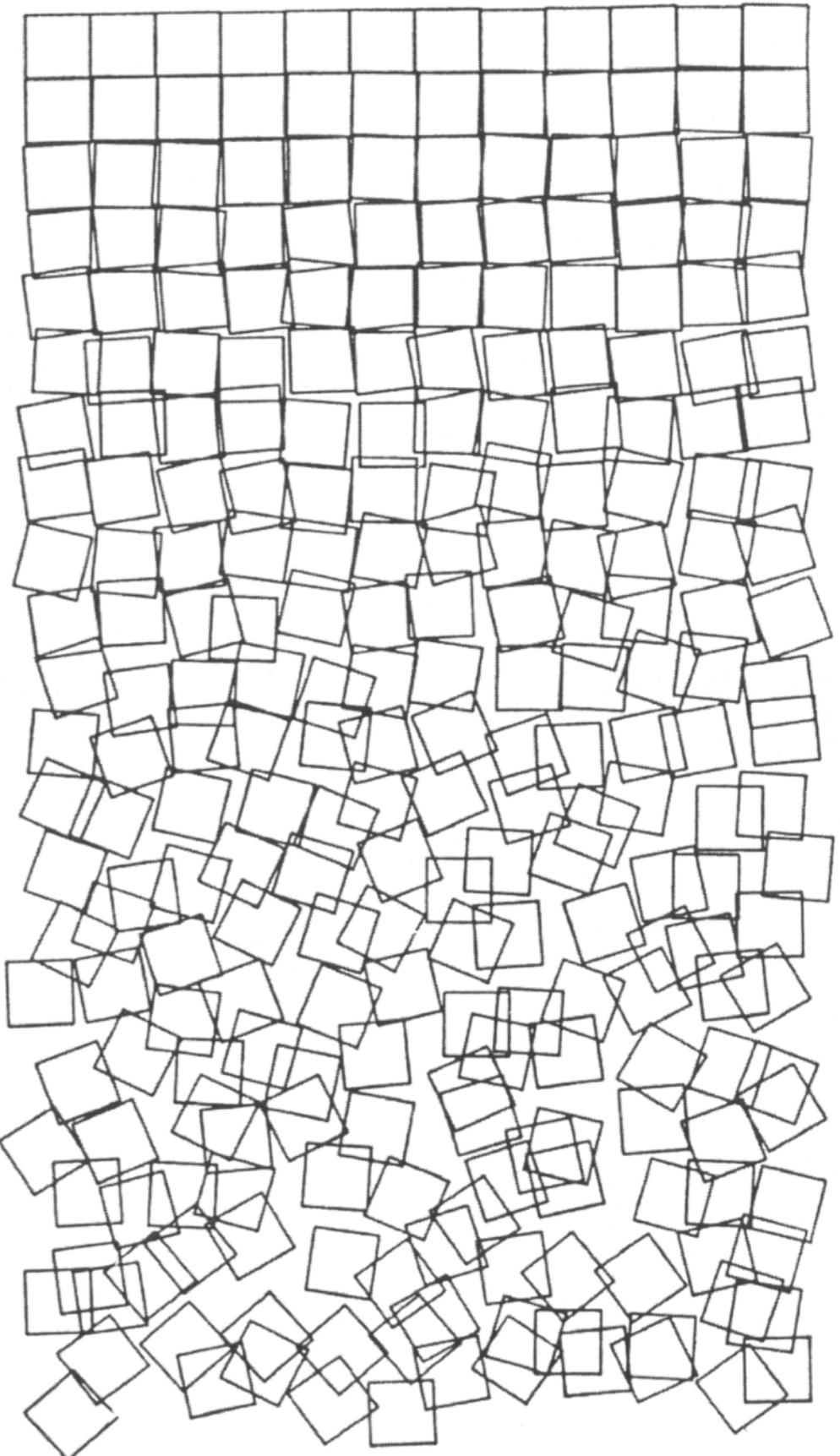
DANIEL C. HOWE
UNIVERSITY OF THE ARTS
LONDON, JULY 9, 2021



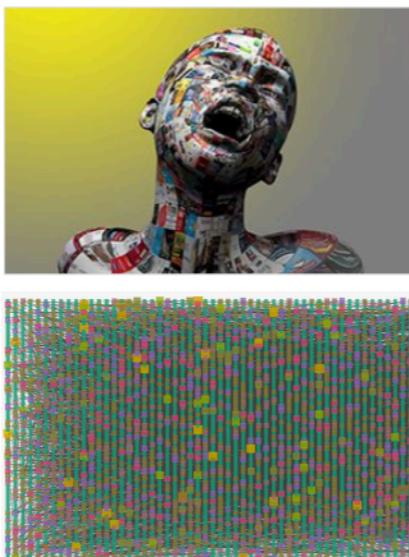
Schotter (Gravel) - Georg Nees, 1968

RANDOMNESS & CREATIVE CODE

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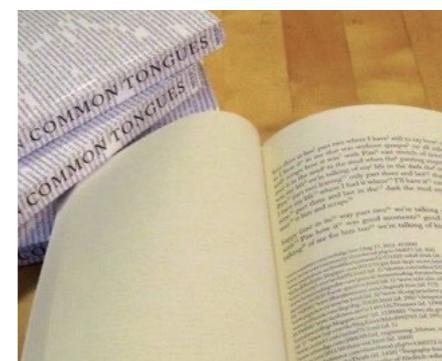
Schotter (Gravel) - Georg Nees, 1968



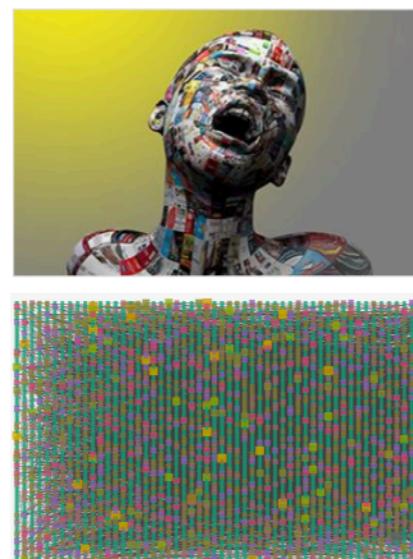
desperate course was to ask a fellow prov
of mine to trace Ah-Q through his crimin
ord. [REDACTED] got
: no such individual – by the name of Ah
Ah-Gui, or anything like it – existed. Th
I had no way of finding out whether this
deed the case, or whether my acquaintar



swimming back alone to the bathing rock, head under,
he reaches out to grasp the familiar ledge, a fold in the
rose-tinged granite just above the surface of the
waist-deep water at its edge, by the stone which he can
see clearly though unfocused through the lake water.
but he has not reached it yet, his expectant hand breaks
the surface, down through 'empty' water and his
knuckles graze the rock, his face will not rise up,
dripping and gasping, out of the water, instead, it 'falls'
forward and, momentarily, down, into the shallows,
stumbles, breathes a choking mouthful, which he



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Does the virtual city have a dump, or is it just a bunch of this Ad?



VICE Watch News Tech Politics Food Drugs Entertainment Health + More

The Zuckerberg Deepfake Heard Around the World

The deepfake of Mark Zuckerberg was perhaps the biggest troll of Facebook in recent memory, but will it change anything?

FACEBOOK

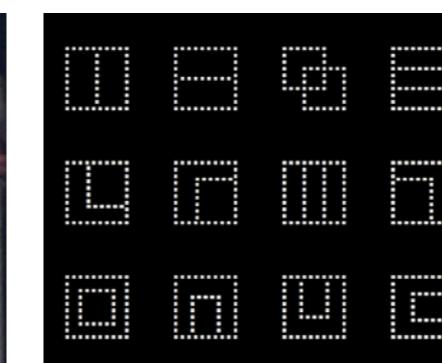
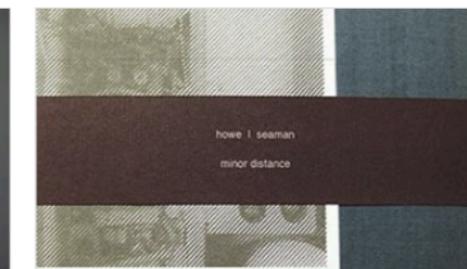
ZUCKERBERG: WE'RE INCREASING TRANSPARENCY ON ADS



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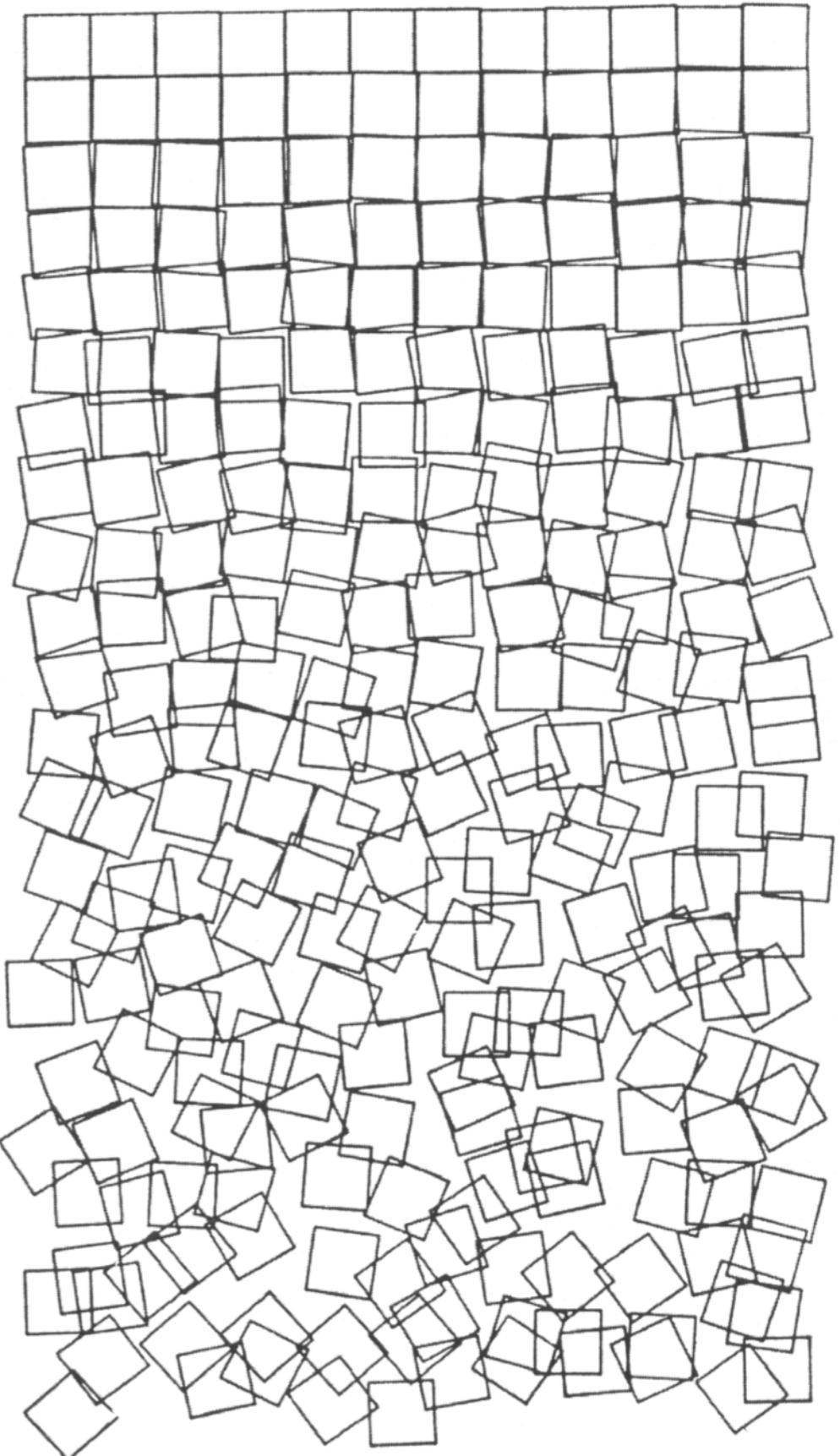
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Schotter (Gravel) - Georg Nees, 1968

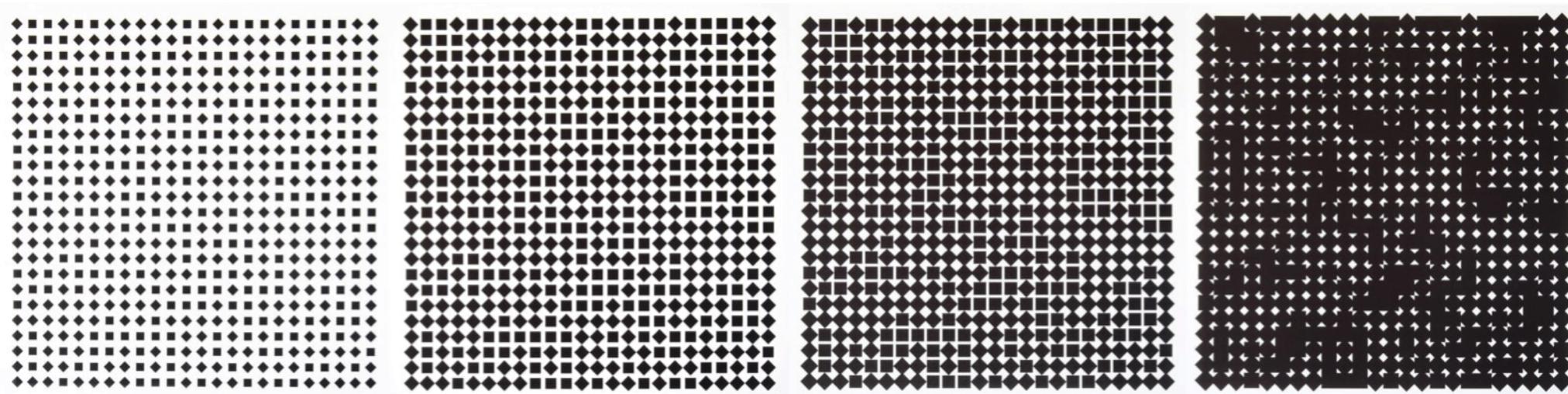
- INTRODUCTION: RESOURCES
 - THEORETICAL: DEFINITIONS
 - AESTHETIC: EXAMPLES IN ART
 - STRATEGIC: WHY USE RANDOMNESS?
 - TECHNICAL: USING RANDOMNESS EFFECTIVELY
-

OBJECTIVES

RESOURCES



<https://github.com/dhowe/rws>



VERA MOLNAR, CARRÉS EN
2 POSITIONS 1-4 , 2011-13

A screenshot of a GitHub repository page for `dhowe/rws`. The page shows a commit history for the `master` branch, which includes updates to `README.md`, `RandomRects.js`, `RandomWalk1.js`, `RandomWalk2.js`, `Recode-Quads.js`, `Recode-Schotter.js`, `randomness.png`, and `slides.pdf`. The most recent commit was made 15 seconds ago. Below the commit history is the `README.md` file, which contains the following content:

```
A micro-workshop on randomness

Resources

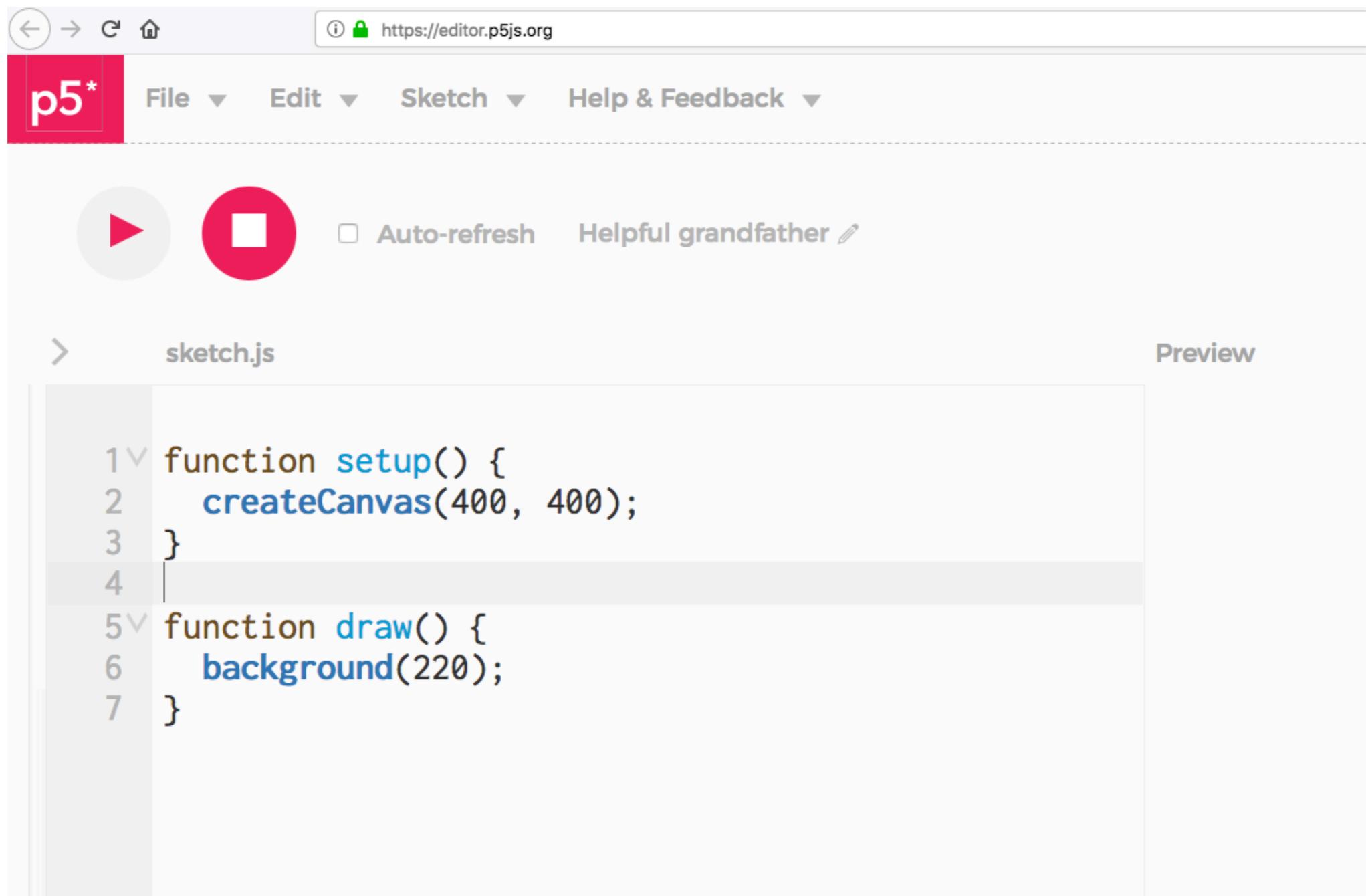

- Lecture slides \(.pdf\)
- p5.js editor and reference
- Vera Molnar on randomness (2-min video)

```

A red arrow points from the link in the `Resources` section of the `README.md` file to the URL at the bottom of the image.

