Types

As Premature Optimization

@brixen

Summary

We can't use them well

We usually don't need them

They can harm more than help

Questions?


BREAD


FUEL the FUN!

AMIABLE

MAISON FONDÉE EN 1879

MARQUE DÉPOSÉE

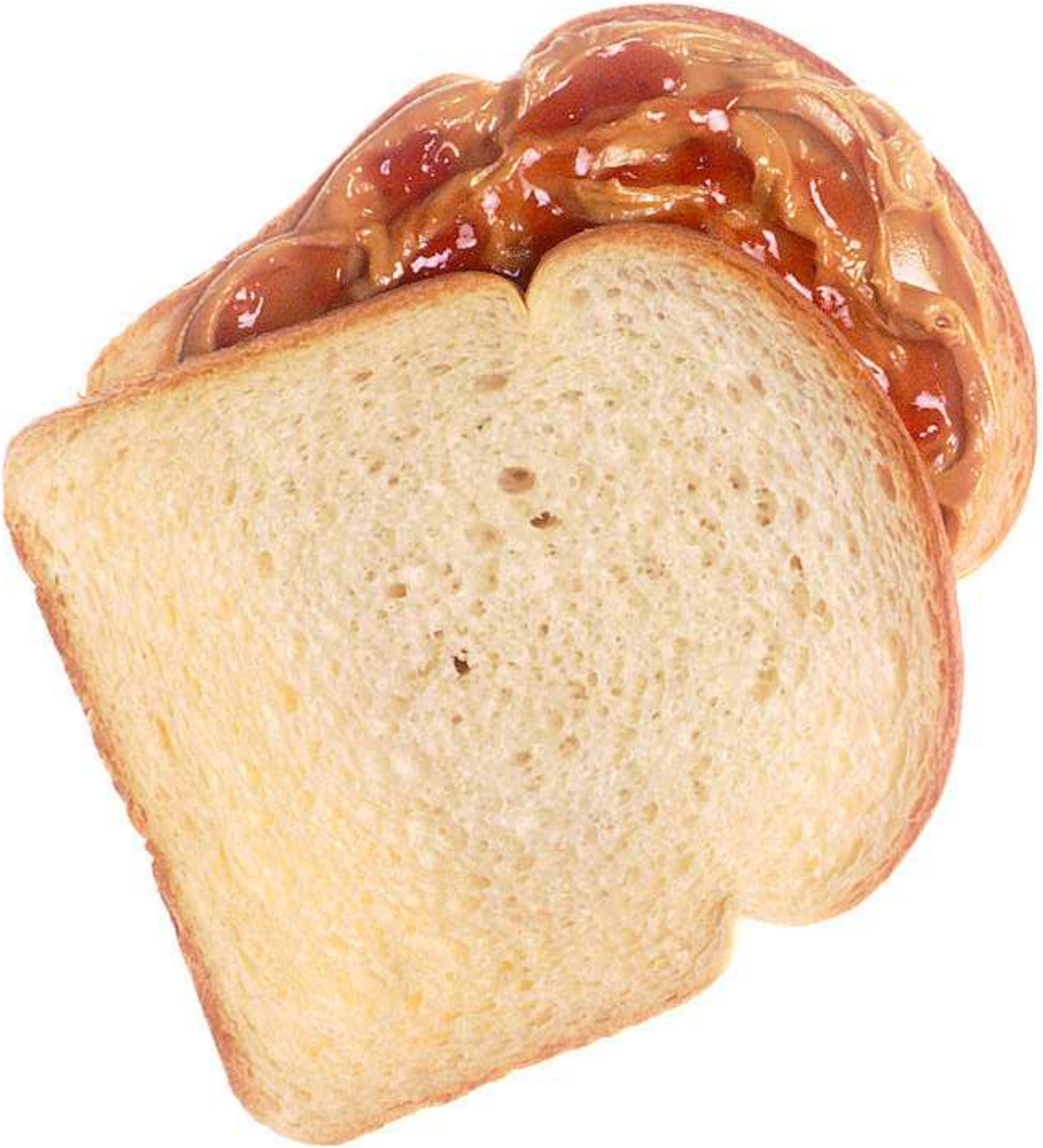
A LA LORRAINE

groseilles épépinées à la plume d'oie

DUTRIEZ

BAR-LE-DUC

FRANCE




Say what?
imgflip.com

Under-specified

What if we put the bread on the floor?

Imperative

Did we just use temporal coupling?

Mutable state

How will we know what's in the fridge?

