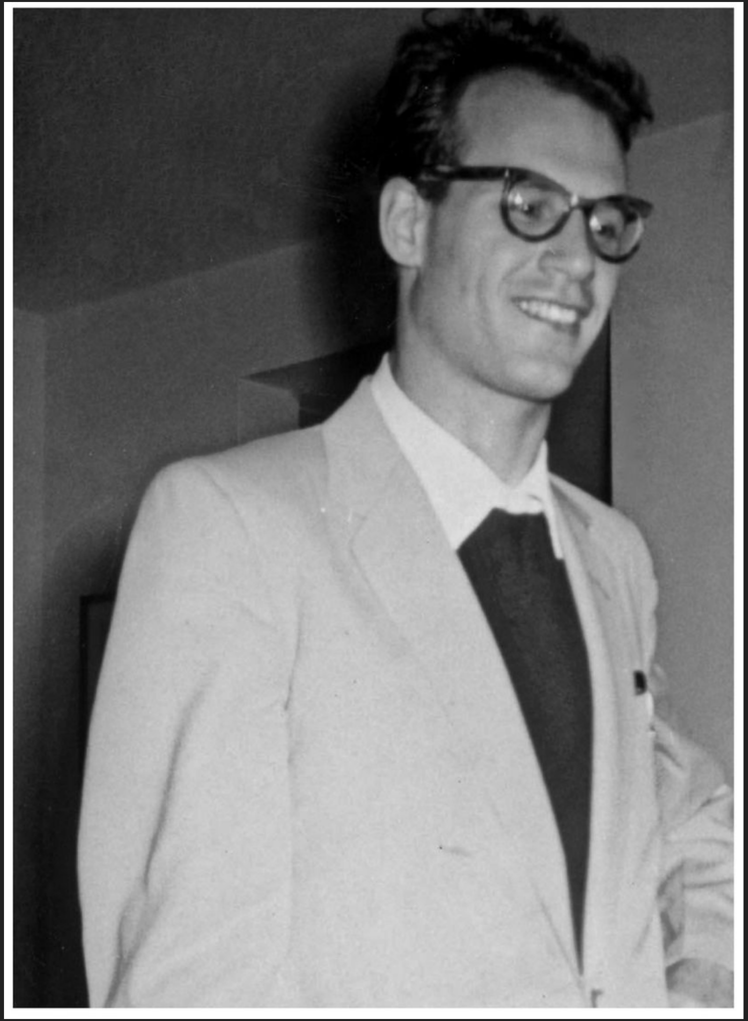
The Rising Sea

Matt Drury, March 2023

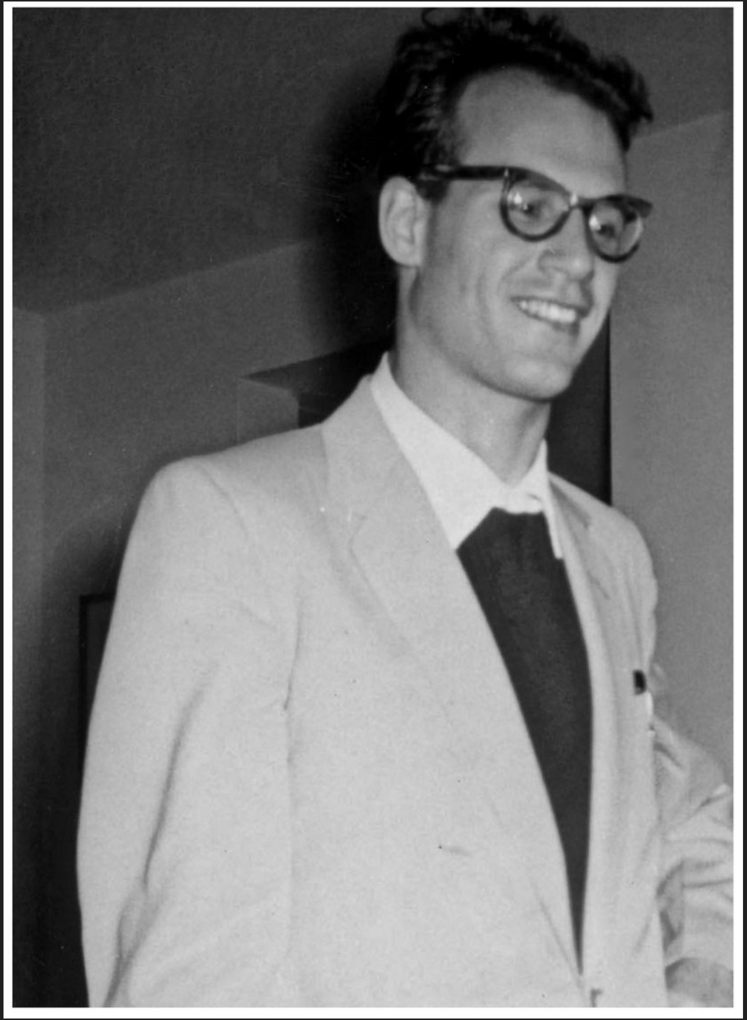
https://github.com/madrury/the-rising-sea