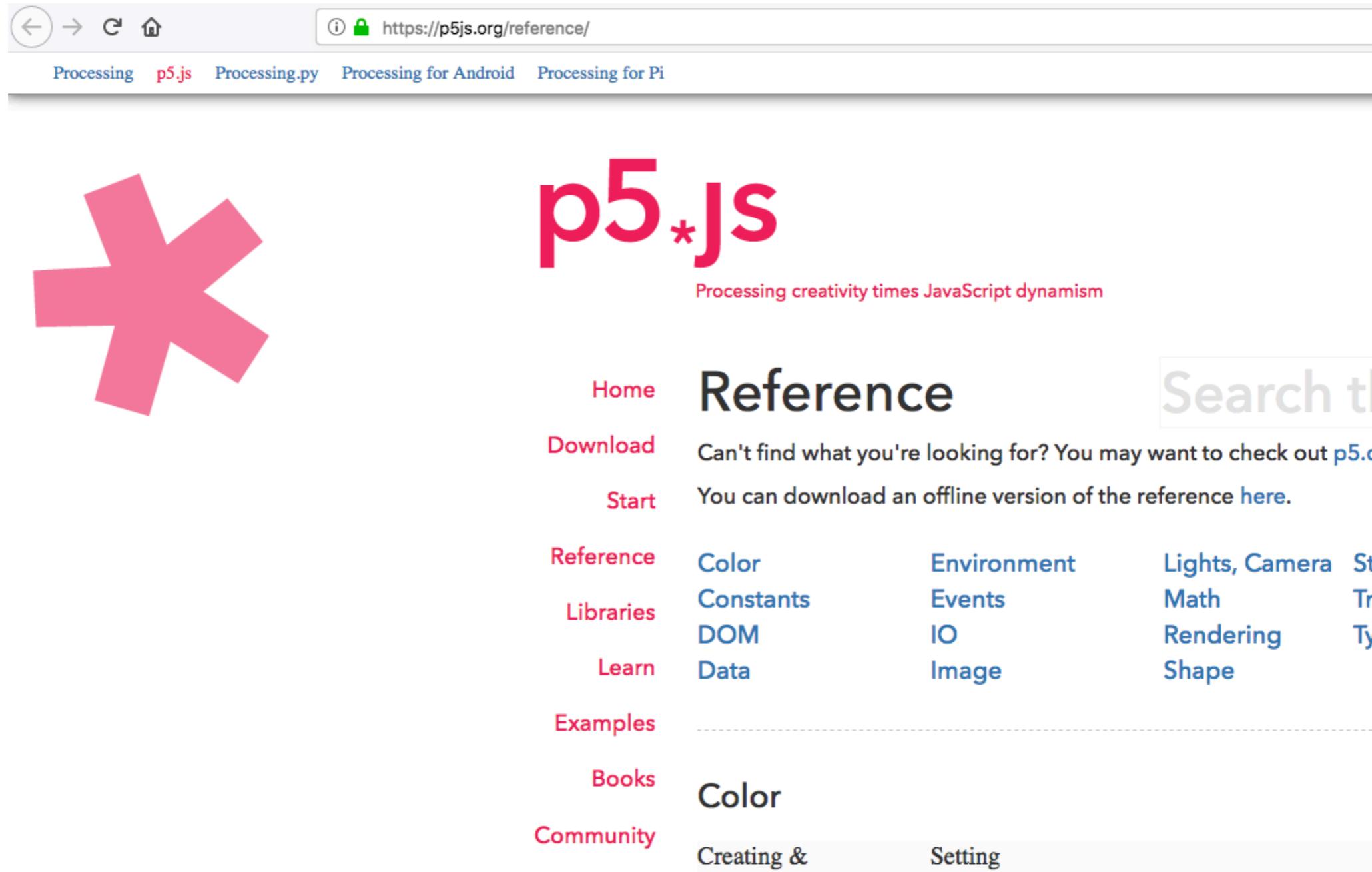
<https://raw.githubusercontent.com/dhowe/rws/master/slides.pdf>

TOOLS: P5.JS EDITOR



<https://editor.p5js.org>

TOOLS: REFERENCE



The screenshot shows a web browser displaying the p5.js reference page at <https://p5js.org/reference/>. The page features a large pink asterisk icon on the left. The title "p5.js" is prominently displayed in pink, with the subtitle "Processing creativity times JavaScript dynamism" below it. A navigation bar at the top includes links for Processing, p5.js, Processing.py, Processing for Android, and Processing for Pi. On the right, there's a search bar labeled "Search t". The main content area has a sidebar with links to Home, Download, Start, Reference, Libraries, Learn, Examples, Books, and Community. The "Reference" section is expanded, showing categories like Color, Environment, and others. Below the sidebar, a "Color" section is shown with sub-links for Creating & Setting.

Processing p5.js Processing.py Processing for Android Processing for Pi

p5.js

Processing creativity times JavaScript dynamism

Home

Download

Start

Reference

Libraries

Learn

Examples

Books

Community

Color

Environment

Events

DOM

IO

Data

Image

Lights, Camera Action

Math

Rendering

Shape

Creating & Setting

Search t

<https://p5js.org/reference/>

RANDOM()

Description

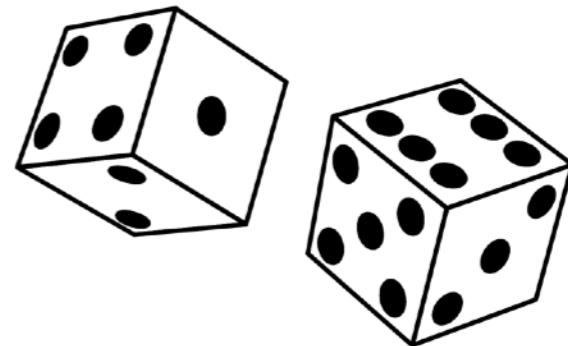
Return a random floating-point number.

Takes either 0, 1 or 2 arguments.

If no argument is given, returns a random number from 0 up to (but not including) 1.

If one argument is given and it is a number, returns a random number from 0 up to (but not including) the number.

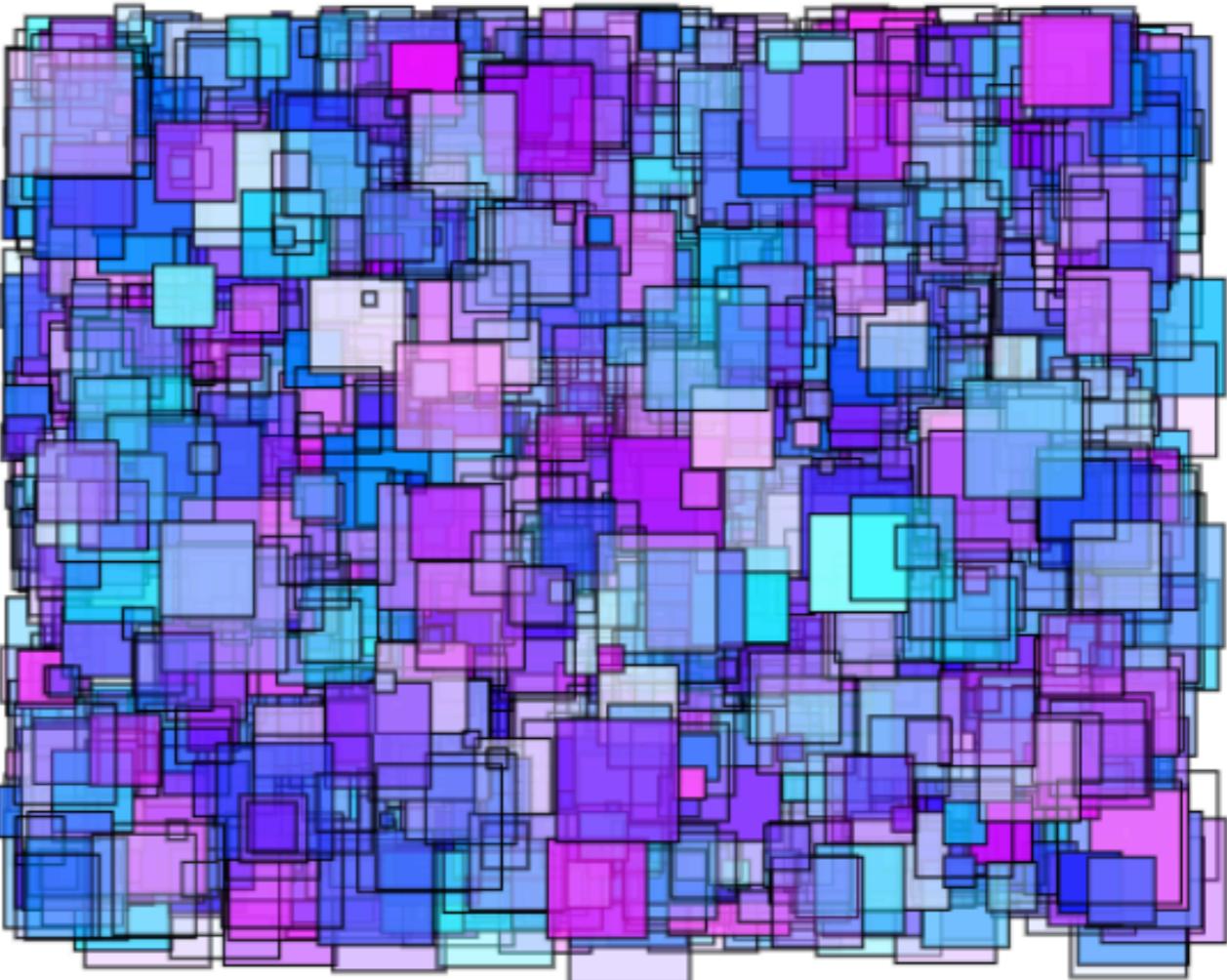
If two arguments are given, returns a random number from the first argument up to (but not including) the second argument.



QUICKSTART

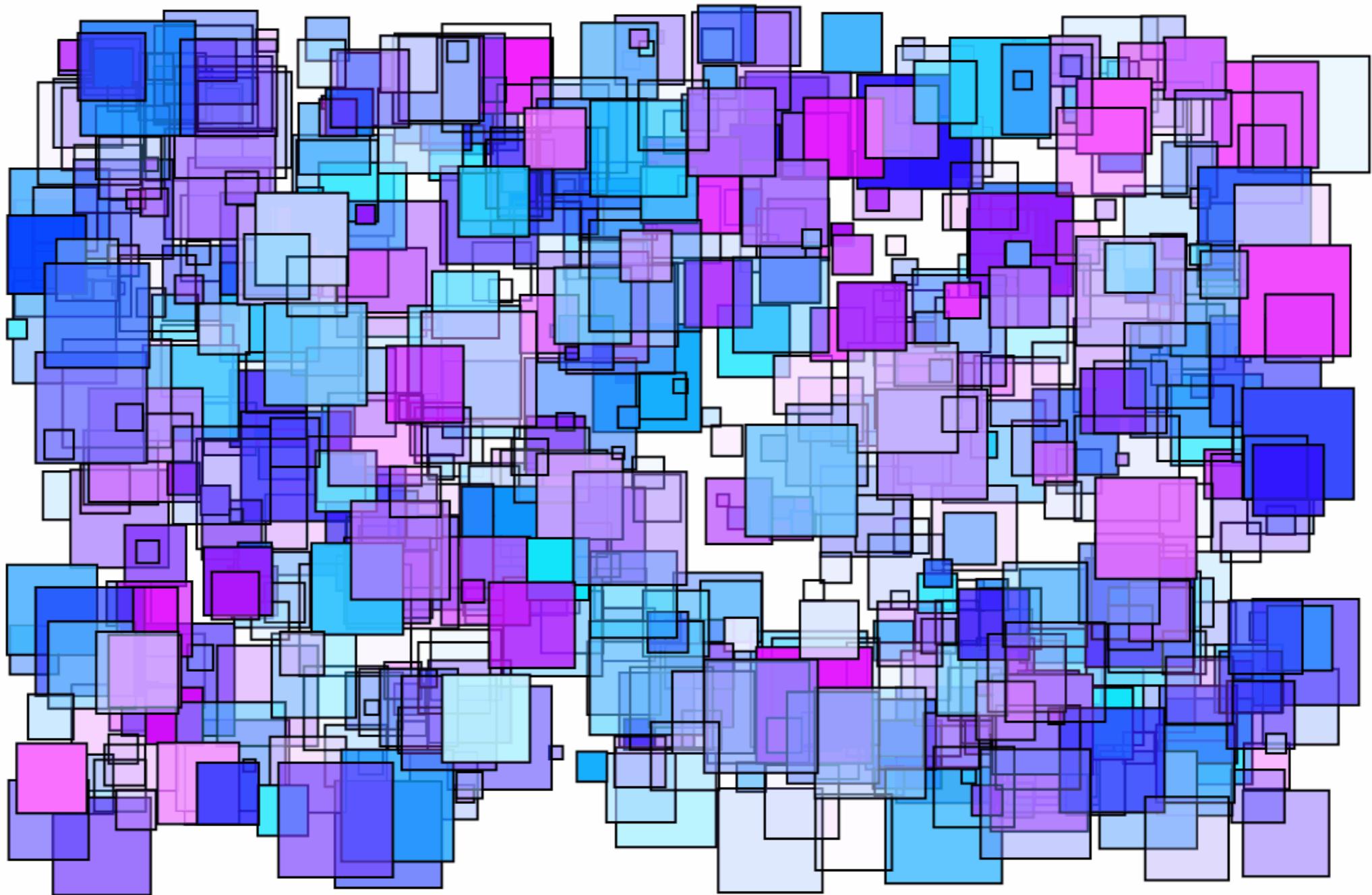
```
> sketch.js•  
1  function setup() {  
2    createCanvas(500, 400);  
3    background(255);  
4  }  
5  
6  function draw() {  
7    let x = random(0, width);  
8    let y = random(0, height);  
9    let sz = random(5, 50);  
10  
11   let r = random(0, 255);  
12   let g = random(0, 255);  
13   let a = random(0, 255);  
14  
15   fill(r, 255-g, 255, a);  
16   square(x, y, sz);  
17 }  
18  
19  
20
```

Preview



file: [RandomRects.js](#)