Repetitive

Never heard of DRY?

```
let a = bread
get a from breadbox
...
spread b on a
```

Not abstract

How are we going to scale?

```
sandwich(:wheat,
         :peanut_butter,
         :jelly)
```

```
sandwich(:rye,
         :ham,
         :swiss)
```

*LTR

Purely functional peanut butter & jelly sandwich

(Extra credit: use static typing)


WHAT IS THIS...
"PROGRAMMING"?
imgflip.com

General purpose

Project failure

70%

Had project failure in previous 12 months

KPMG (New Zealand) - Dec 2010

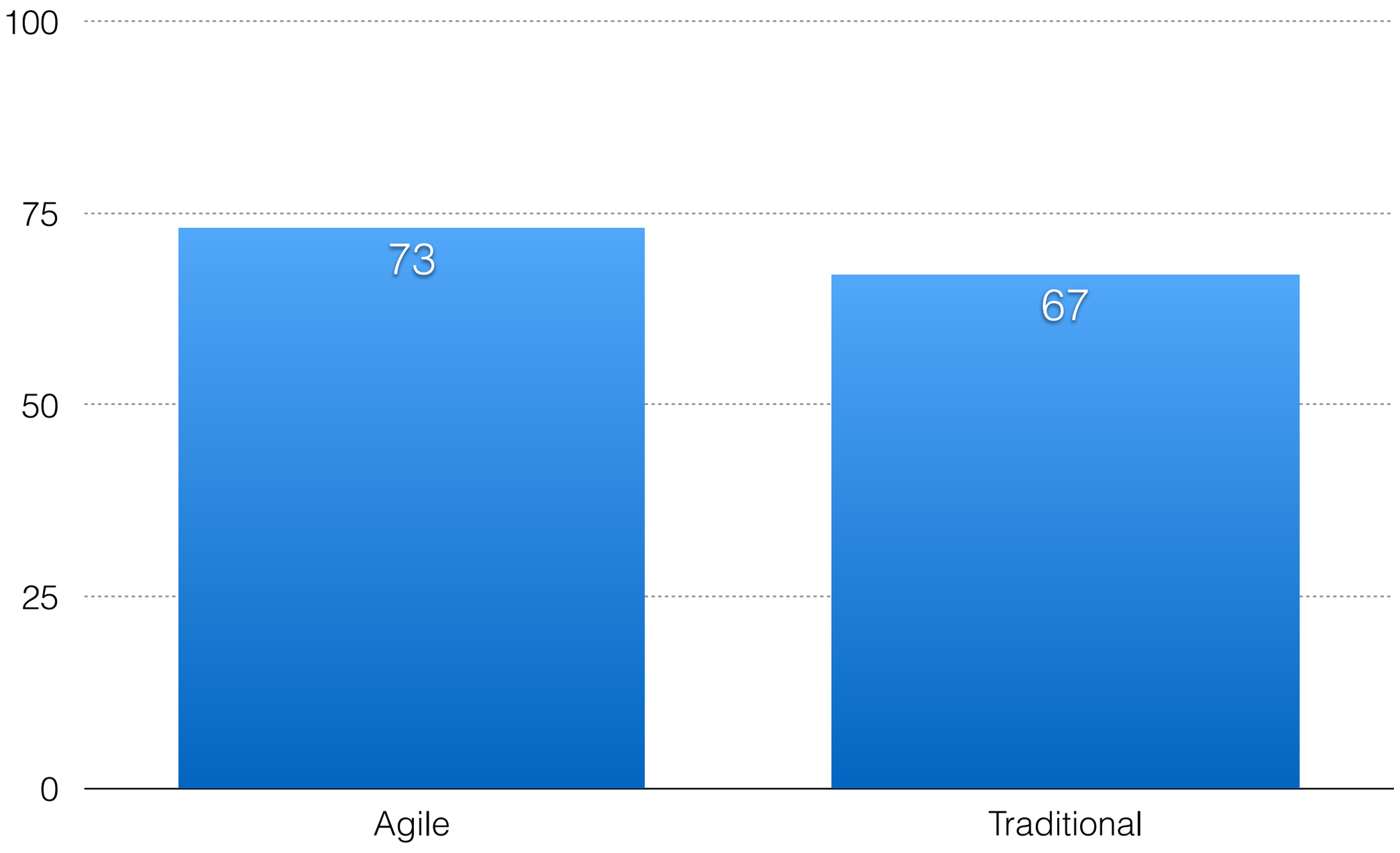
Project failure

17%

Failure could threaten company

McKinsey & Company in conjunction with the University of Oxford - 2012

Project success



Dr Dobbs Journal - Aug 2007, Oct 2011

We don't learn from failure

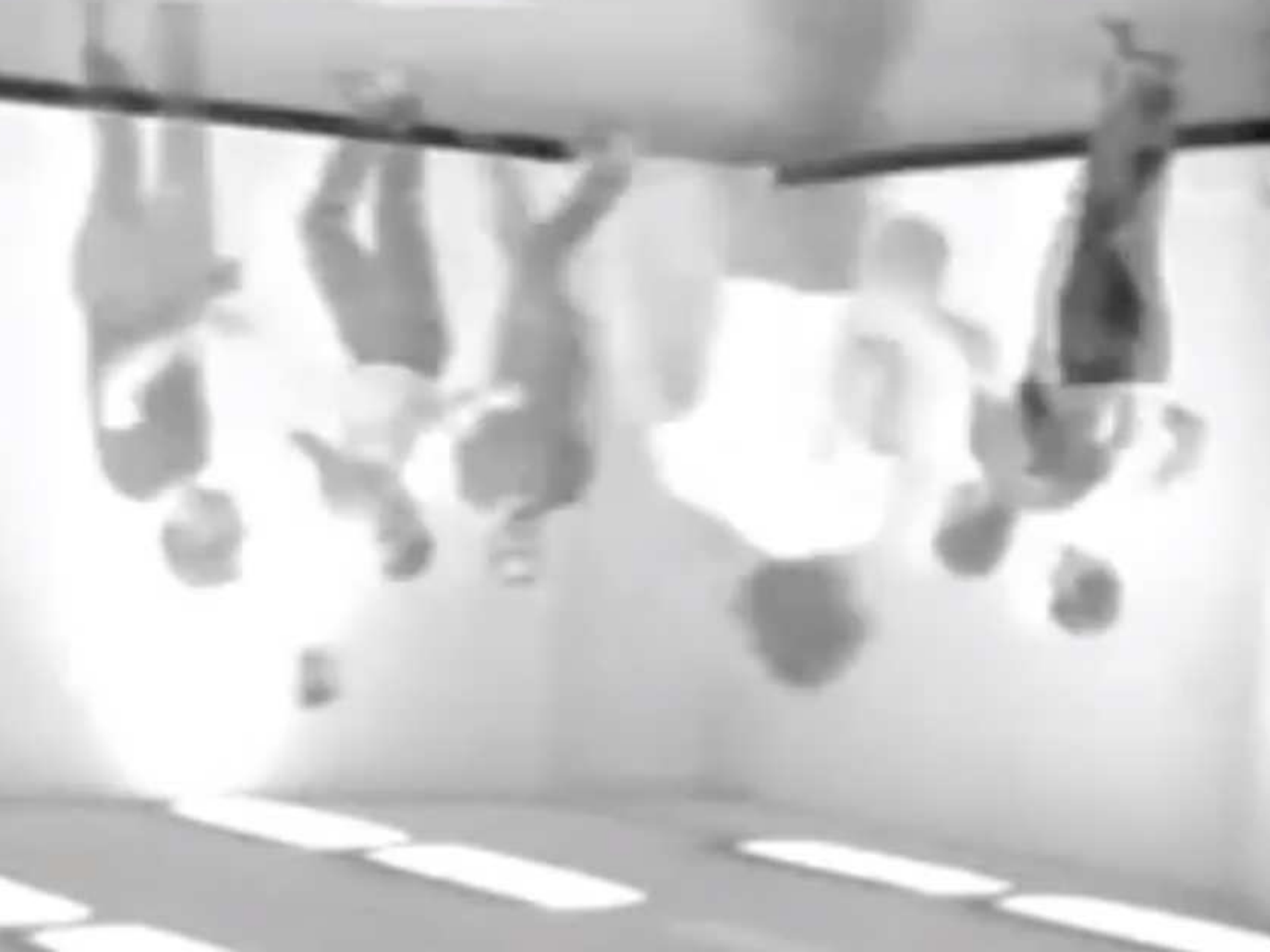
We learn from *other's* failure

Programming is a behavioral science

Sorry maths people

Perception

Is it reality?



Cognition

Is it reality?

3

8

3

8

3

8

3

8

3

8

3

8

if even then red

if red then even

Converse

if red then even

Converse

if ¬¬even then ¬¬red

Inverse

if ¬¬even then ¬¬red

Inverse

if ¬¬red then ¬¬even

Contrapositive

3

8

90%

People who gave incorrect response

Propositions as types


ONE DOES NOT SIMPLY
USE A CHAINSAW
HISTORY.COM
imgflip.com


But we're...
programmers!
imgflip.com

Statisticians

How to Keep Your Neighbours in Order

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Abstract