The Rising Sea

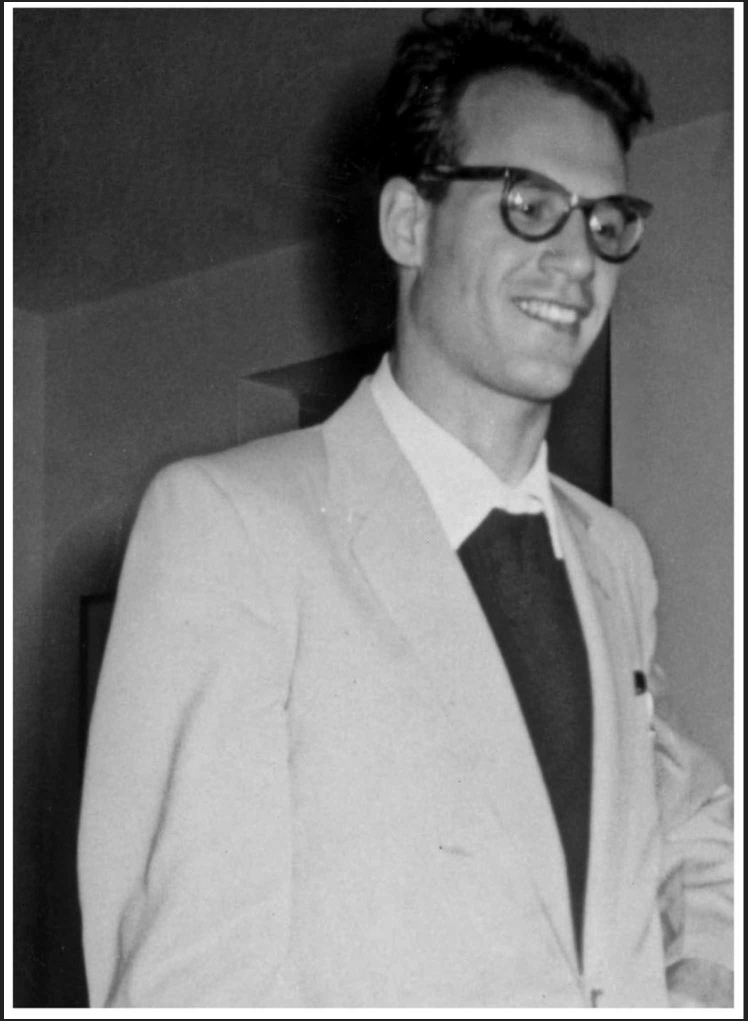
A talk about **one** method for composing computer programs.



???