QUICKSTART



QUICKSTART

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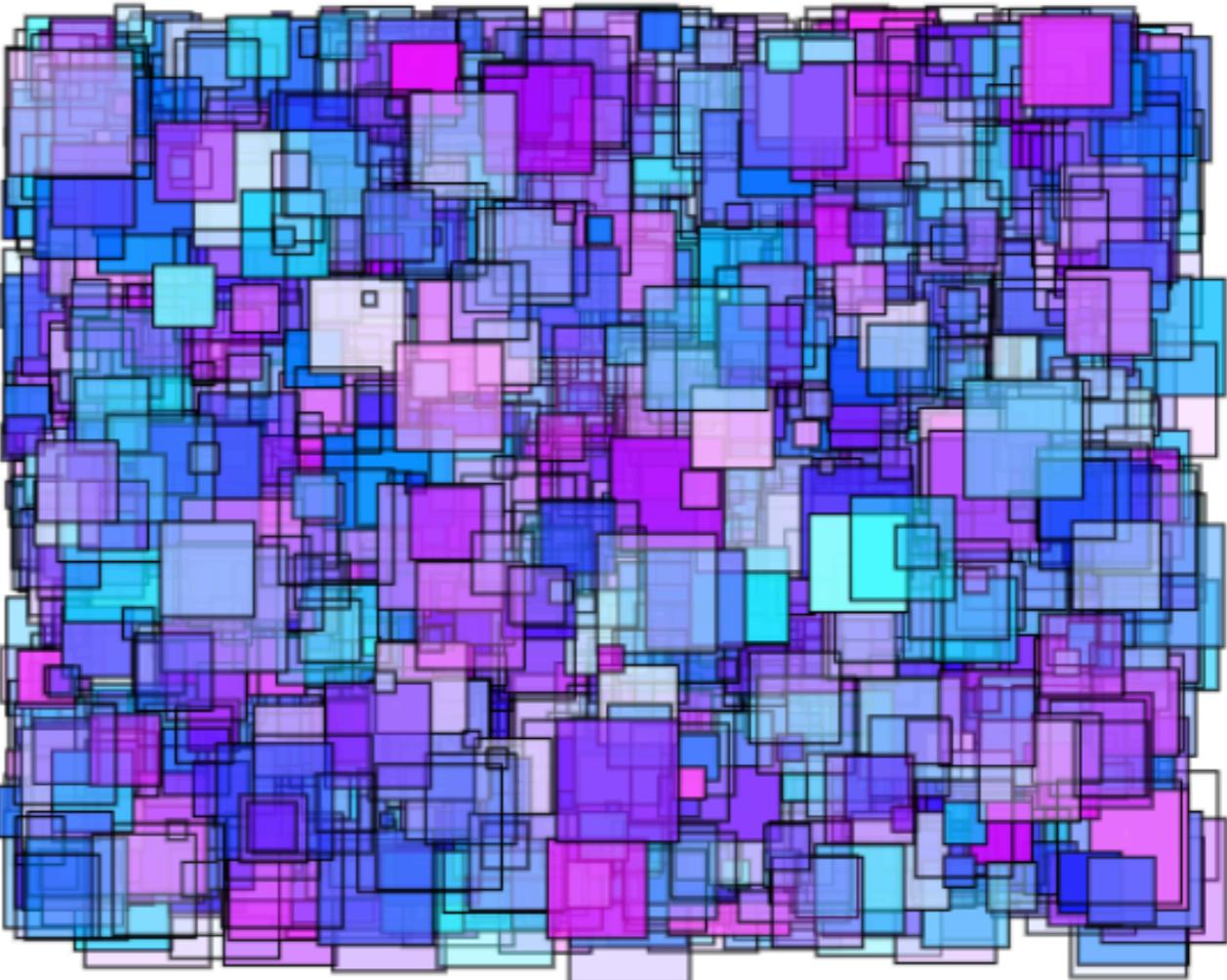
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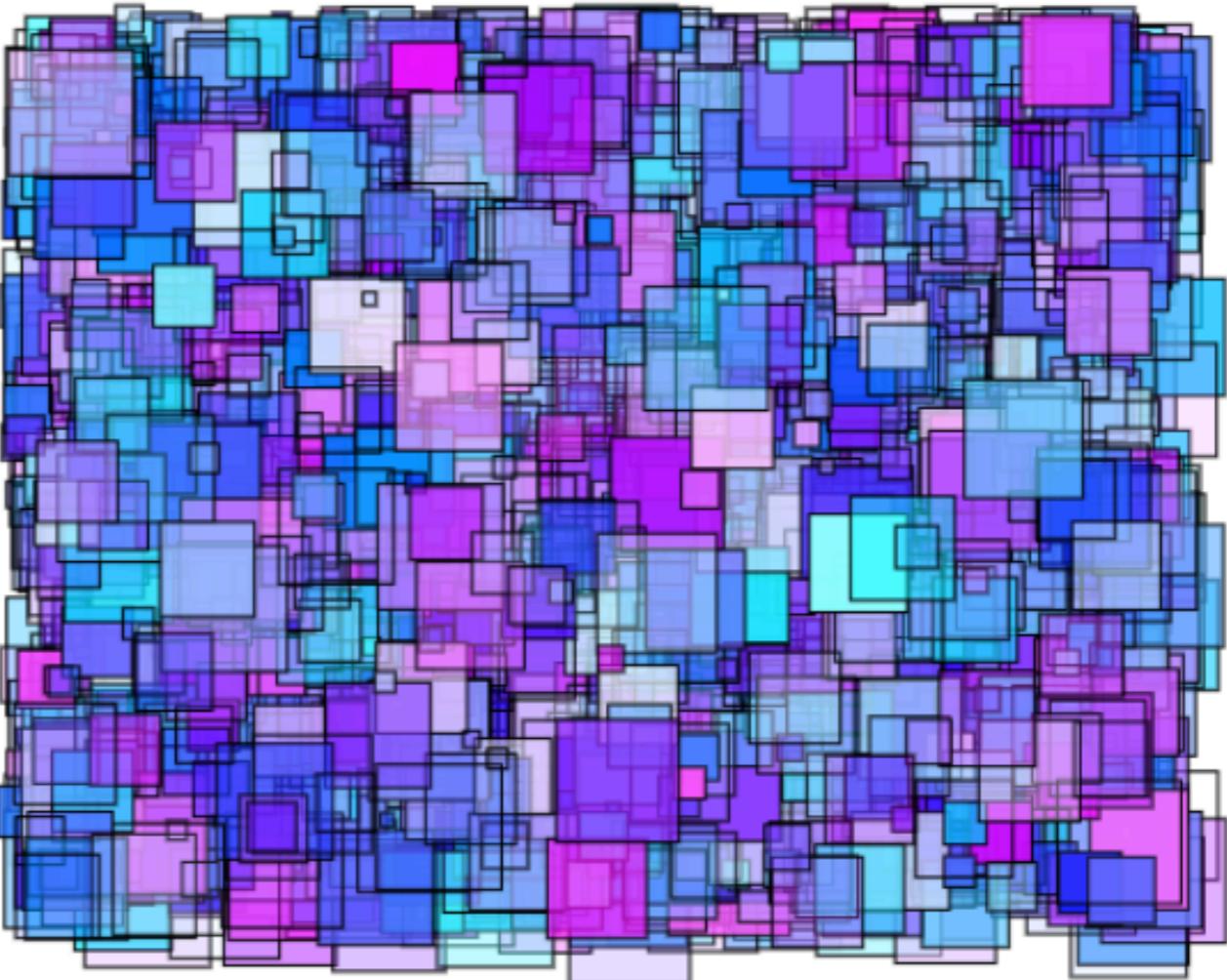
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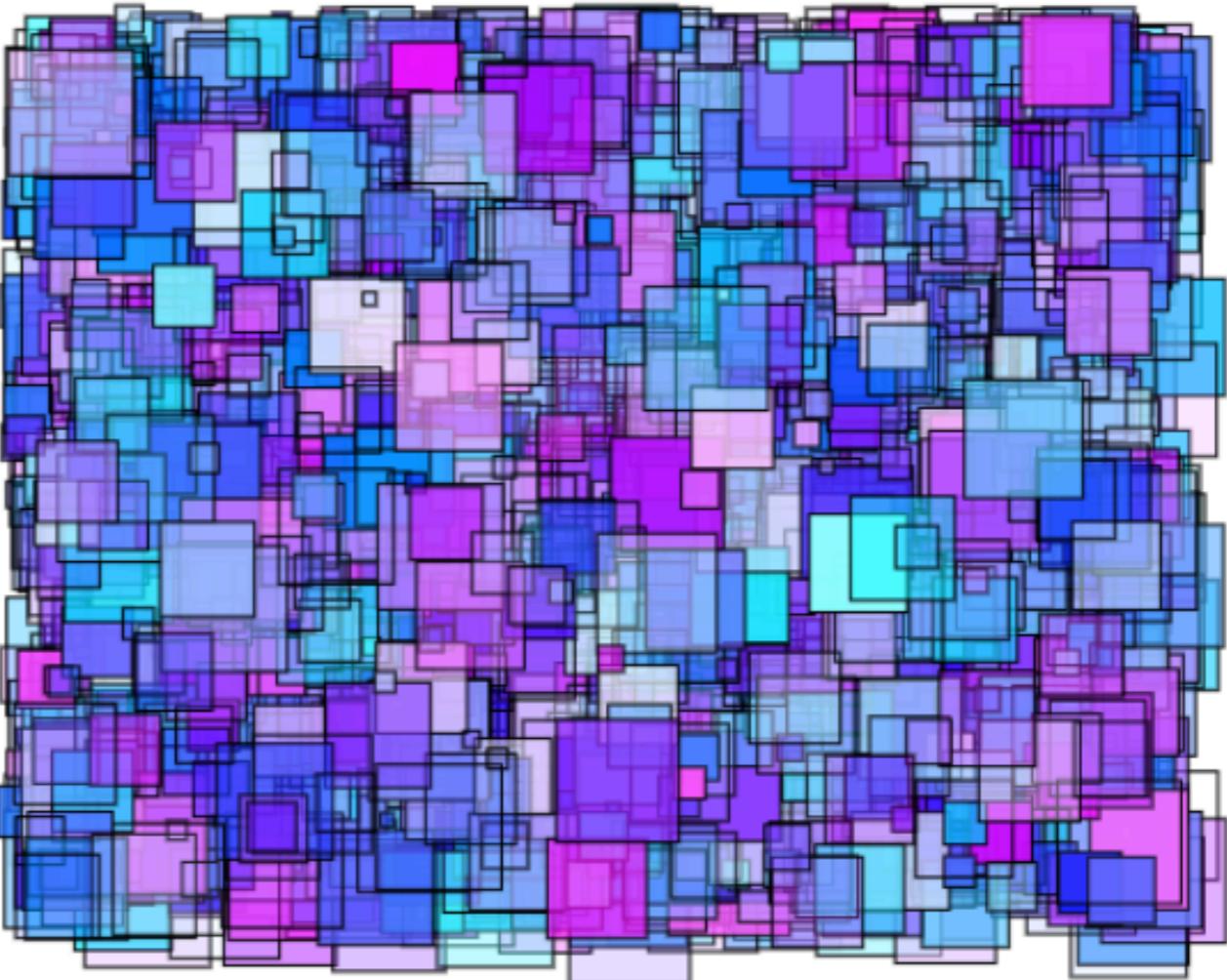


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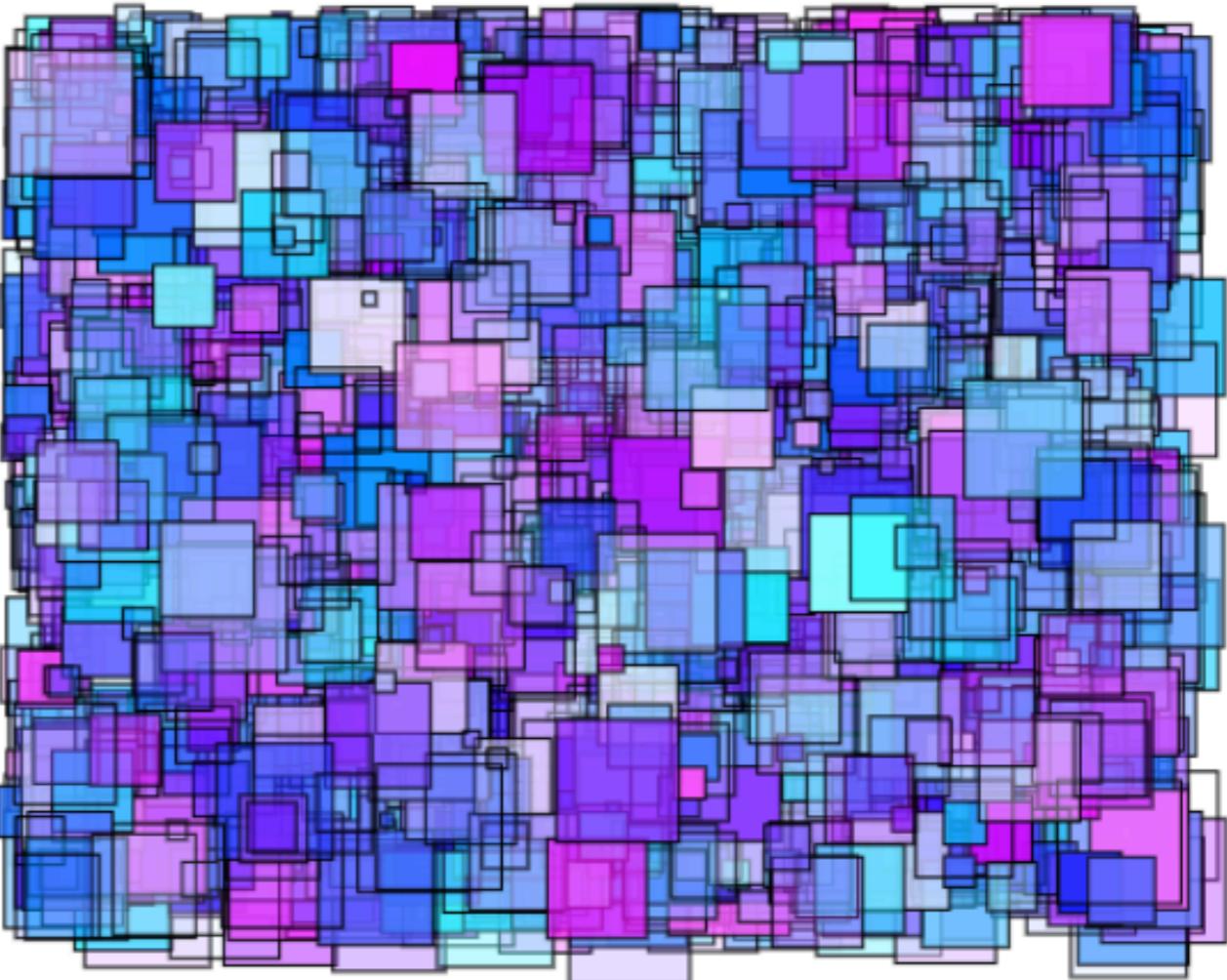
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Preview



THEORETICAL

CAN WE DEFINE RANDOMNESS ?

RANDOMNESS HAS AN INCREDIBLY POWERFUL PLACE IN OUR CULTURE. IF YOU THINK ABOUT IT, YOU CAN SEE IT DRIVING THE ALGORITHMS THAT RUN OUR INFORMATION ECONOMY, PATTERNS THAT MAKE UP THE TRAFFIC OF OUR CITIES, AND ON OVER TO THE WAY THE STARS AND GALAXIES FORMED.

DJ SPOOKY

HOW TO DEFINE RANDOMNESS ?

RANDOMNESS

IS '2' A RANDOM NUMBER ?

RANDOMNESS

A NUMBER IS RANDOM WHEN THERE
IS AN EQUAL PROBABILITY FOR IT TO
BE SELECTED FROM A SET OF
POSSIBLE VALUES...

RANDOMNESS



**CONSIDER THE FOLLOWING TWO
SEQUENCES OF 20 COIN FLIPS:**

- A. HTHHTTTHTTTHTHHTHTHH
- B. TTTTTTTTTTTTTTTTTTT

WHICH IS MORE LIKELY, A OR B?



ACCORDING TO PROBABILITY, THE TWO ARE EQUALLY LIKELY, EACH HAVING A CHANCE OF 1 IN 1024

- A. HTHHTTTHTTTTHHTHHHTHTHH
- B. TTTTTTTTTTTTTTTTTTT

BUT WHICH SEQUENCE IS MORE RANDOM?



ACCORDING TO PROBABILITY, THE TWO ARE EQUIALLY LIKELY, EACH HAVING A CHANCE OF 1 IN 1024

- A. HTHHTTTHTTTTHHTHHHTHTHH
- B. TTTTTTTTTTTTTTTTTTT

BUT WHICH SEQUENCE IS MORE RANDOM?



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- A. HTHHTTTHTTTTHHTHHHTHTHH
- B. TTTTTTTTTTTTTTTTTTT

BUT WHICH SEQUENCE IS MORE RANDOM?

LET'S DESCRIBE EACH AS CONCISELY AS POSSIBLE

B. TTTTTTTTTTTTTTTTTTT

→ *write T 20 times*

A. HTHHTTHTTTHTHHHTHTH

???

FOR A, THE BEST WE CAN DO IS TO LIST THE WHOLE SEQUENCE ITSELF...

HTHHTTHTTTHTHHHTHTH



LET'S ADD ONE MORE SEQUENCE...

C. TTFFFTTFFTFFTTFFTTFF

???