I present a datatype-generic treatment of recursive container types whose elements are guaranteed to be stored in increasing order, with the ordering invariant rolled out systematically. Intervals, lists and binary search trees are instances of the generic treatment. On the journey to this treatment, I report a variety of failed experiments and the transferable learning experiences they triggered. I demonstrate that a *total* element ordering is enough to deliver insertion and flattening algorithms, and show that (with care about the formulation of the types) the implementations remain as usual. Agda's *instance arguments* and *pattern synonyms* maximize the proof search done by the typechecker and minimize the appearance of proofs in program text, often eradicating them entirely. Generalizing to indexed recursive container types, invariants such as *size* and *balance* can be expressed in addition to *ordering*. By way of example, I

2. How to Hide the Truth

If we intend to enforce invariants, we shall need to mix a little bit of logic in with our types and a little bit of proof in with our programming. It is worth taking some trouble to set up our logical apparatus to maximize the effort we can get from the computer and to minimize the textual cost of proofs. We should prefer to encounter logic only when it is dangerously absent!

Our basic tools are the types representing falsity and truth by virtue of their number of inhabitants:

```
data 0 : Set where                    -- no constructors!
record 1 : Set where constructor ⟨⟩    -- no fields!
```

Dependent types allow us to compute sets from data. E.g., we can represent evidence for the truth of some Boolean expression which we might have tested.