Alexander Grothendieck
1928 - 2014

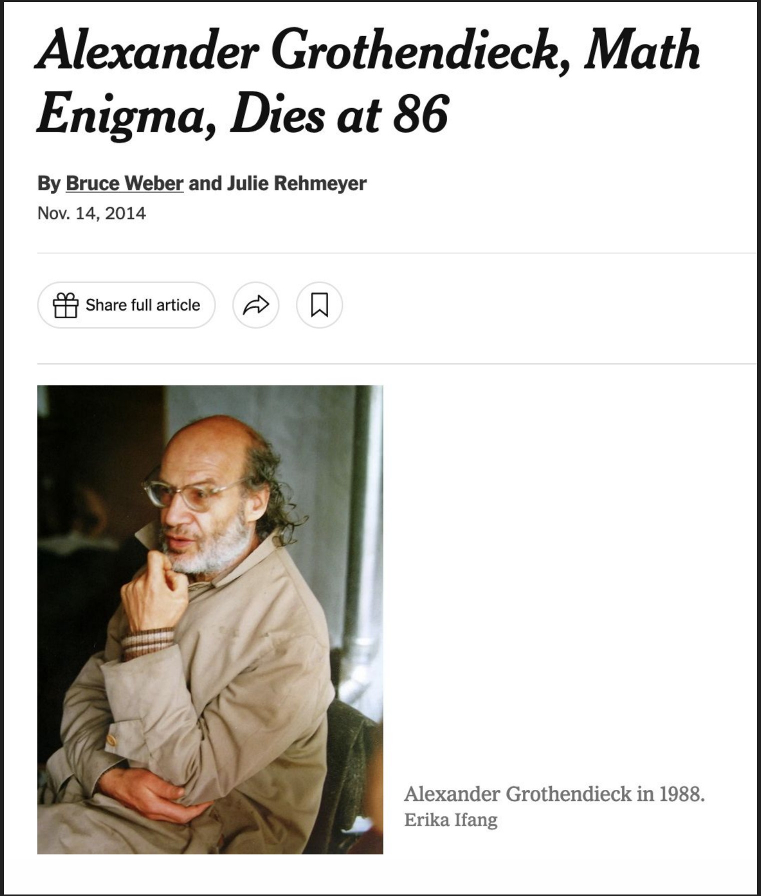


Alexander Grothendieck
1928 - 2014

Mathematician

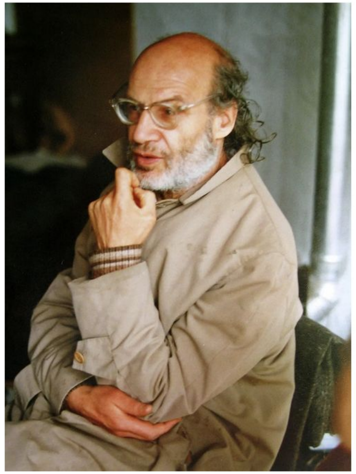
Analogies in Other Fields:

- Mathematics : Grothendieck
- Physics : Paul Dirac
- Computer Science : Alonzo Church
- Programming Languages : John McCarthy