B. TTTTTTTTTTTTTTTTT

write T 20 times

A. HTHHTTTHTTTHTHHHTHTH

write HTHHTTTHTTTHTHHHTHTH



LESS
RANDOM
(SHORTER)



B. TTTTTTTTTTTTTTTTT

write T 20 times

C. TTFFTFFTTFFTTFF

write TTFF 5 times

A. HTHTTHTHTHHTHHHTH

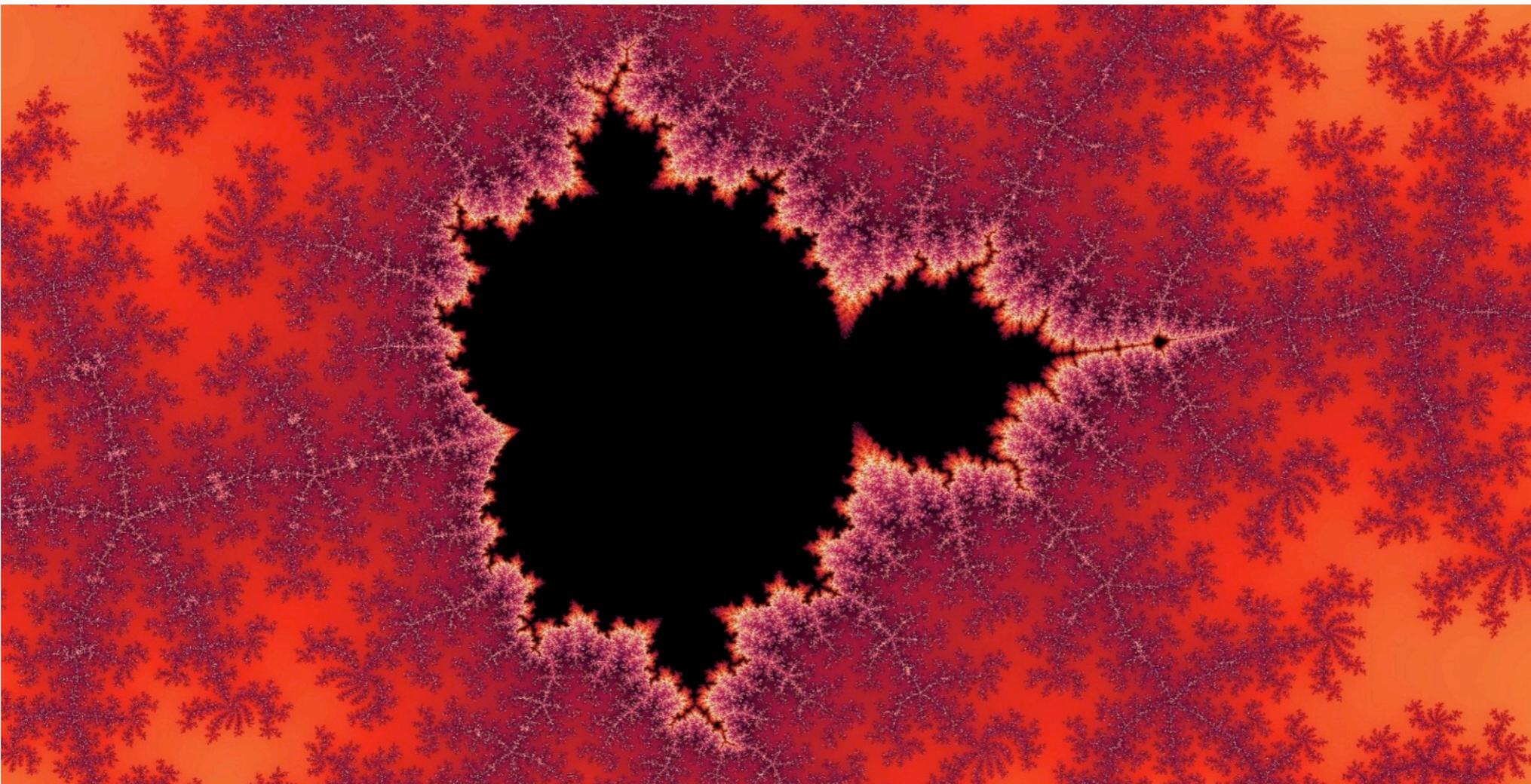
write HTHTHTTHTHTHHHTH

MORE
RANDOM
(LONGER)

from Kolmogorov, 1965

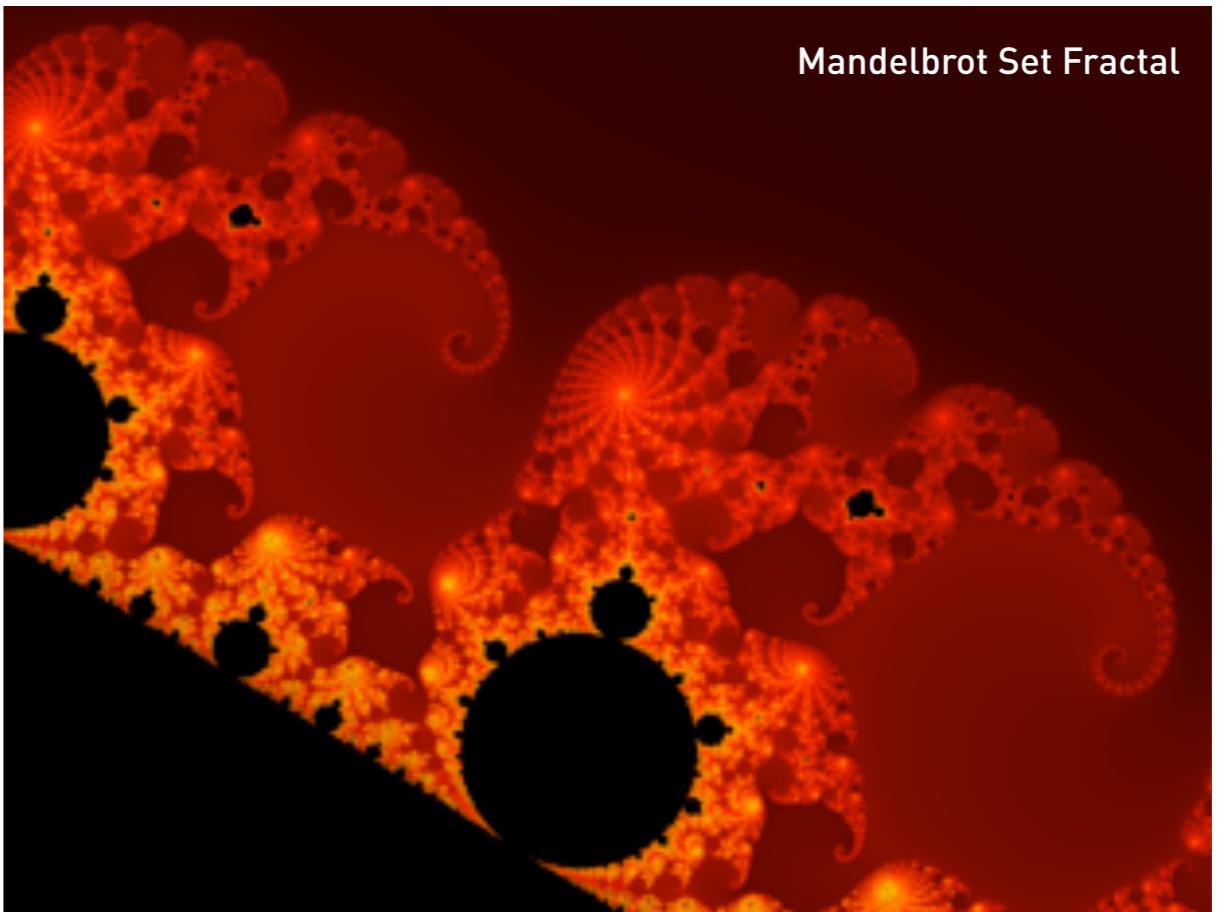
THE THEORY OF KOLMOGOROV COMPLEXITY
IS BASED ON A SIMPLE INSIGHT:

*random objects (or sequences) cannot
be described with a short program*



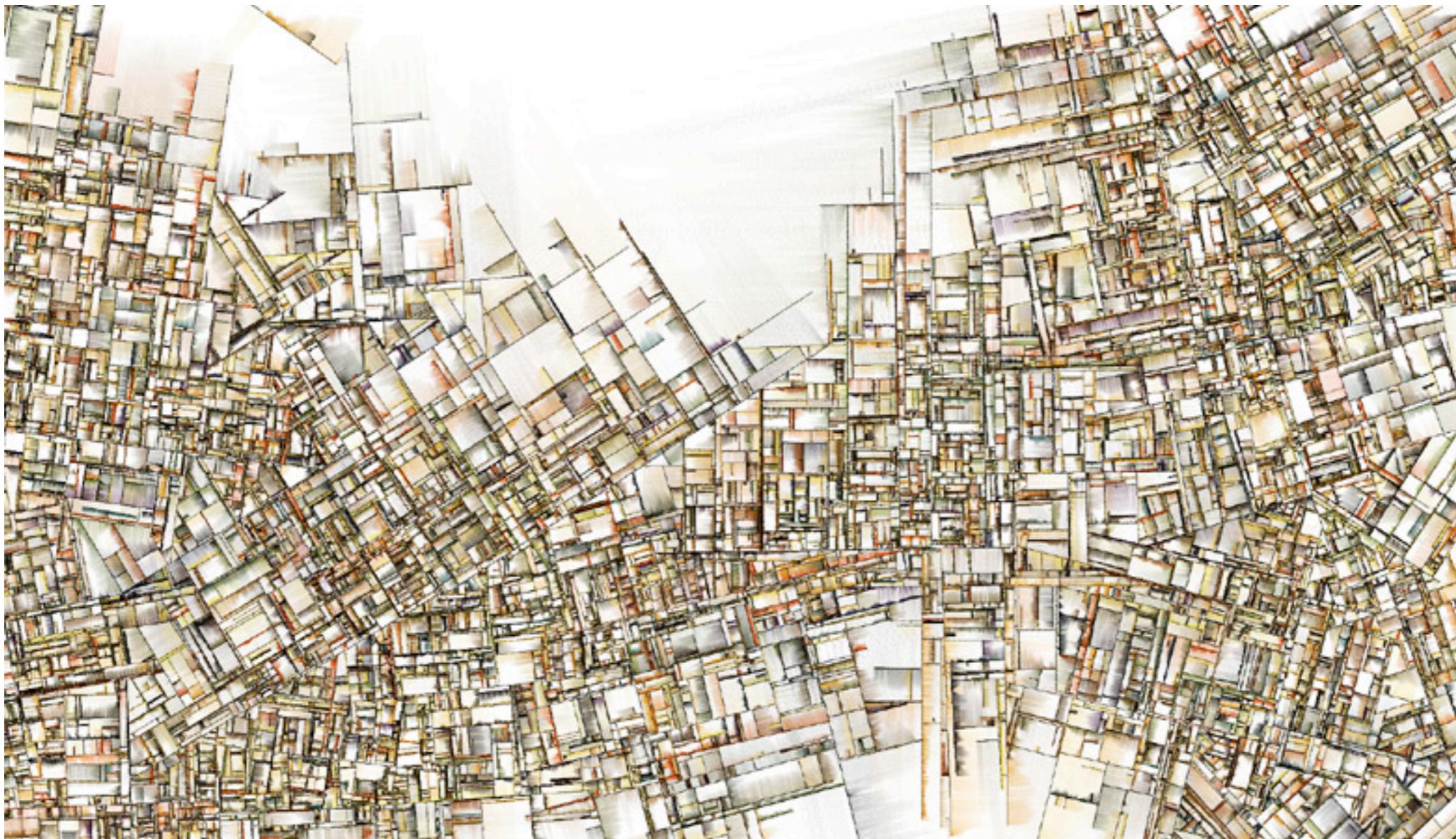
KOLMOGOROV COMPLEXITY

- Storing the 24-bit color of each pixel in this Mandelbrot set fractal would require around 1.6 million bytes
- Yet a short program can reproduce the image using the definition of the Mandelbrot set
- Thus, the complexity of the image is far less than 1.6 million bytes, or, equivalently that it is not very random at all...



KOLMOGOROV'S APPROACH WAS ANOTHER
WAY OF ASKING ...

IS THERE A PATTERN TO THE SEQUENCE?



Jared Tarbell, Substrate, 2003

RANDOMNESS IN ART + DESIGN

HISTORICAL EXAMPLES

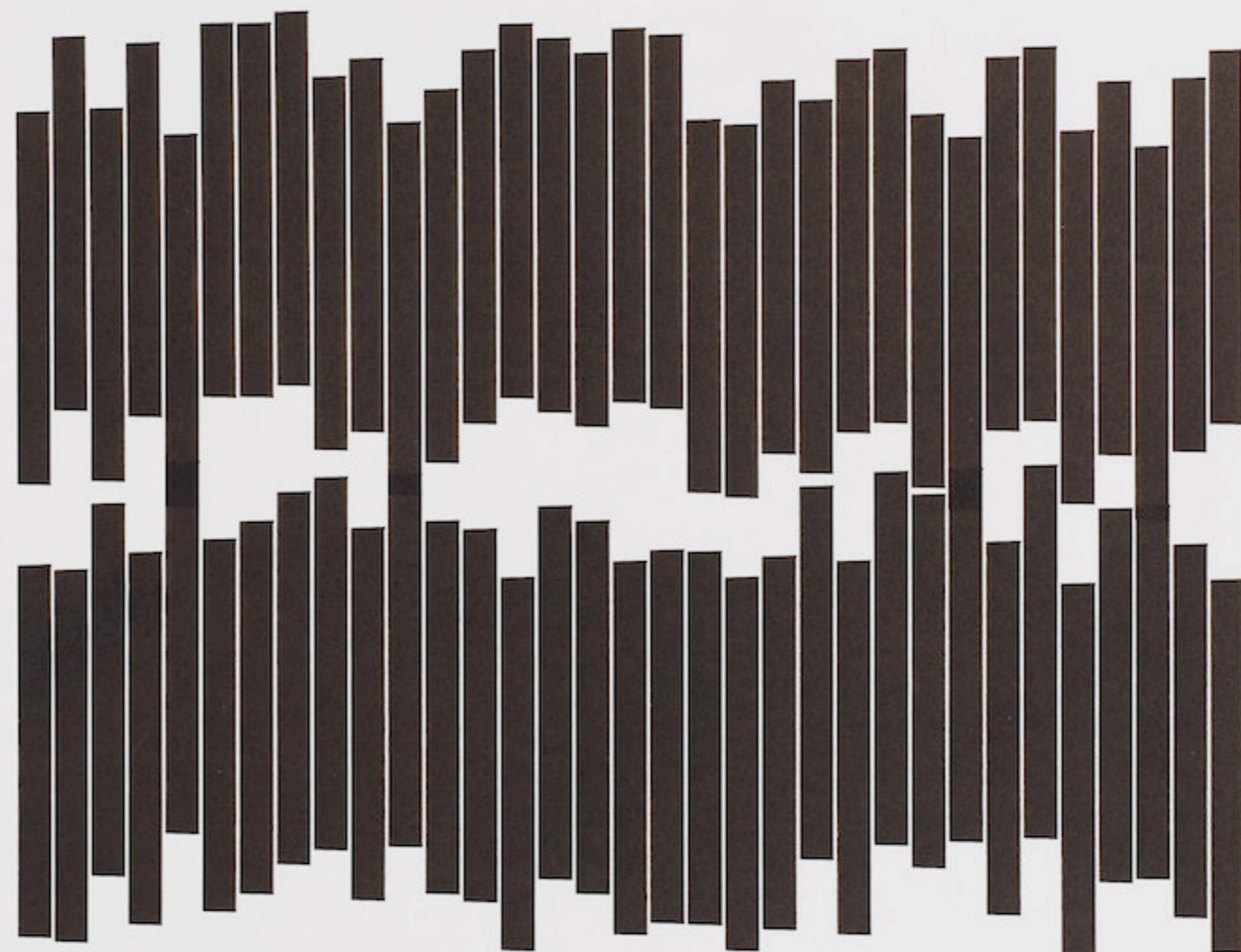
VERA MOLNAR

“*The machine, thought to be cold and inhuman, can help to realize what is most subjective, unattainable, and profound in a human being.*

-Vera Molnár

Vera Molnár (born 1924) is a French media artist of Hungarian origin. She is a pioneer of computer and generative art, active for over 75 years...





14/85

VERA MOLNAR

PERHAPS YOU ARE WONDERING WHY ARTISTS COPY PAINTINGS IN MUSEUMS, AS I AM DOING. THE ANSWER IS TO STUDY, TO LEARN, AND TO FIND INSPIRATION FROM THE GREAT MASTERS OF THE PAST.

COPYING DIRECTLY FROM WORKS OF ART GIVES THE ARTIST INSIGHT INTO THE CREATIVE PROCESS: INSIGHTS WHICH CANNOT BE LEARNED FROM ANY OTHER SOURCE.

- GERALD KING

RECODING

Marcel Duchamp

3 Standard Stoppages

Paris 1913-14

In *3 Standard Stoppages* (*3 stoppages étalon*), Duchamp dropped three meter-long lengths of thread onto three stretched canvases, where they were then adhered, in order to preserve the random curves they assumed upon landing

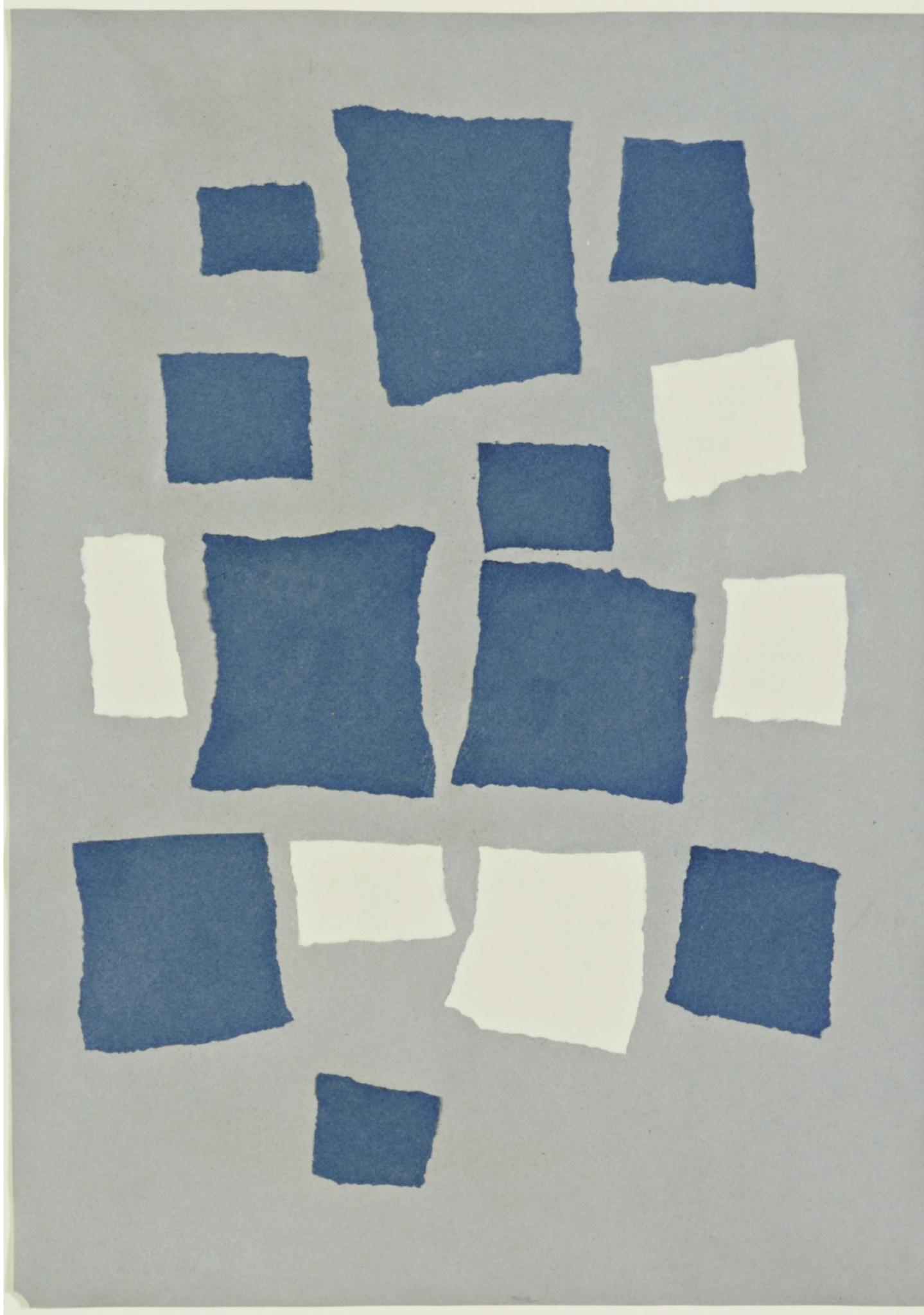


“

If a straight horizontal thread one meter long falls from a height of one meter onto a horizontal plane twisting as it pleases, [it] creates a new image of the unit of length...