Correct by construction

We can't use them well

Eight fallacies of programming

1 Same scale


rockwell.com


EVERGREEN
EVER GIVEN
PANAMA

klocs

2

Same risk


TOYOTA
DENSO
SAAS
BRIDGESTONE
Racing Development
TRD
TOYOTA GAZOO
Racing
KDDI

3 Same cost

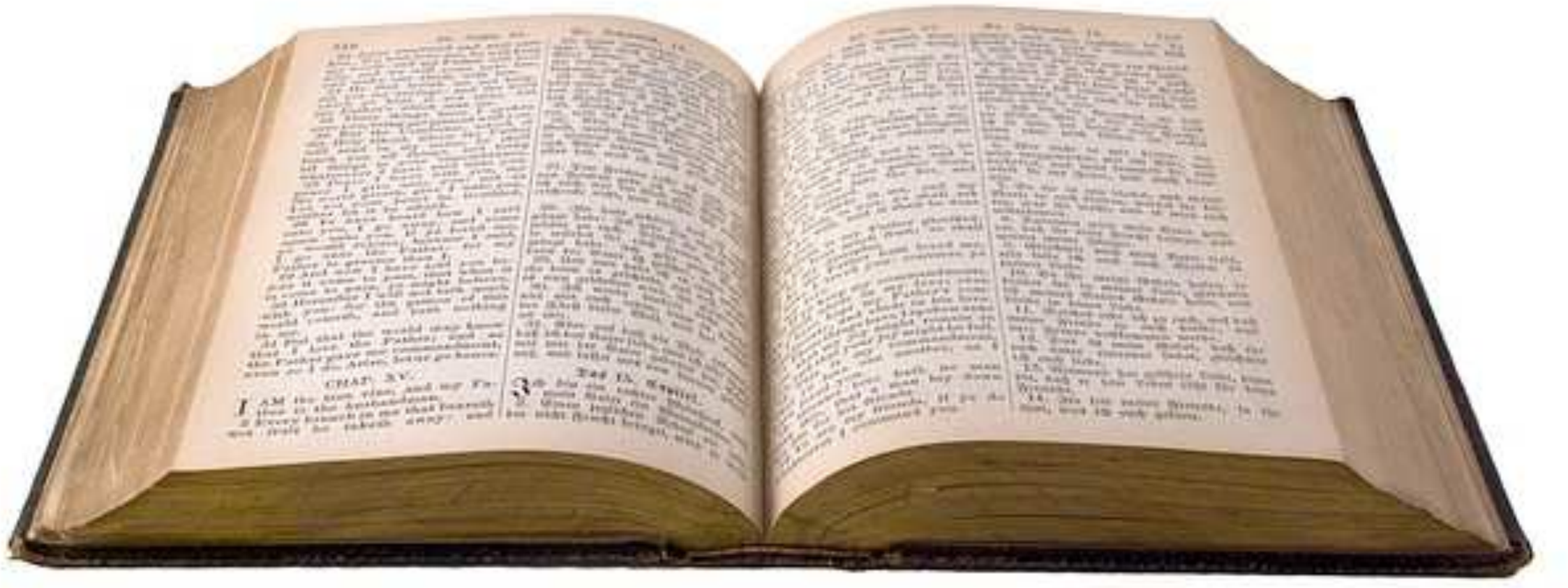
N * klocs = $

4