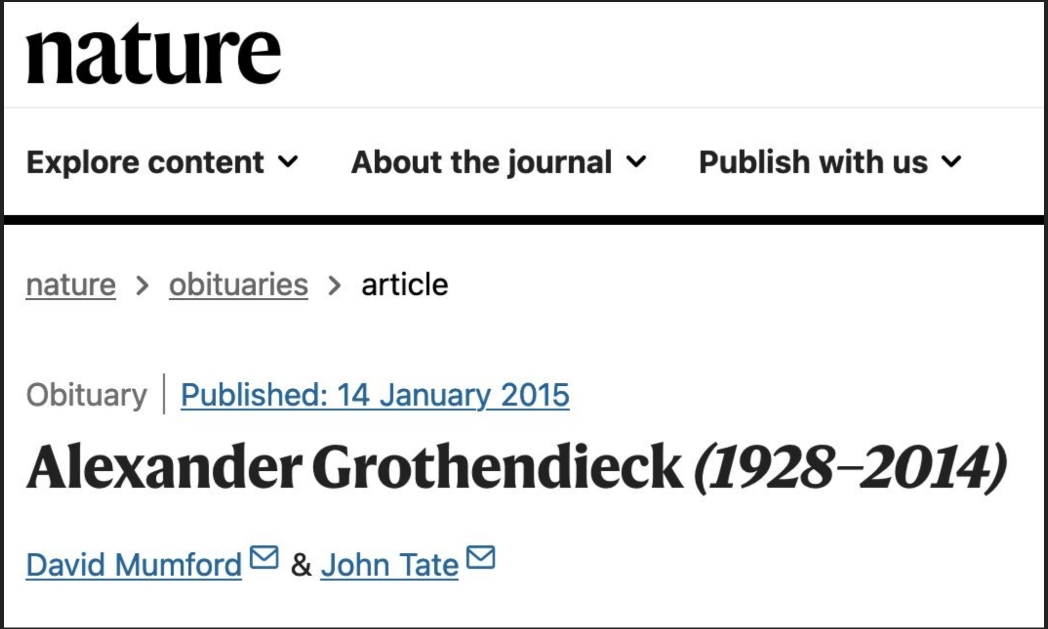


Alexander Grothendieck, Math Enigma, Dies at 86

By Bruce Weber and Julie Rehmeyer
Nov. 14, 2014



Alexander Grothendieck in 1988.
Erika Ifang



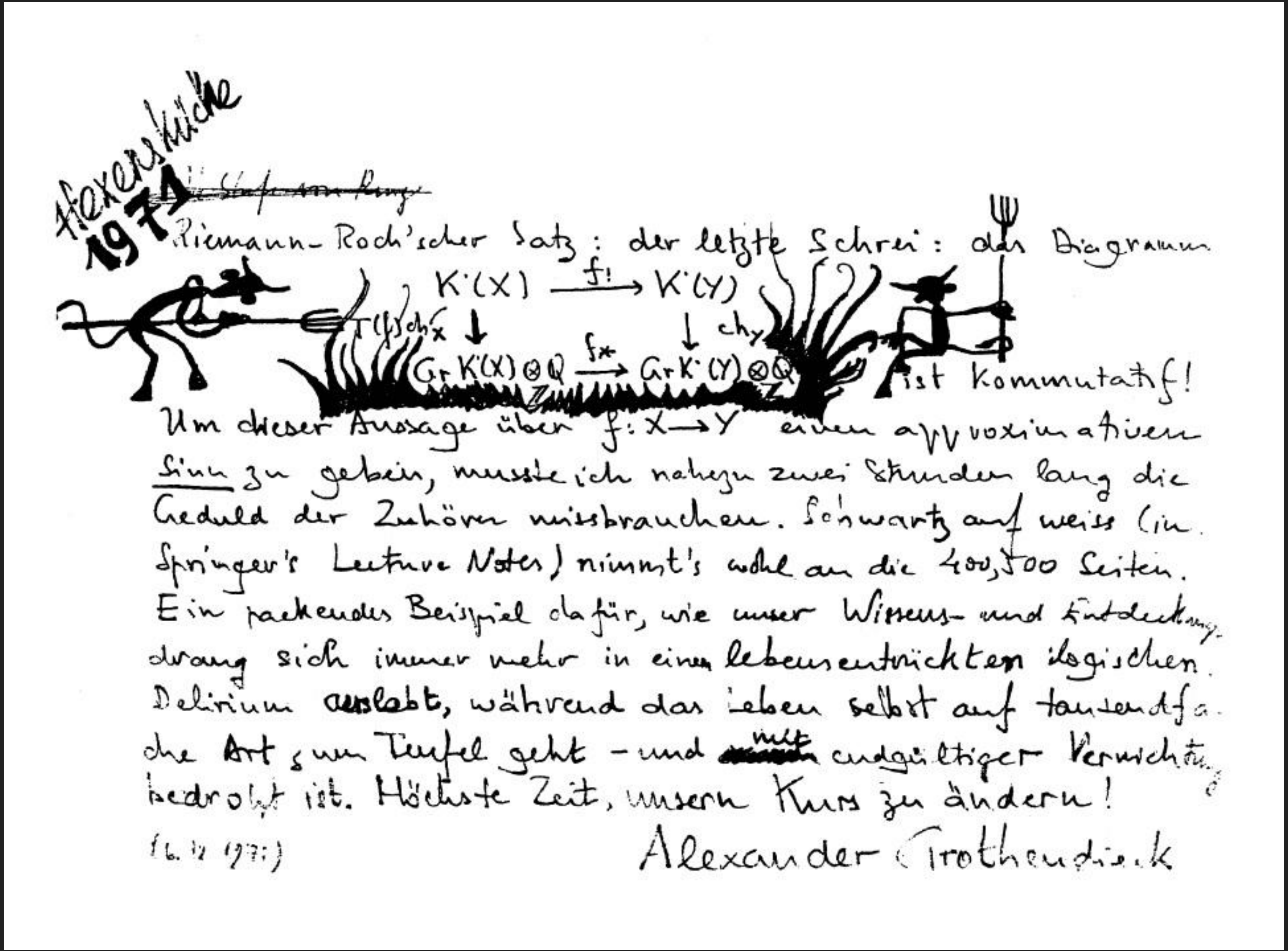
Obituary | Published: 14 January 2015

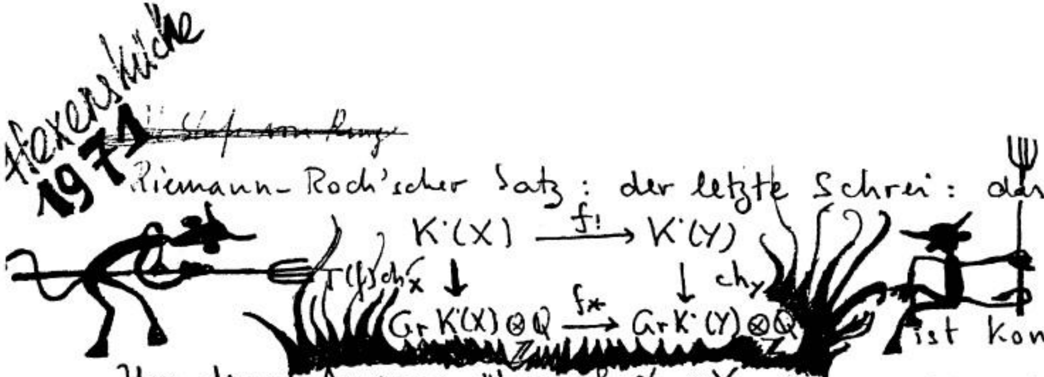
Alexander Grothendieck *(1928–2014)*

David Mumford & John Tate

“The sad thing is that this was rejected as much too technical for their readership. Their editor wrote me that 'higher degree polynomials', 'infinitesimal vectors' and 'complex space' (even complex numbers) were things at least half their readership had never come across.”

David Mumford





Hexenküche 1971

~~[illegible]~~

Riemann-Roch'scher Satz: der letzte Schrei: das Diagramm

$$\begin{tikzcd}
K^{\cdot}(X) \arrow[r, "f_!"] \arrow[d, "\tau(f)ch_X"'] & K^{\cdot}(Y) \arrow[d, "ch_Y"] \\
Gr\,K^{\cdot}(X)\otimes\mathbb{Q} \arrow[r, "f_*"] & Gr\,K^{\cdot}(Y)\otimes\mathbb{Q}
\end{tikzcd}$$

ist kommutativ!

Um dieser Aussage über $f: X \to Y$ einen approximativen Sinn zu geben, musste ich nahezu zwei Stunden lang die Geduld der Zuhörer missbrauchen. Schwarz auf weiss (in Springer's Lecture Notes) nimmt's wohl an die 400, 500 Seiten. Ein packendes Beispiel dafür, wie unser Wissens- und Entdeckungsdrang sich immer mehr in einen lebensentrückten logischen Delirium auslebt, während das Leben selbst auf tausendfache Art zum Teufel geht – und ~~[illegible]~~ mit endgültiger Vernichtung bedroht ist. Höchste Zeit, unsern Kurs zu ändern!

(6. 12 1971)

Alexander Grothendieck

🌊 The Rising Sea 🌊

"A different image came to me a few weeks ago. The unknown thing to be known appeared to me as some stretch of earth or hard marl, resisting penetration... the sea advances insensibly in silence, nothing seems to happen, nothing moves, the water is so far off you hardly hear it... yet it finally surrounds the resistant substance..."