DADA

In this and similar works, Dadaist Jean Arp played with random composition by dropping painted pieces of paper onto a surface, then gluing them into place...

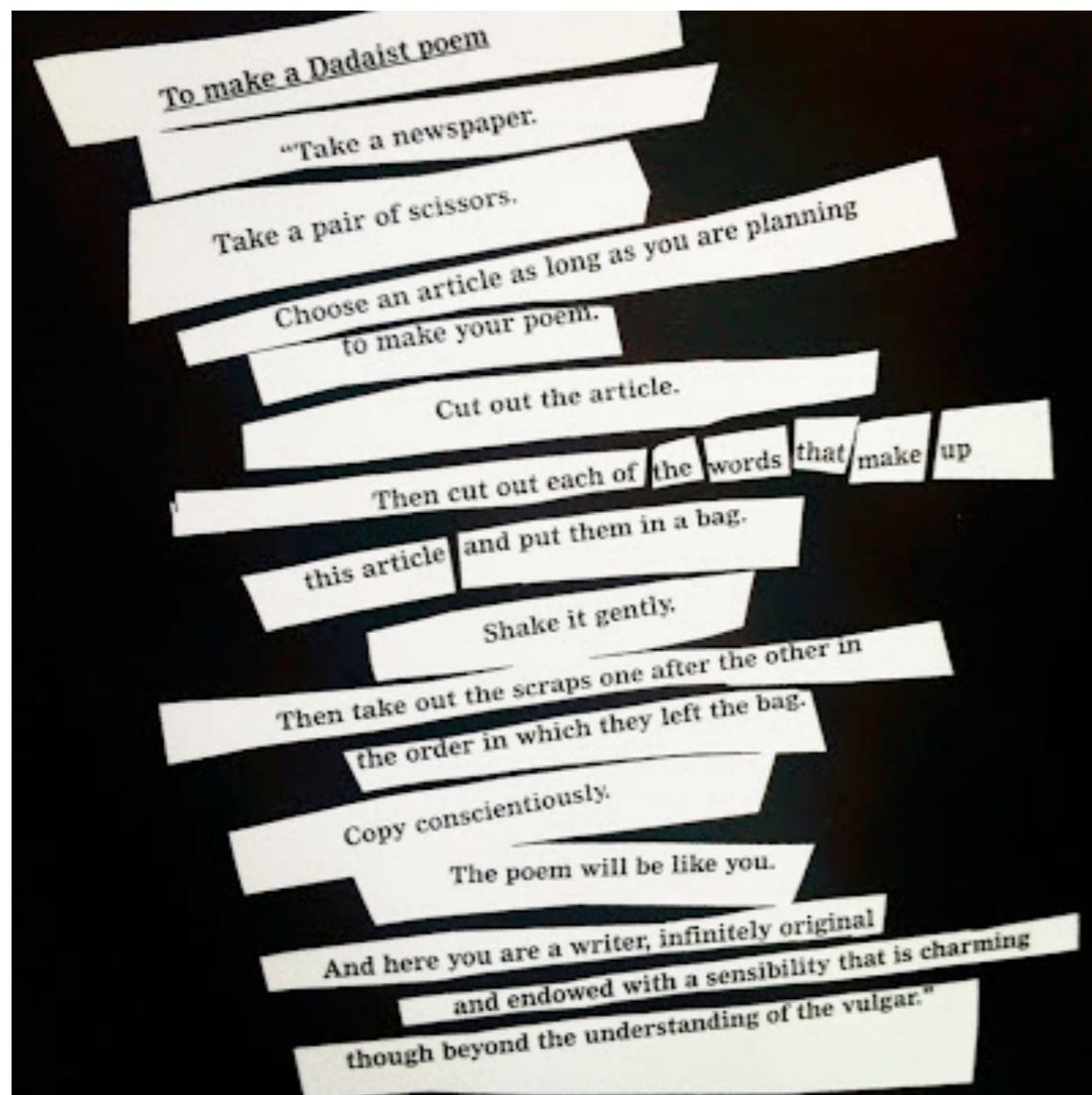


Jean (Hans) Arp

Untitled (Collage with Squares Arranged according to the Law of Chance)
1916–17

TO MAKE A DADAIST POEM

TRISTAN TZARA, 1951



ASSESSMENT

voltaic arc of these two nerves that don't touch

near the heart

we note the black shivers under a lens
is this feeling this white spouting

and methodical love
splits my body into rays

toothpaste pastry

transatlantic
tickets

the crowds crash the column couched in wind

range of rockets

on my head

the bloody revenge of the liberated two-step

directory of determinations at prix fixe

folly at 3:20 am

or 5.50 francs

cocaine slowly gnaws the walls for its pleasure

satanic horoscope dilates under your vigor

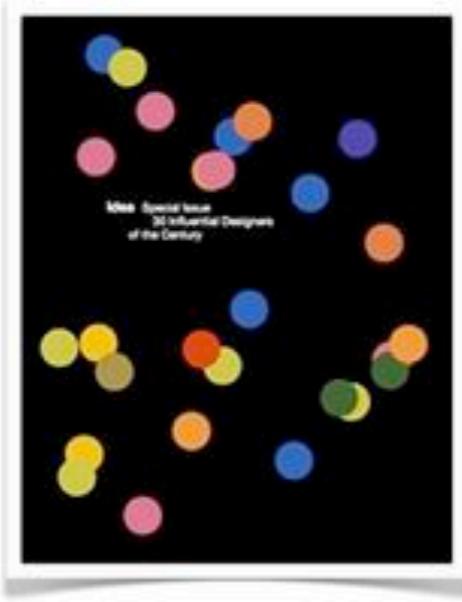
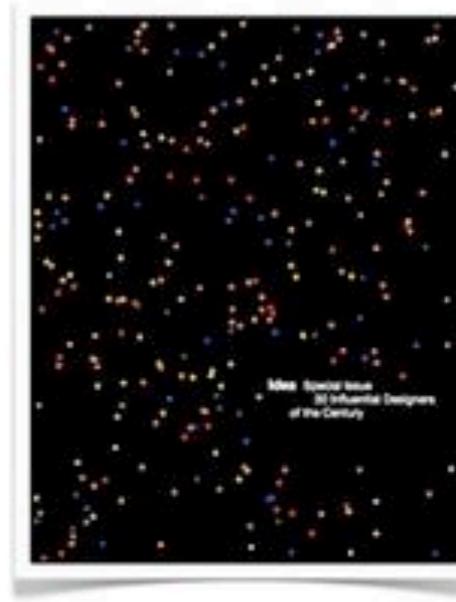
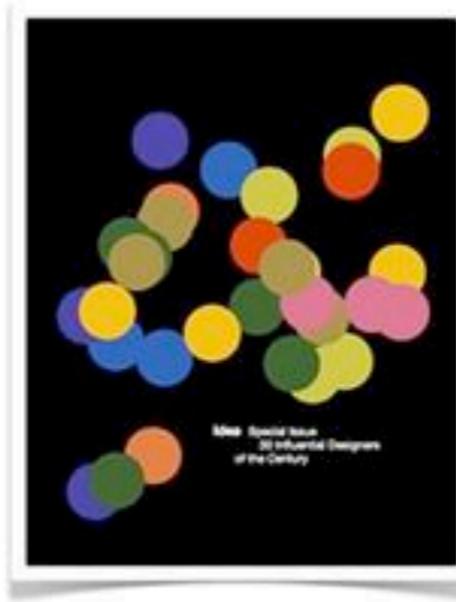
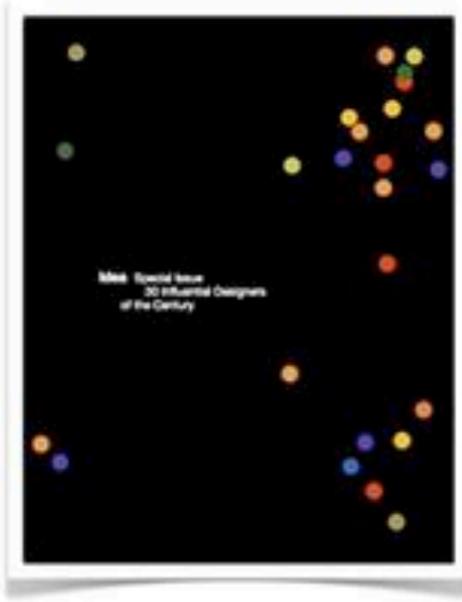
VIRGIL'S VIGILANCE VERIFIES THE VIRAL WIND

eyes droop once more



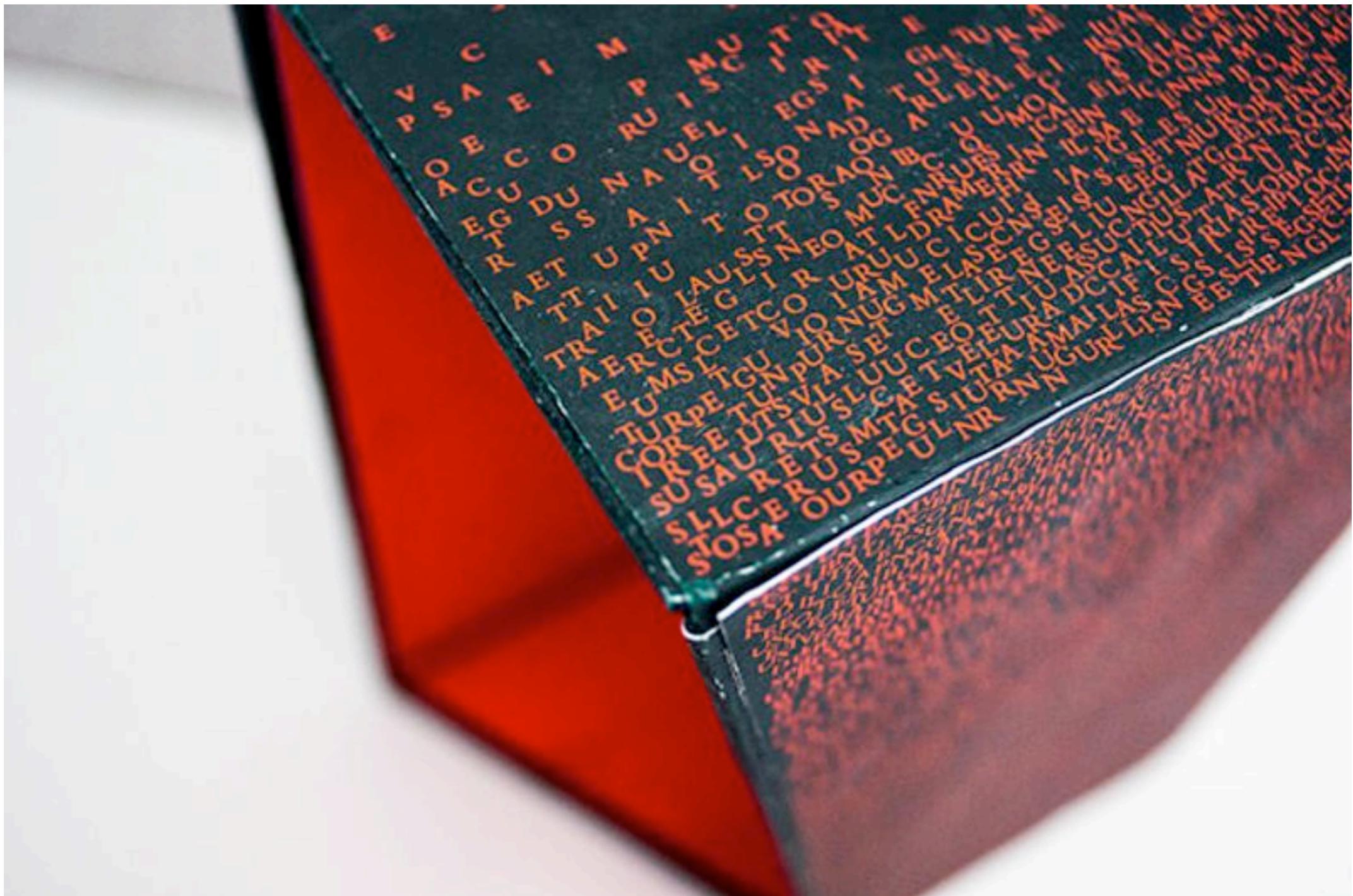
TRISTAN TZARA

RANDOMNESS IN DESIGN



Paul Rand

RANDOMNESS IN DESIGN



Design by Zhusi Xie, for a John Cage novel

MUSIC OF CHANGES

JOHN CAGE, 1951

“
*the first sound composition
to be largely determined by
random procedures...*



Music of Changes for solo piano, composed by John Cage in 1951 for pianist and friend David Tudor, applied decisions made using the *I Ching*, a classical Chinese text commonly used as a divination system, to sounds durations, dynamics, tempo and densities.

EMILY MASON

Abstract painter Emily Mason (1932–2019) used the laws of chance and gravity to create vital works with poured paint. She believed in chance operation, particularly as experienced in New York, where, she said, “you could be inspired by a tropical fruit in Chinatown and an exhibition on Byzantine art uptown...”



Emily Mason, *The Bullock Farm*, 1987, Oil on canvas

TIM KNOWLES



Tim Knowles, Oak/Larch On Easel (2005)

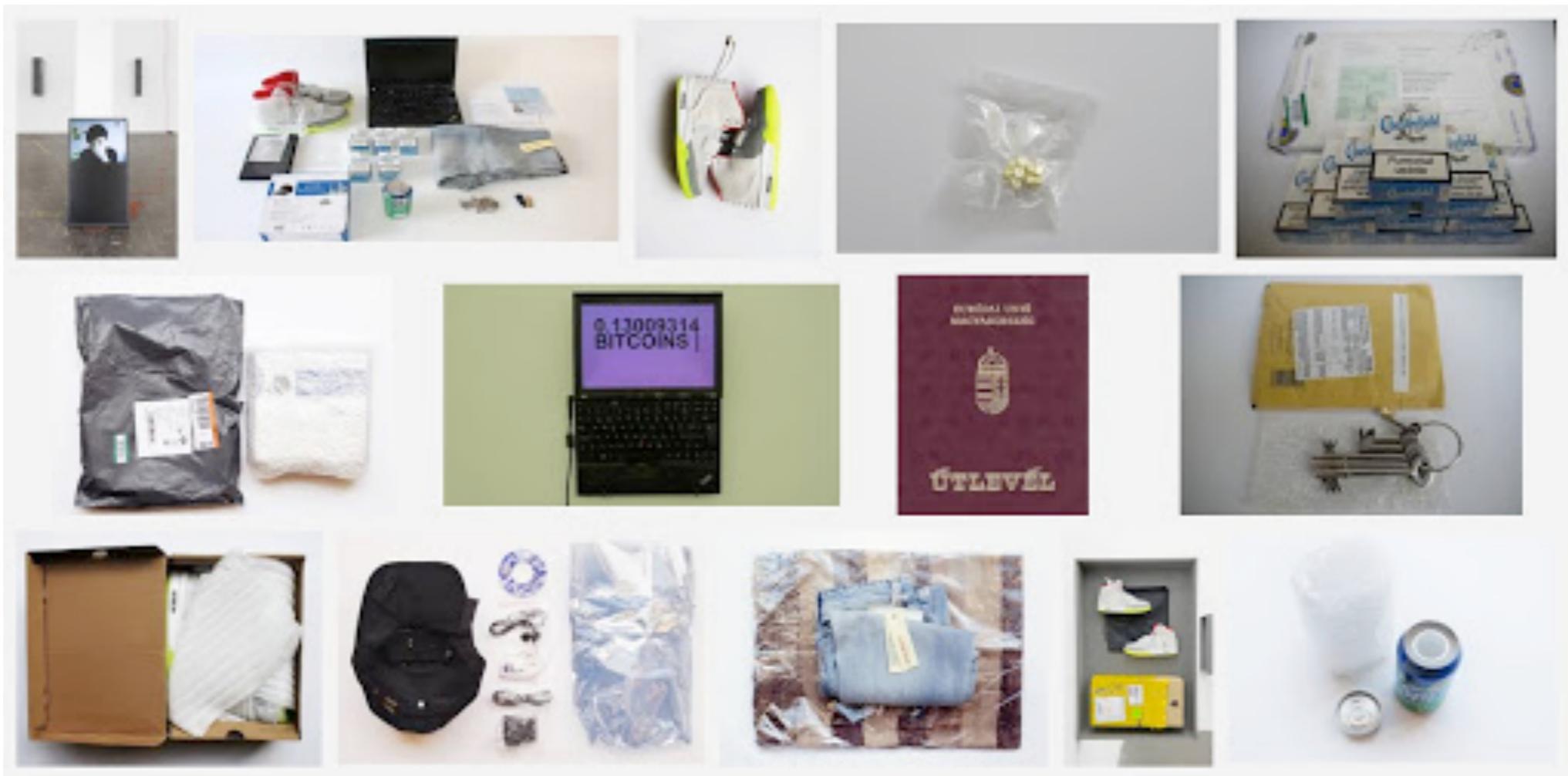
CAROLEE SCHNEEMANN

Schneemann's video *American I-Ching Apple Pie* (1977) incorporated the notion of chance as a ruling cosmological principle, associated with the *I-Ching*, to free women from the confines of both the kitchen and the rational recipe.