Same granularity

Everything is an object

Everything is a function



5

Same abstraction

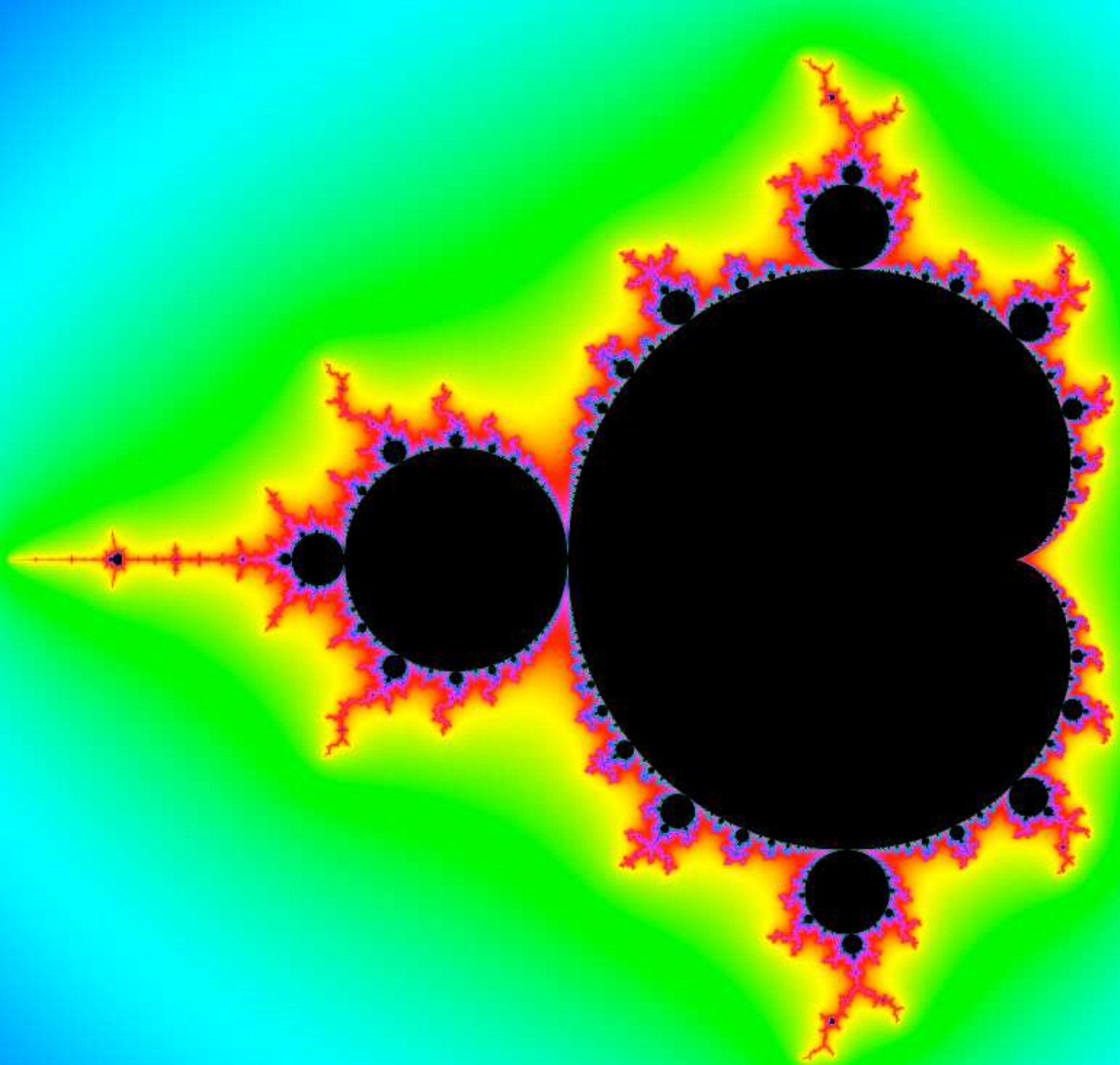
6

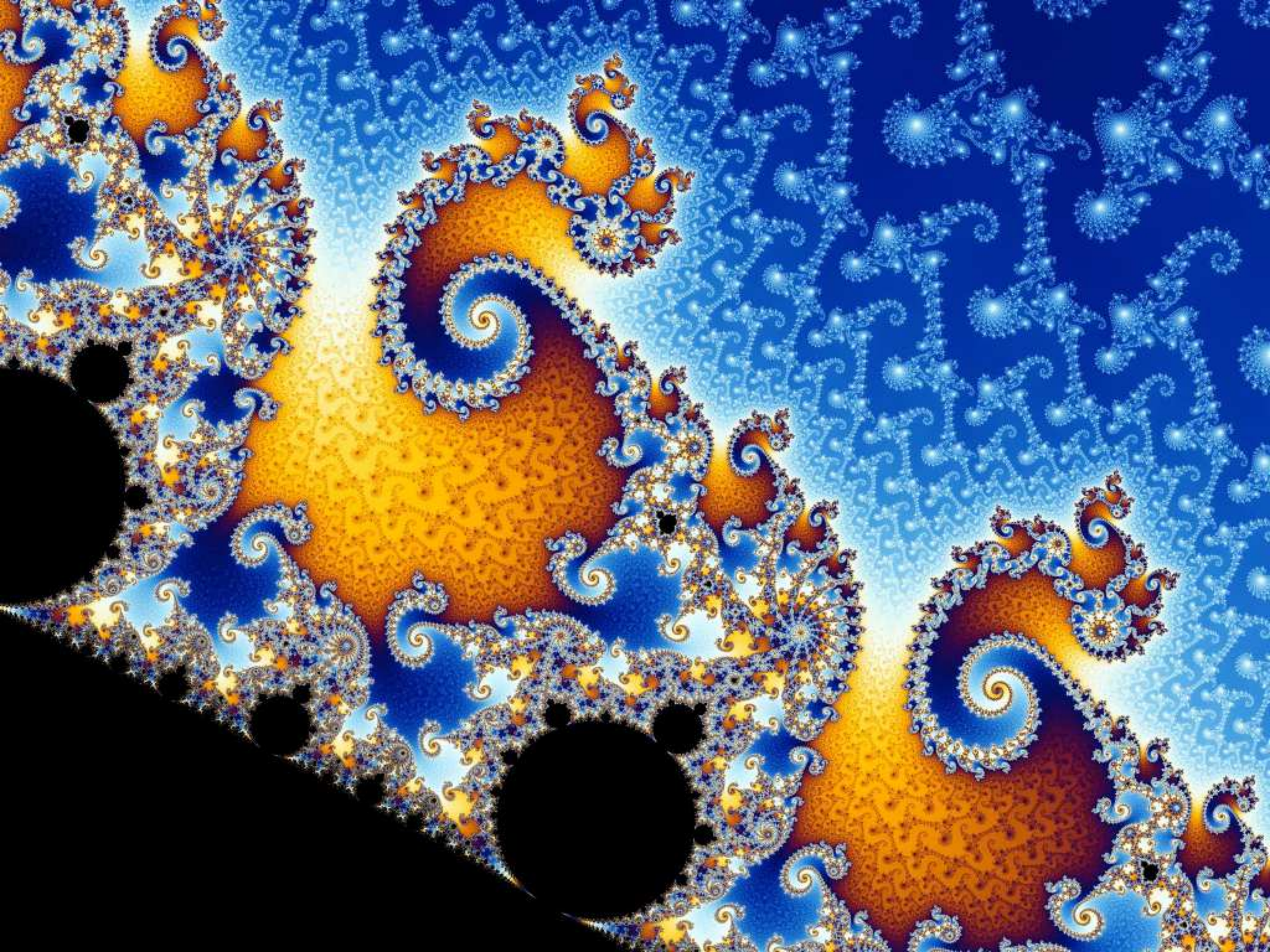
Same temporality

Compile at one point in time

7

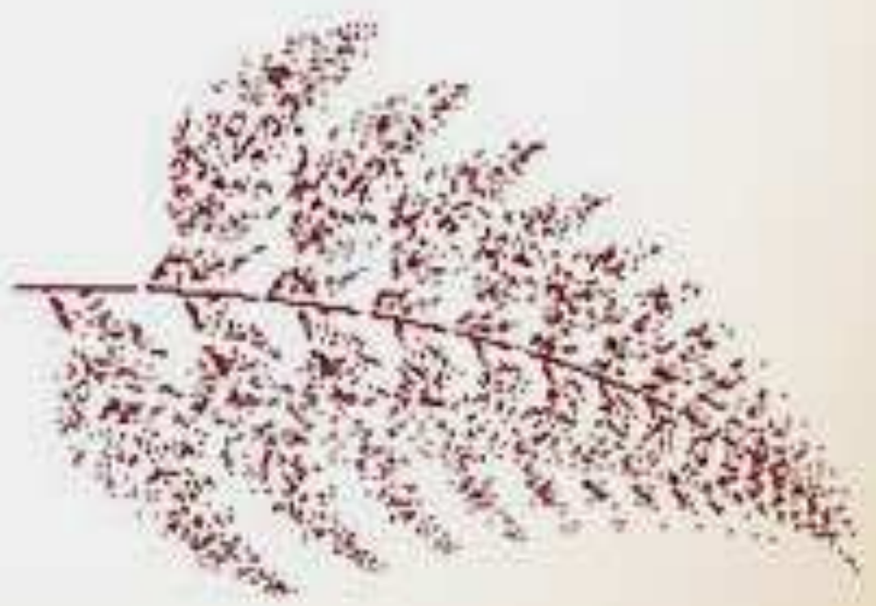
Same order

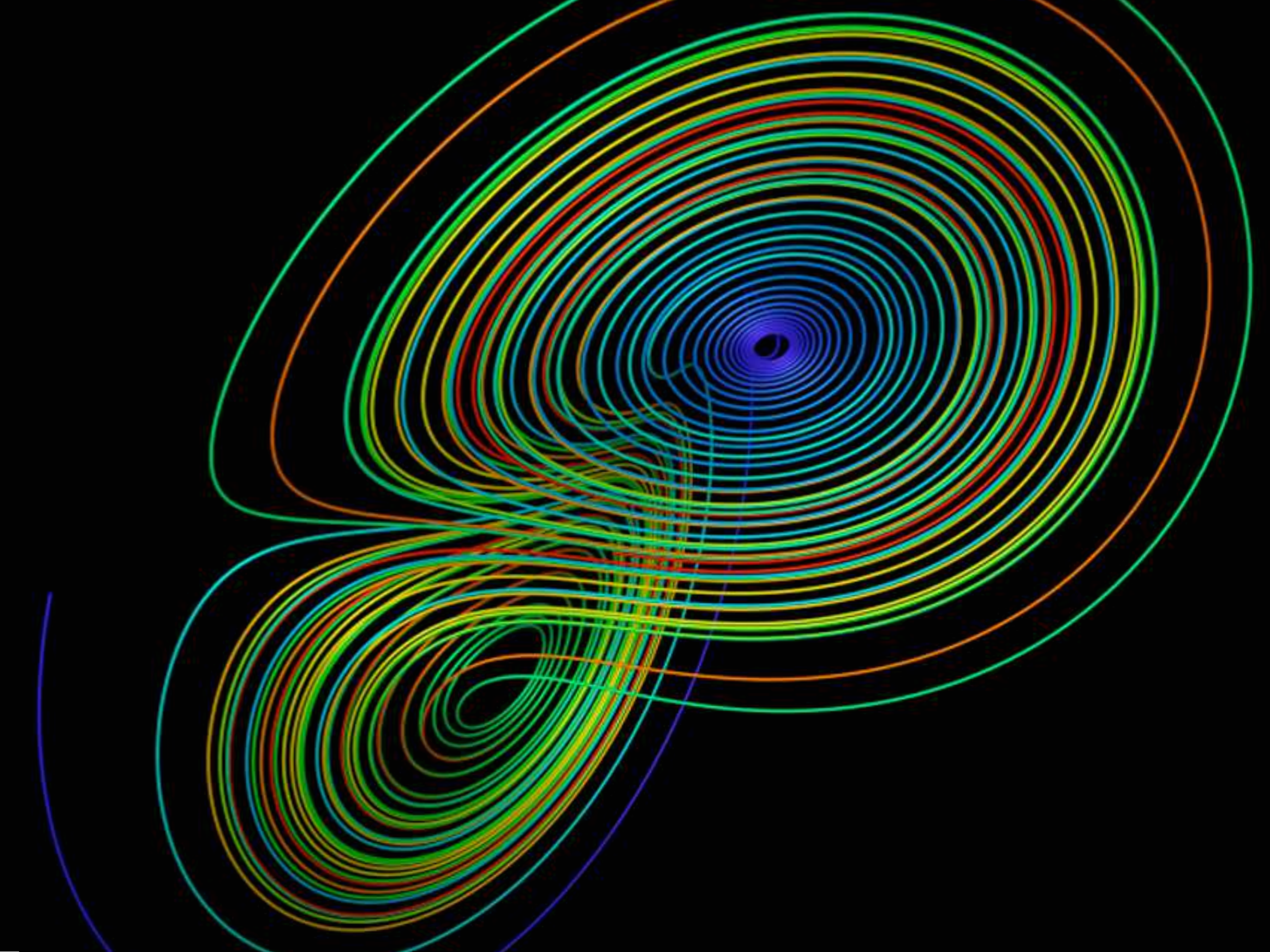