Grothendieck

“I have also learned not to take glory in the difficulty of a proof: difficulty means we have not understood. The ideal is to be able to paint a landscape in which the proof is obvious.”

Grothendieck

🌰 Nut Cracking 🌰

Jean-Paul Serre

"Serre created a series of concise elegant tools which Grothendieck and coworkers simplified into thousands of pages of category theory"

Colin McLarty

Which style makes for better computer programs?

Advent of Code, 2022
Problem #5

```
    [D]    
[N] [C]    
[Z] [M] [P]
-----------
 1   2   3 
```

```
move 1 from 2 to 1
```

```
[D]
[N] [C]
[Z] [M] [P]
-----------
 1   2   3
```

```
move 2 from 1 to 3
```

```
        [D]
[N] [C] [N]
[Z] [M] [P]
-----------
 1   2   3
```

```
[T]     [Q]             [S]
[R]     [M]             [L] [V] [G]
[D] [V] [V]             [Q] [N] [C]
[H] [T] [S] [C]         [V] [D] [Z]
[Q] [J] [D] [M]     [Z] [C] [M] [F]
[N] [B] [H] [N] [B] [W] [N] [J] [M]
[P] [G] [R] [Z] [Z] [C] [Z] [G] [P]
[B] [W] [N] [P] [D] [V] [G] [L] [T]
-----------------------------------
 1   2   3   4   5   6   7   8   9
```

Serre: “You should write code to solve the problem.”

Grothendieck: “You should structure your data so that the problem solves itself.”

Concepts in program space we need to model:

- Instruction
- Program
- Stack of Boxes
- Harbor (multiple stacks) of boxes.

```
move 2 from 1 to 3
```

```python
@dataclass
class Instruction:
    source: int
    destination: int
    count: int
```

```
move 1 from 2 to 1
move 2 from 1 to 3
move 1 from 3 to 1
        ...
```

```
Program = list[Instruction]
```

```python
class Harbor:
    # Some representation of the data.
    def execute(self, i: Instruction):
        # Some code that moves around the stacks.
    def run(self, p: Program):
        for instruction in p:
            self.execute(instruction)
```

```python
@dataclass
class Harbor:
    stacks: List[Stack]
    def execute(self, i: Instruction):
        source = self.stacks[i.source]
        destination = self.stacks[i.destination]
        payload = source.popsome(i.count)
        destination.extend(payload)
```

```python
@dataclass
class Stack:
    boxes: list[Box]
    def popsome(self, count: int) -> List[Box]:
        tail = self.boxes[-count:]
        self.boxes = self.boxes[:-count]
        return self.tail
    def extend(self, some: List[Box]):
        self.boxes.extend(some)
```

All my choices were made here.

- Instruction
- Program
- Stack of Boxes
- Harbor (multiple stacks) of boxes.

🎤 The Darkness 🎸

```
Harbor?
[T]     [Q]             [S]
[R]     [M]             [L] [V] [G]
[D] [V] [V]             [Q] [N] [C]
[H] [T] [S] [C]         [V] [D] [Z]
[Q] [J] [D] [M]     [Z] [C] [M] [F]
[N] [B] [H] [N] [B] [W] [N] [J] [M]
[P] [G] [R] [Z] [Z] [C] [Z] [G] [P]
[B] [W] [N] [P] [D] [V] [G] [L] [T]
-----------------------------------
 1   2   3   4   5   6   7   8   9
```

```
def parse_harbor(stackstr: Iterable[str]) -> Harbor:
    bottomup = list(stackitr)[:-1]
    harbor: Harbor = Harbor([[] for _ in
range(N_STACKS)])
    for line in bottomup:
        tokens = [
            ''.join(x for _, x in g[1])
            for g in itertools.groupby(
                enumerate(line),
                lambda t: t[0] // N_CHARS_IN_BOX_TOKEN
            )
        ]
        boxes: List[Box] = [t.strip('[] ') for t in
tokens]
        for box, stack in zip(boxes,
harbor.iter_stacks()):
            if box: stack.append(box)
    return stacks
```