Schneemann chose her cooking tools randomly, including colanders, strainers, nails, hammers, arrows, and ball bearings, using chance and Eastern philosophy to break down traditional gender boundaries.



RANDOMNESS AS CRITICAL INTERVENTION



AN ALGORITHM WITH A WEEKLY BUDGET OF \$100 IN BITCOIN, RANDOMLY PURCHASES ITEMS FROM THE DARK WEB, INCLUDING ECSTASY, A HUNGARIAN PASSPORT, AND A BASEBALL CAP WITH A BUILT-IN CAMERA...

IN JANUARY 2015, THE SWISS POLICE CONFISCATED THE ROBOT AND ITS ILLEGAL PURCHASES. THEN THREE MONTHS LATER, RETURNED ALL (MINUS THE ECSTASY)

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OBJECTIVES

TO DARE EVERY DAY TO BE IRREVERENT AND BOLD.
TO DARE TO PRESERVE THE RANDOMNESS OF MIND
WHICH IN CHILDREN PRODUCES STRANGE AND
WONDERFUL NEW THOUGHTS AND FORMS. TO
CONTINUALLY SCRAMBLE THE FAMILIAR AND
BRING THE OLD INTO NEW JUXTAPOSITION.

GORDON WEBBER

WHY USE RANDOMNESS ?

- diminish authorial control
- avoid common habits of the artist
- add variation to predictable outputs
- create surprise (for author or audience)
- explore a possibility space (see Molnár)
- conceptual or critical strategies

RANDOM WALK

sketch.js*

```
let x = 200, y = 200;

function setup() {
    createCanvas(400, 400);
    noStroke();
}

function draw() {
    x += random(-3, 3);
    y += random(-3, 3);

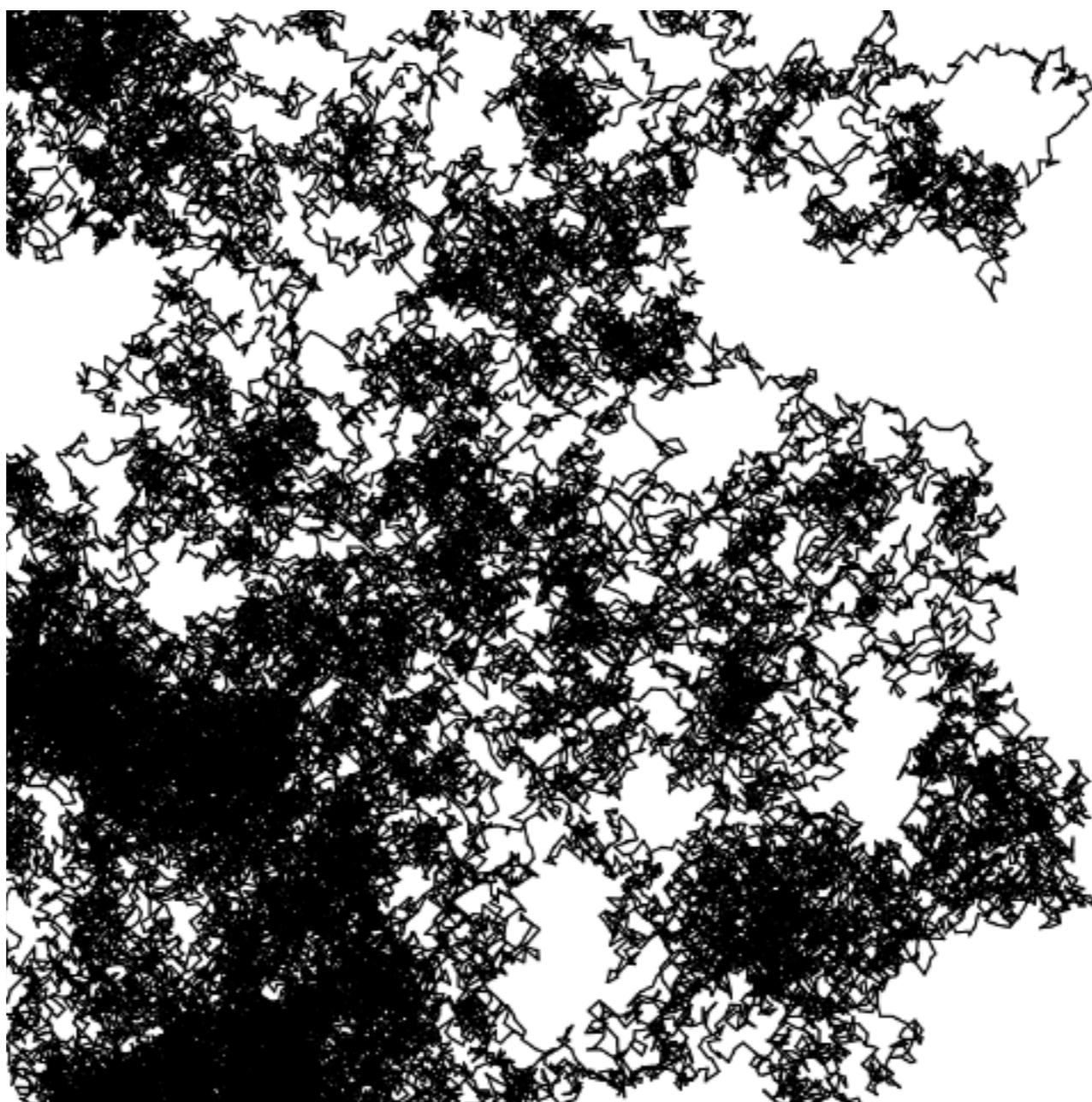
    background(255);
    fill(50);
    circle(x, y, 20);
}
```

Preview



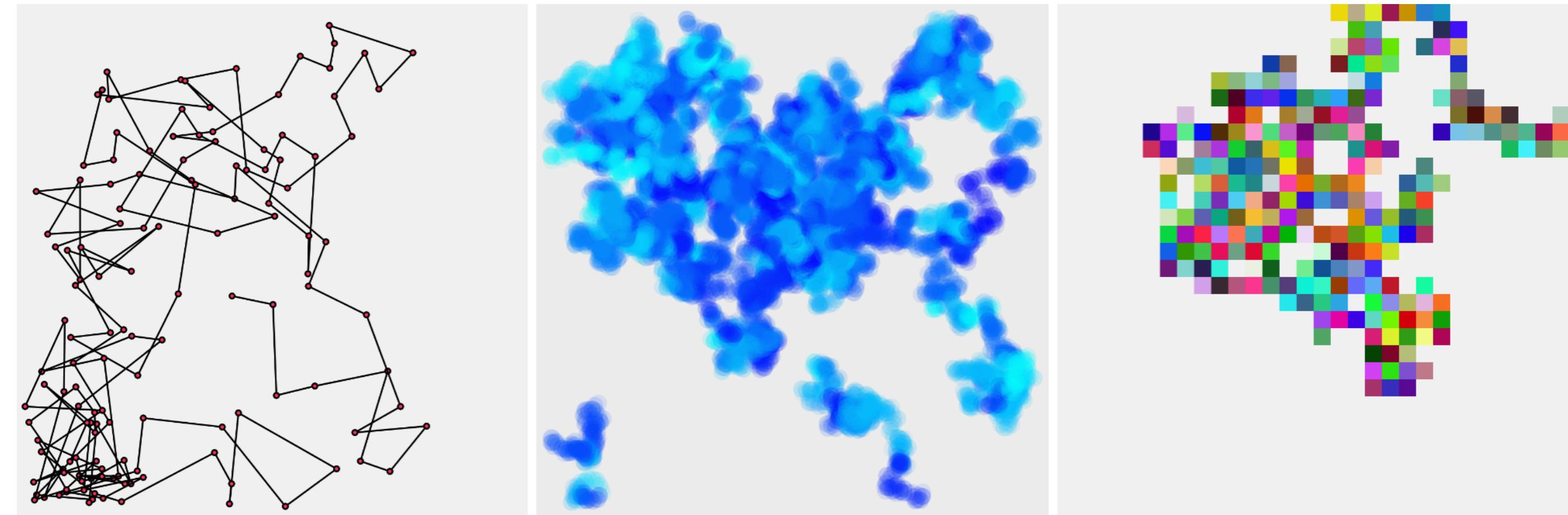
One of the most common techniques using randomness is the *random walk*, which shows up in a ranges of real-world contexts, from the movement of financial asset prices, to the paths of particles in quantum physics...

RANDOM WALK



a single random walker over thousands of steps...

RANDOM WALK

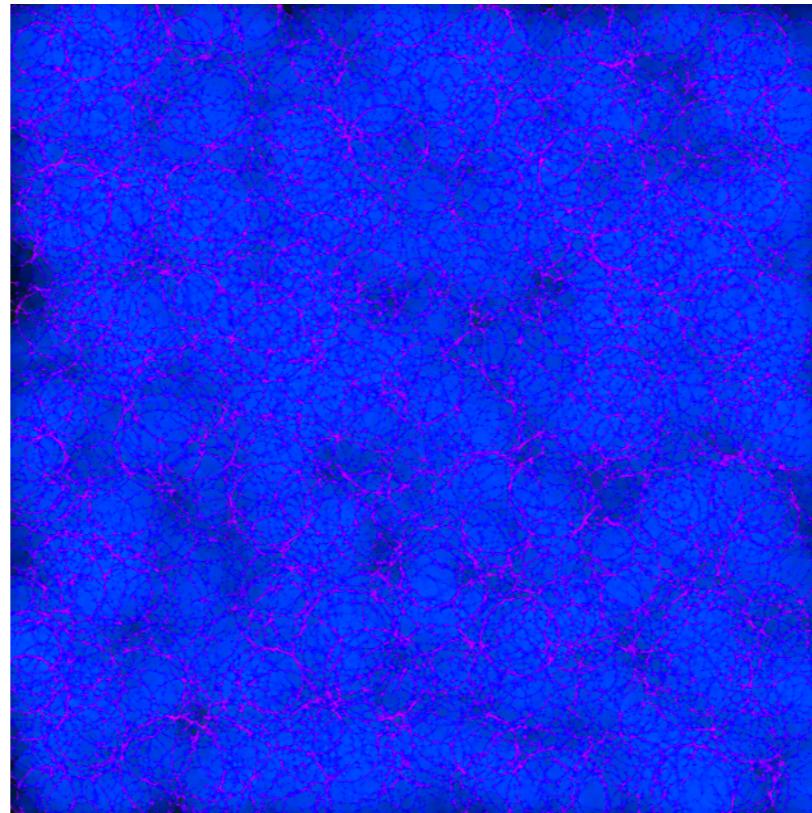


visualizing random walks...

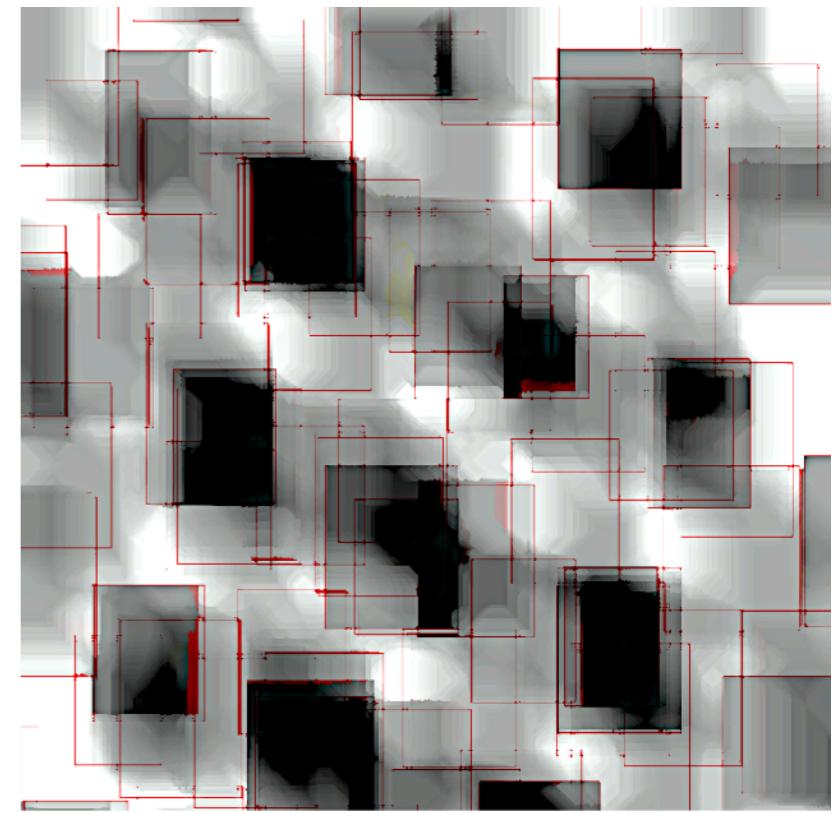
RANDOM WALK



as circles



on a grid



as rectangles

multiple random walkers interacting ...

RANDOM WALK



multiple random walkers interacting ...

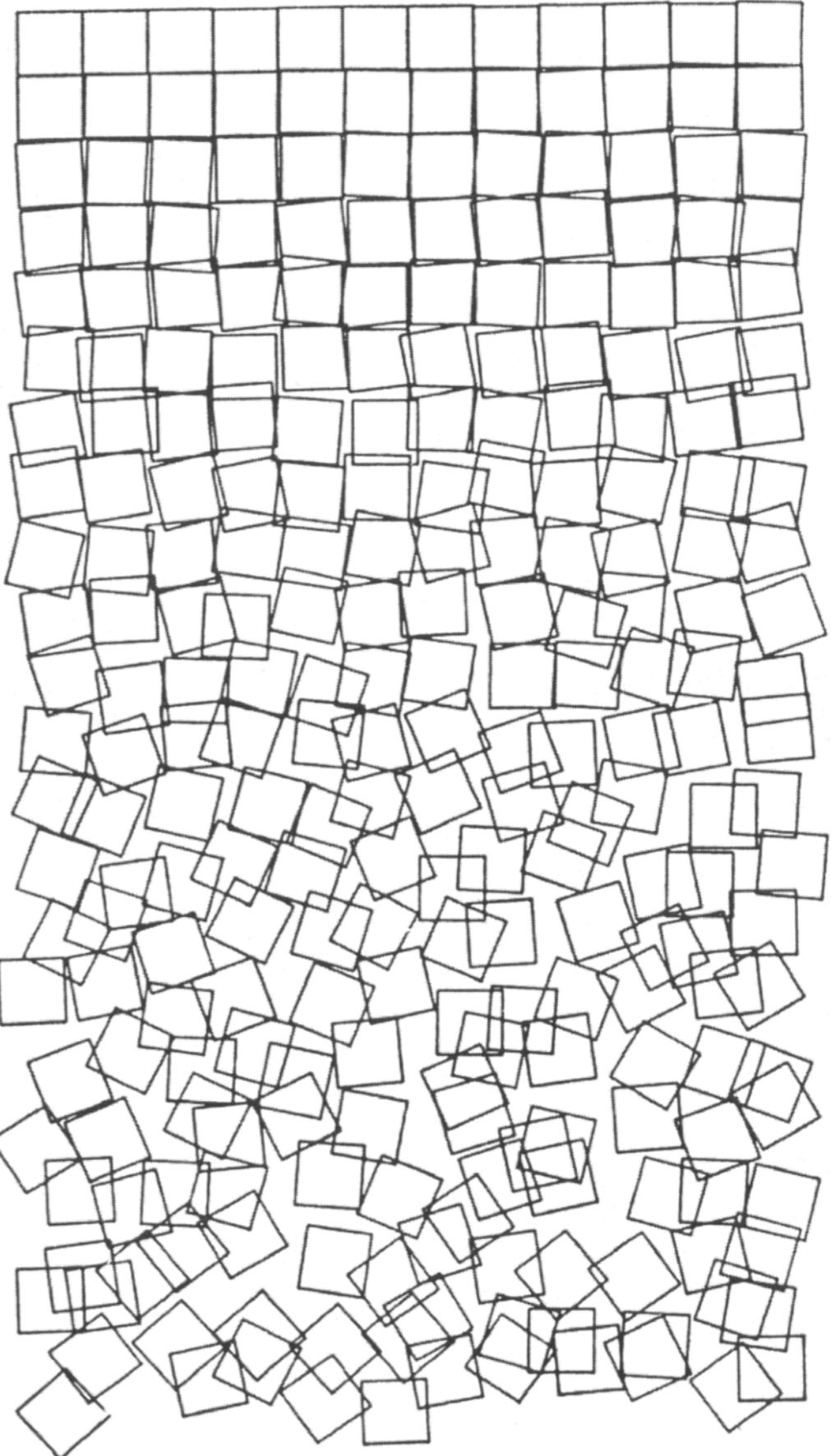
RECODING

COPYING DIRECTLY FROM WORKS OF ART GIVES THE ARTISTS INSIGHT INTO THE CREATIVE PROCESS: INSIGHTS WHICH CANNOT BE LEARNED FROM ANY OTHER SOURCE.