$$z \rightarrow z^2 + c$$

Michael Barnsley





They can harm more than help

8

General purpose

nil

nil is not null

```
$ nil.to_s
=> ""
```

```
$ nil.to_h
=> {}
```

```
$ nil.to_i
=> 0
```

```
$ nil.to_c
=> (0+0i)
```

```
id x = x
```

$$f(g(h(x)))$$

$$f(g(h(nil))) = nil$$

```
class NilClass
  def method_missing(*)
    self
  end
end
```

We usually don't need them

```
puts "Hello, Barcelona!"
```

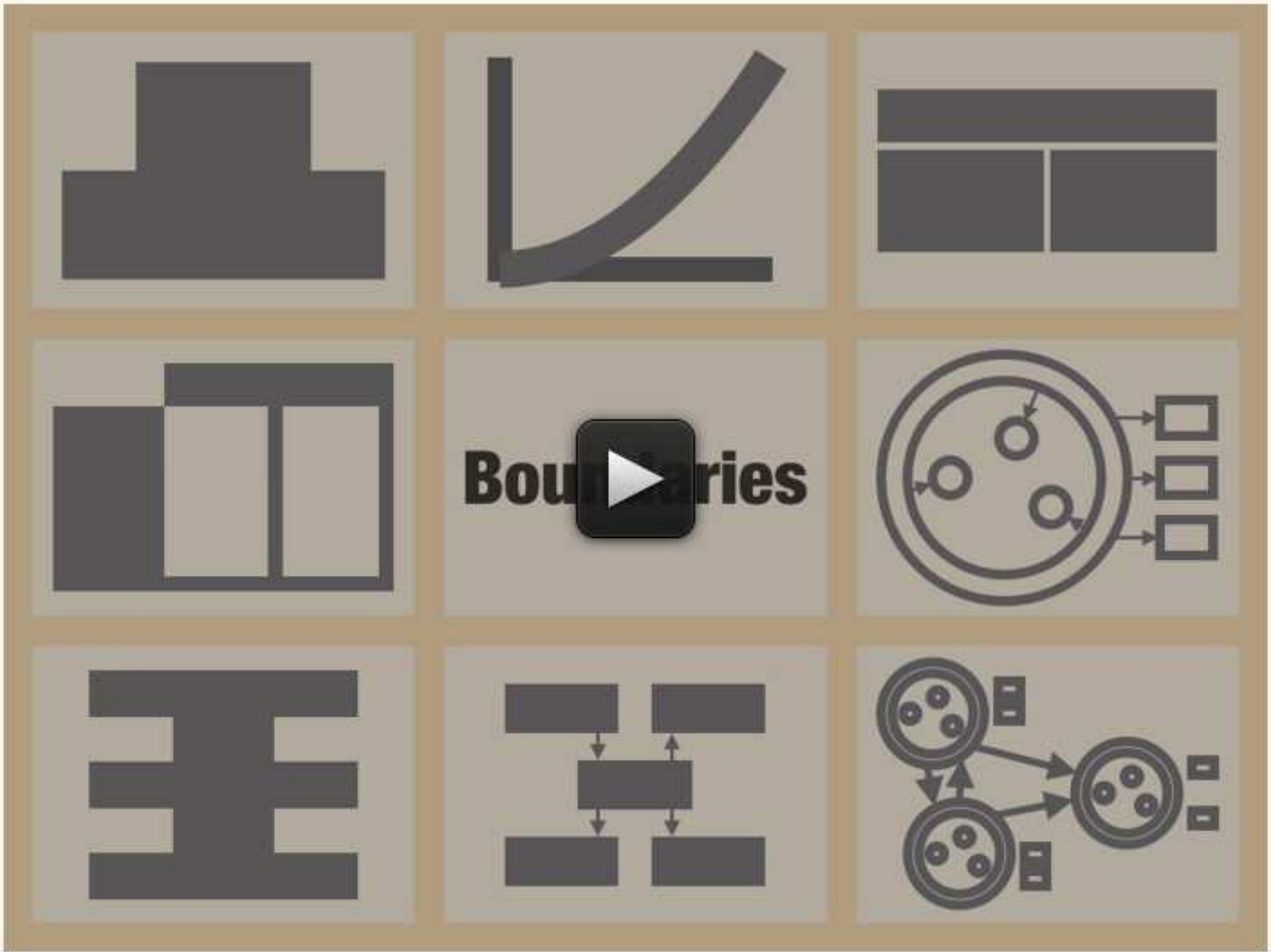
```ruby
module Kernel
  def puts(*args)
    # ...
  end
  module_function :puts
end
```

```
puts "Hello, Barcelona!"
```

```
fun puts(*args)
    # ...
end
```