- GERALD KING

**LET'S DESCRIBE THIS WORK
AS CONCISELY AS WE CAN,
USING PLAIN ENGLISH...**

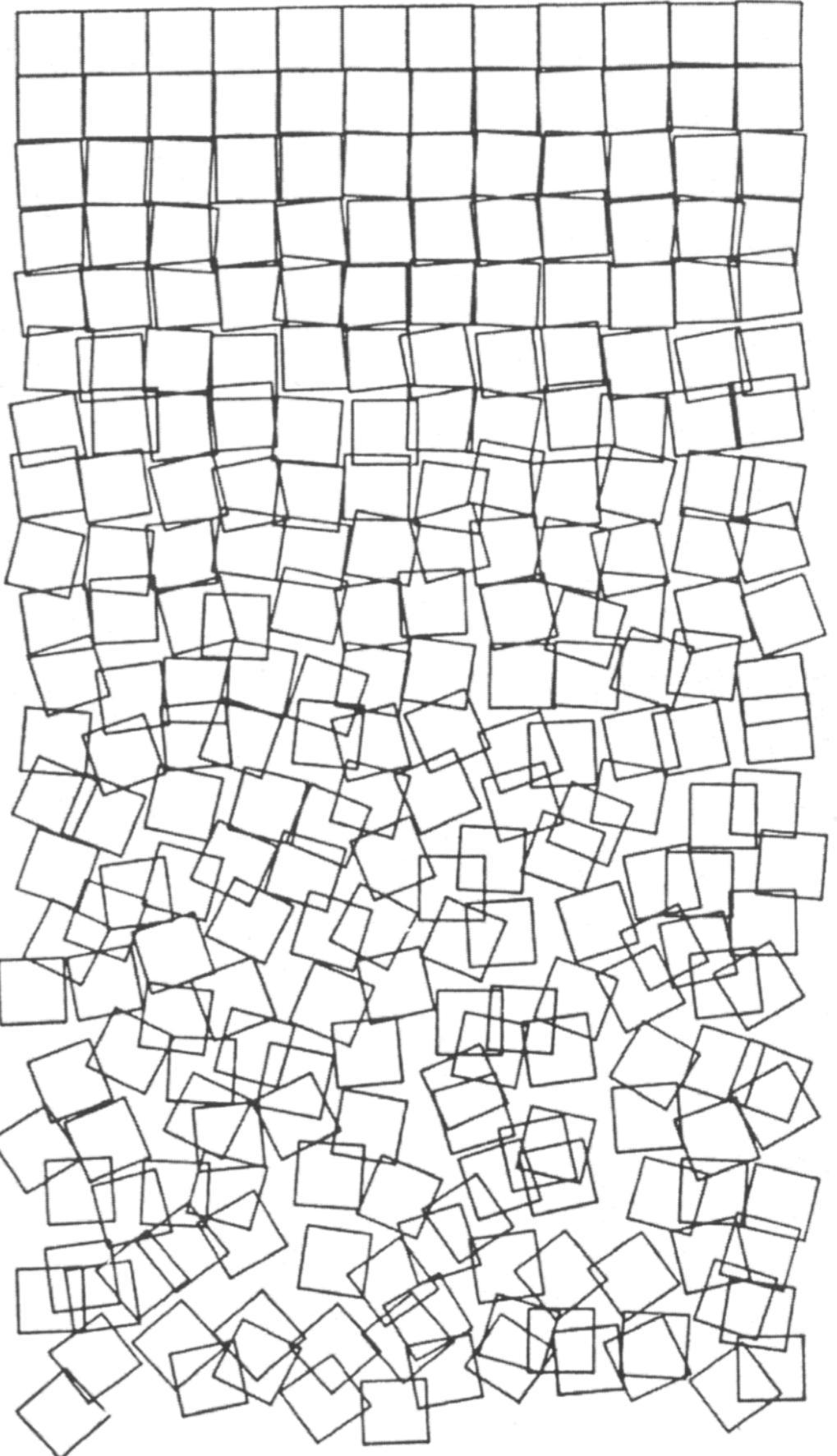
?



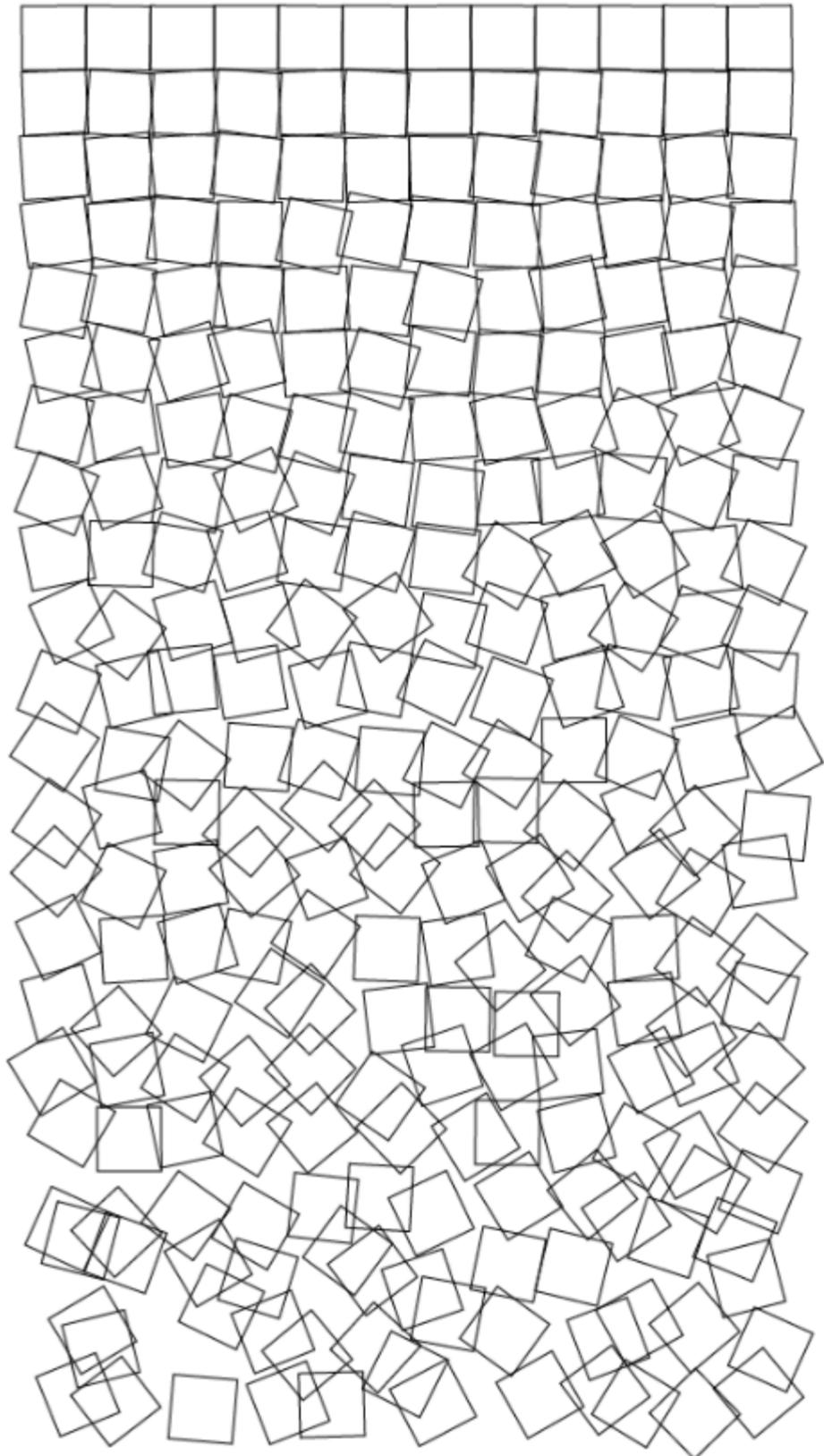
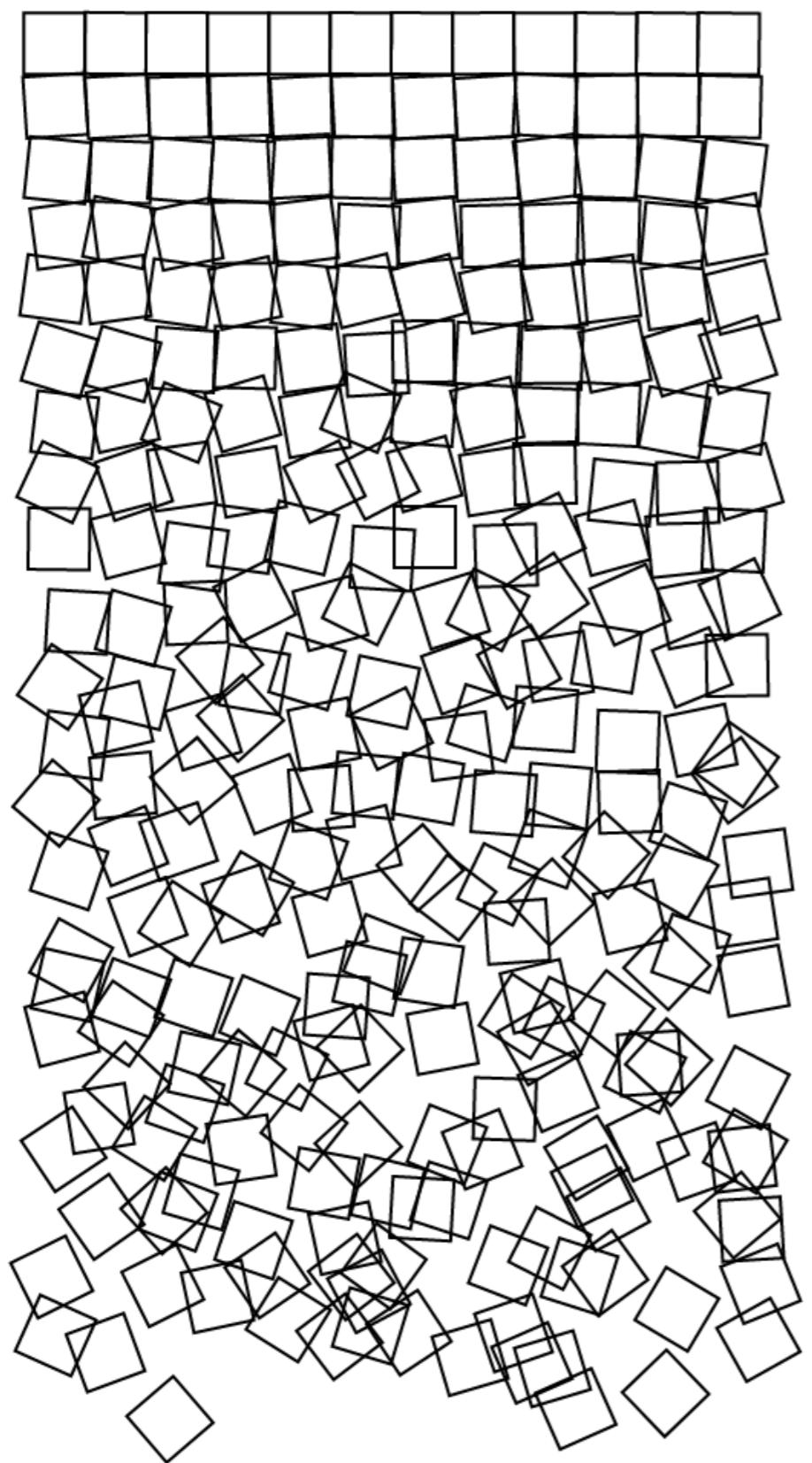
Schotter (Gravel) - Georg Nees, 1968

**LET'S DESCRIBE THIS WORK
AS CONCISELY AS WE CAN,
USING PLAIN ENGLISH...**

?



Schotter (Gravel) - Georg Nees, 1968



Recode of *Schotter (Gravel)* by Georg Nees, 2021

```
let sqSz = 20;

function setup() {
  createCanvas(400, 600);
  noFill();
  background(255);
  translate(width/5, height/8);

  for (let i = 0; i < 12; i++) {
    for (let j = 0; j < 22; j++) {

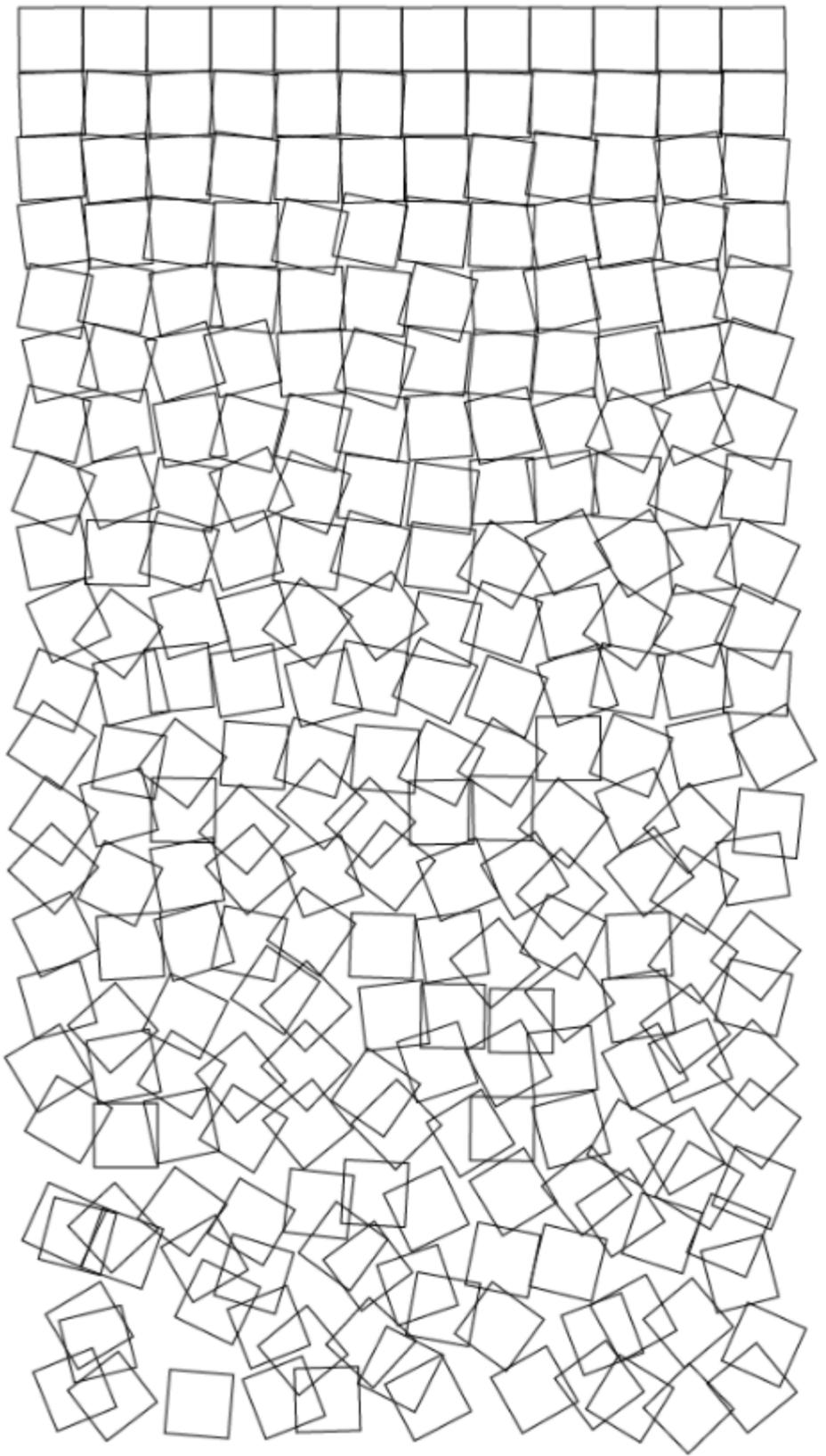
      let displace = max(j, 0.2);
      let randRot = random(-4, 4) * displace;
      let randShift = random() * displace;

      translate(i * sqSz, j * sqSz);
      rotate(radians(randRot));

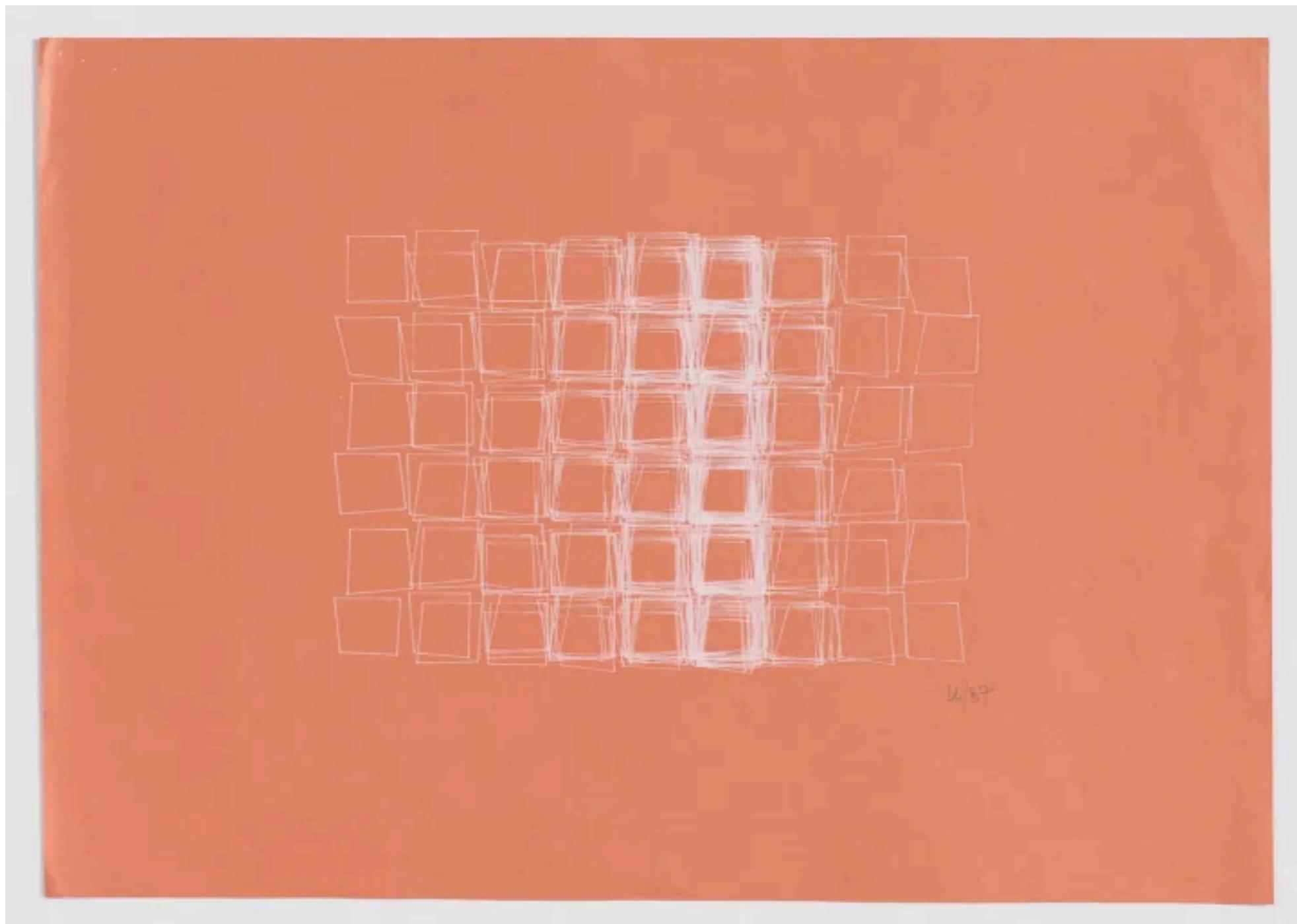
      square(-sqSz / 2 + randShift, -sqSz / 2 + randShift, sqSz);

      rotate(radians(-randRot));
      translate(-i * sqSz, -j * sqSz);
    }
  }
}
```

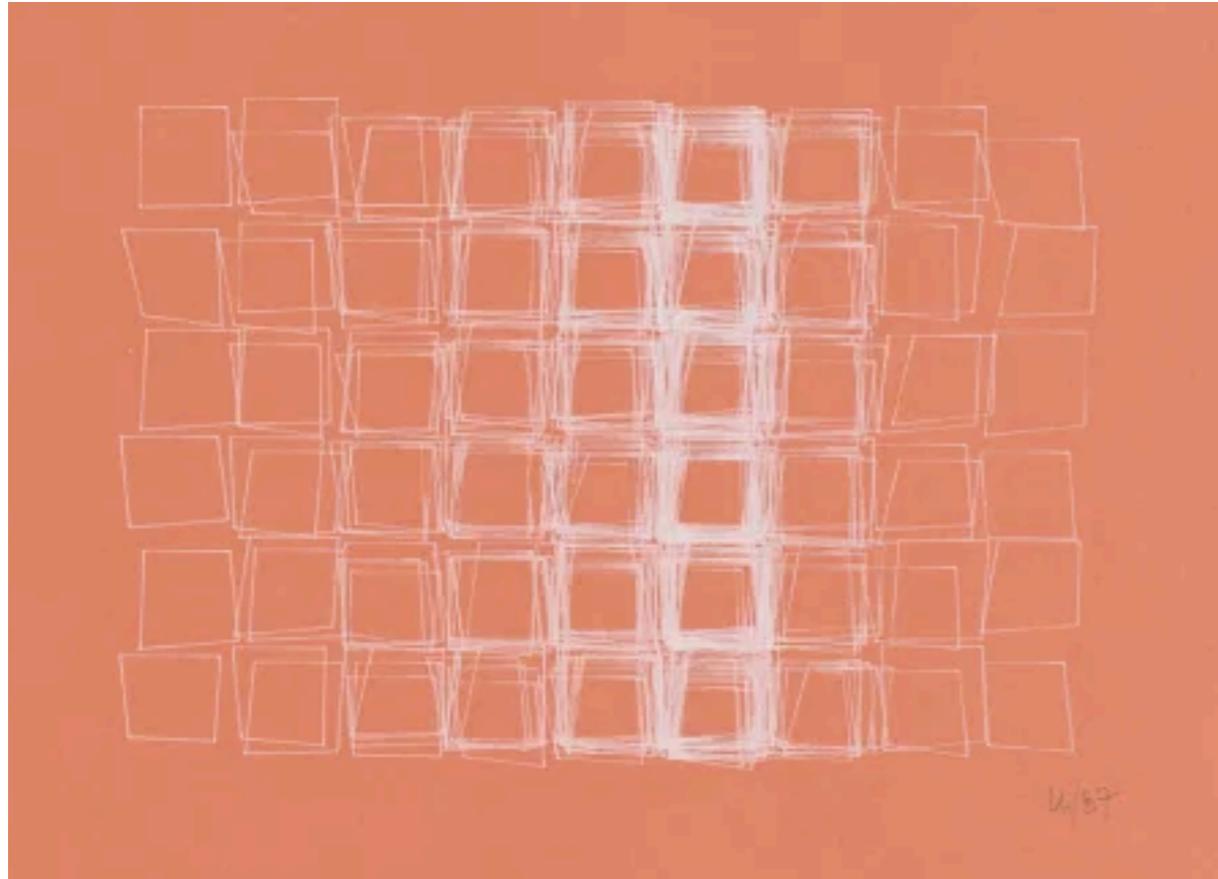
file: Recode-Schotter.js



Recode of Schotter (*Gravel*) by Georg Nees, 2021

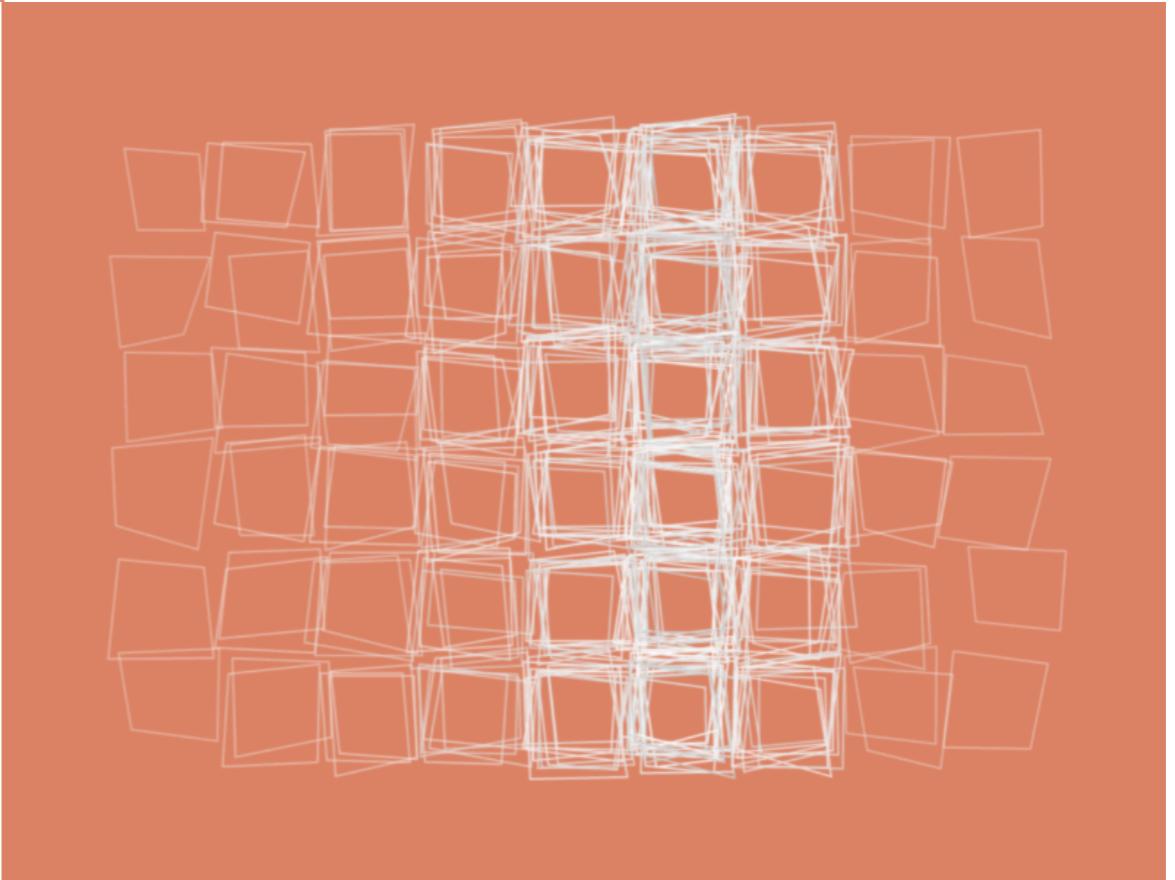


VERA MOLNAR “STRUCTURE DE QUADRILATERES” (1987)



ORIGINAL

RECODE



VERA MOLNAR "STRUCTURE DE QUADRILATERES" (1987)

```

let sz = 50, k = 8;
let num = [1,2,3,6,10,18,9,2,1];

function setup() {

  createCanvas(690, 520);
  background(222, 133, 103);
  noFill();

  for (let i = 0; i++ < 6; ) {
    for (let j = 0; j++ < 9; ) {
      for (let h = 0; h < num[j-1]; h++) {

        let x1 = 50 + j * 60 - sz / 2 + random(-k, k);
        let y1 = 50 + i * 60 - sz / 2 + random(-k, k);

        let x2 = x1 + sz + random(-k, k);
        let y2 = y1 + random(-k, k);

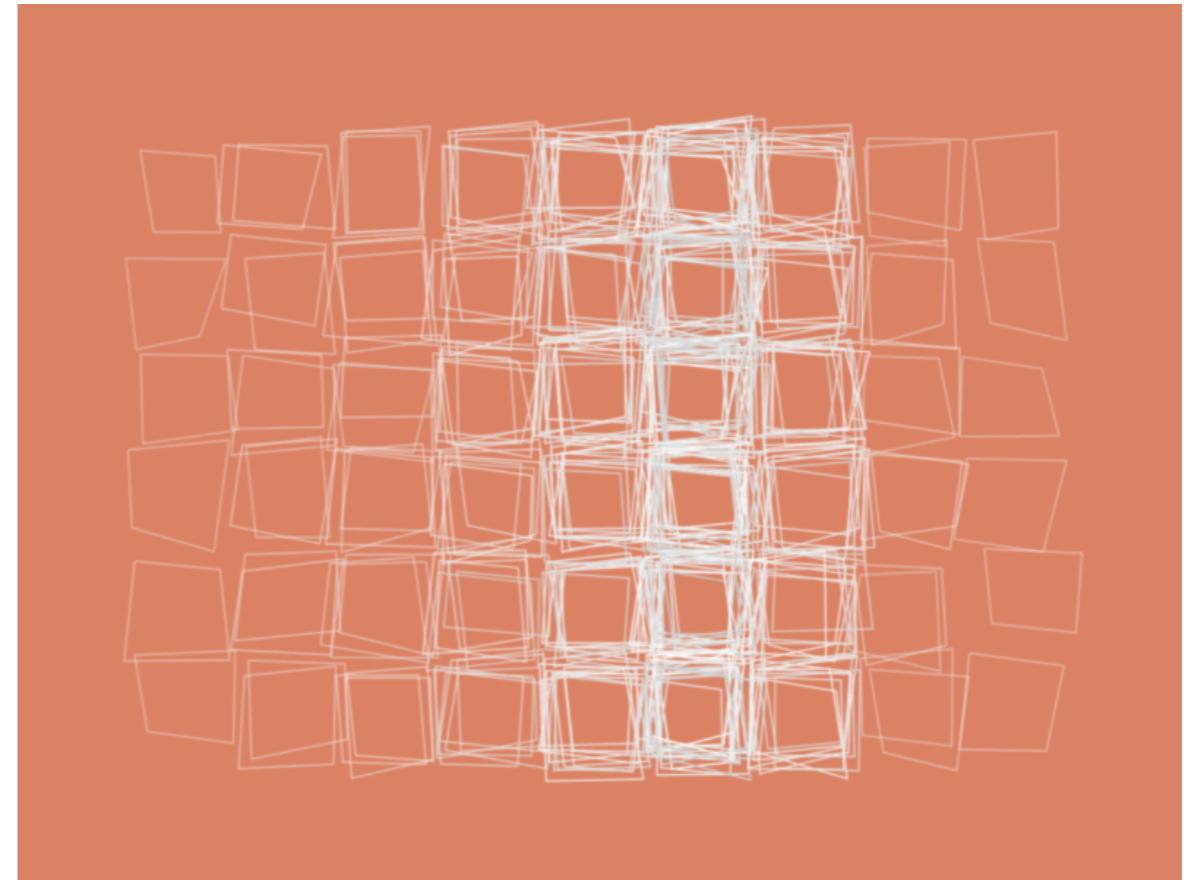
        let x3 = x1 + sz + random(-k, k);
        let y3 = y1 + sz + random(-k, k);

        let x4 = x1 + random(-k, k);
        let y4 = y1 + sz + random(-k, k);

        stroke(random(240-num[j-1]*2, 255), 100+num[j-1]*12);
        quad(x1, y1, x2, y2, x3, y3, x4, y4);
      }
    }
  }
}

```

file: [Recode-Quads.js](#)

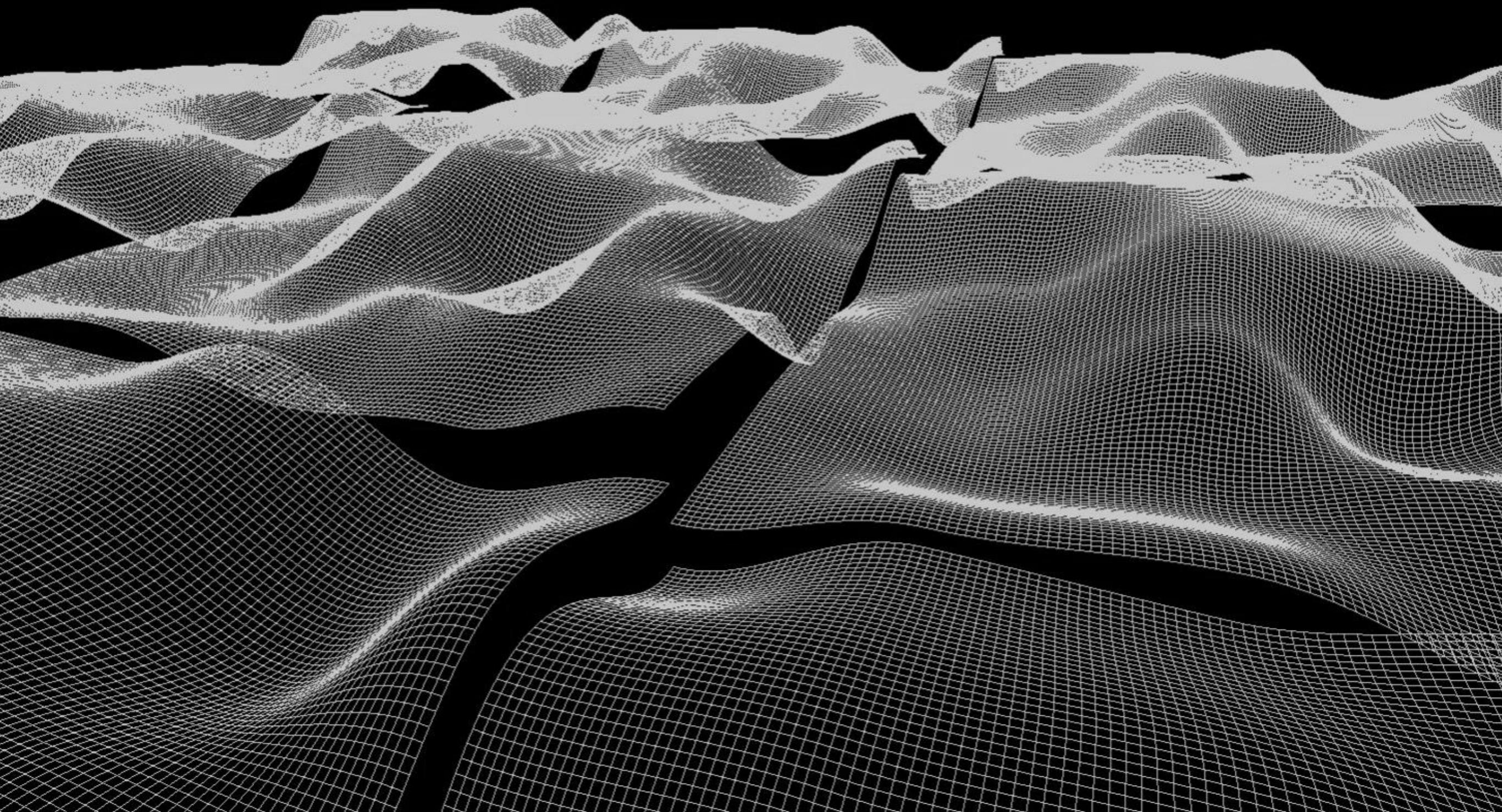


RECODE OF VERA MOLNAR “STRUCTURE DE QUADRILATERES” (1987)

LIFE CANNOT BE CALCULATED. THAT'S THE BIG MISTAKE OUR CIVILIZATION MADE. WE NEVER ACCEPTED THAT RANDOMNESS IS NOT A MISTAKE IN THE EQUATION - IT IS PART OF THE EQUATION.

JEANETTE WINTERSON

NOISE()



END

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