BOUNDARIES

A talk by Gary Bernhardt from SCNA 2012



The Power of Interoperability: Why Objects Are Inevitable

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Abstract

Three years ago in this venue, Cook argued that the essence of objects is procedural data abstraction. His observation raises a natural question: if procedural data abstraction is the essence of objects, has it contributed to the empirical success of objects, and if so, how?

This essay attempts to answer that question. It begins by reviewing Cook's definition and then, following Kay, broadens the scope of inquiry to consider objects that abstract not just data, but higher-

index[2] are 6 and 3. SourceForge's most popular languages[3] are Java and C++; GitHub's are JavaScript and Ruby[4]. Furthermore, objects' influence is not limited to object-oriented languages; Cook [5] argues that Microsoft's Component Object Model (COM), which has a C language interface, is "one of the most pure object-oriented programming models yet defined." Academically, object-oriented programming is a primary focus of major conferences such as ECOOP and OOPSLA, and its pioneers Dahl, Nygaard, and Kay were honored with two Turing Awards.

```
fun add(a, b)
    a + b
end
```

```
fun add(a: int, b: int)
    a + b
end
```

```
load_int 0, r1
load_int 1, r2
add r1, r2, r3
#   ^a   ^b   ^c
store_int r3, 2
```

CLIs

JSON • YAML • XML/HTML parsers

HTTP parsers

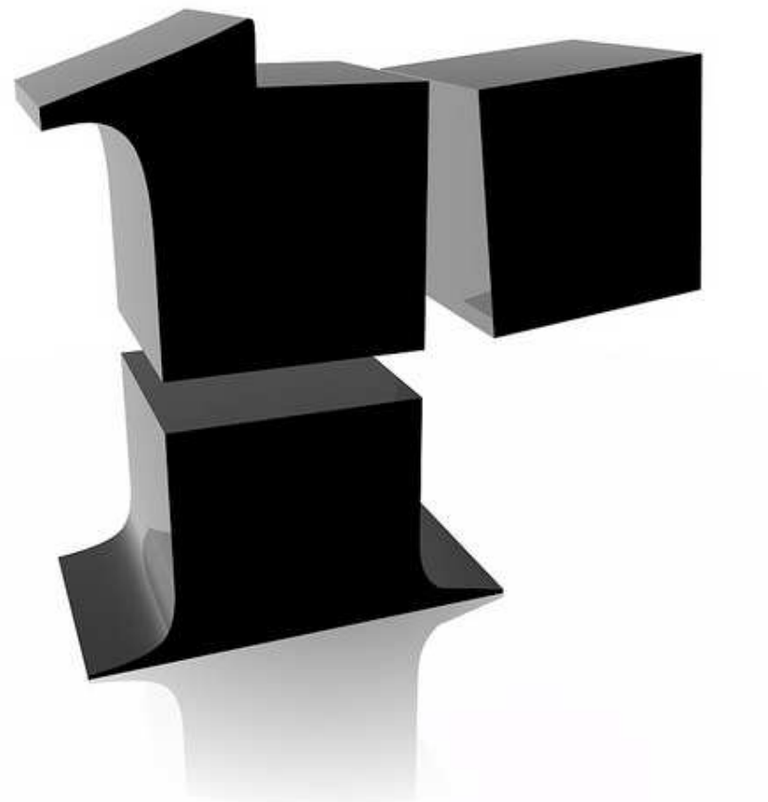
Garbage collectors

General purpose

```
grammar date do
  ...
end
```

$$a = q\ r$$

Try Rubinius



github.com/rubinius/rubinius

```
# Gemfile
platforms :mri do
  gem "ruby-debug"
end
```

```
$ bundle update
```

```
$ bundle exec puma
```

~2.1

1.8.7

enova®

Open source is not a spectator sport


ORACLE
ORACLE

Don't worry, have fun

"Don't worry about people stealing your ideas..."

"If your ideas are any good, you'll have to ram them down people's throats.

–Howard H. Aiken

"Sometimes the questions are complicated and the answers are simple"

–Dr. Seuss

"You never change things by fighting the existing reality...

"To change something, build a new model that makes the existing model obsolete."

–Buckminster Fuller

"No [corporation] can stop an idea whose time has come.

–Victor Hugo

"Complain about the way other people make software by making software."

–Andre Torrez

@brixen

Thank you!

References

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Credits

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