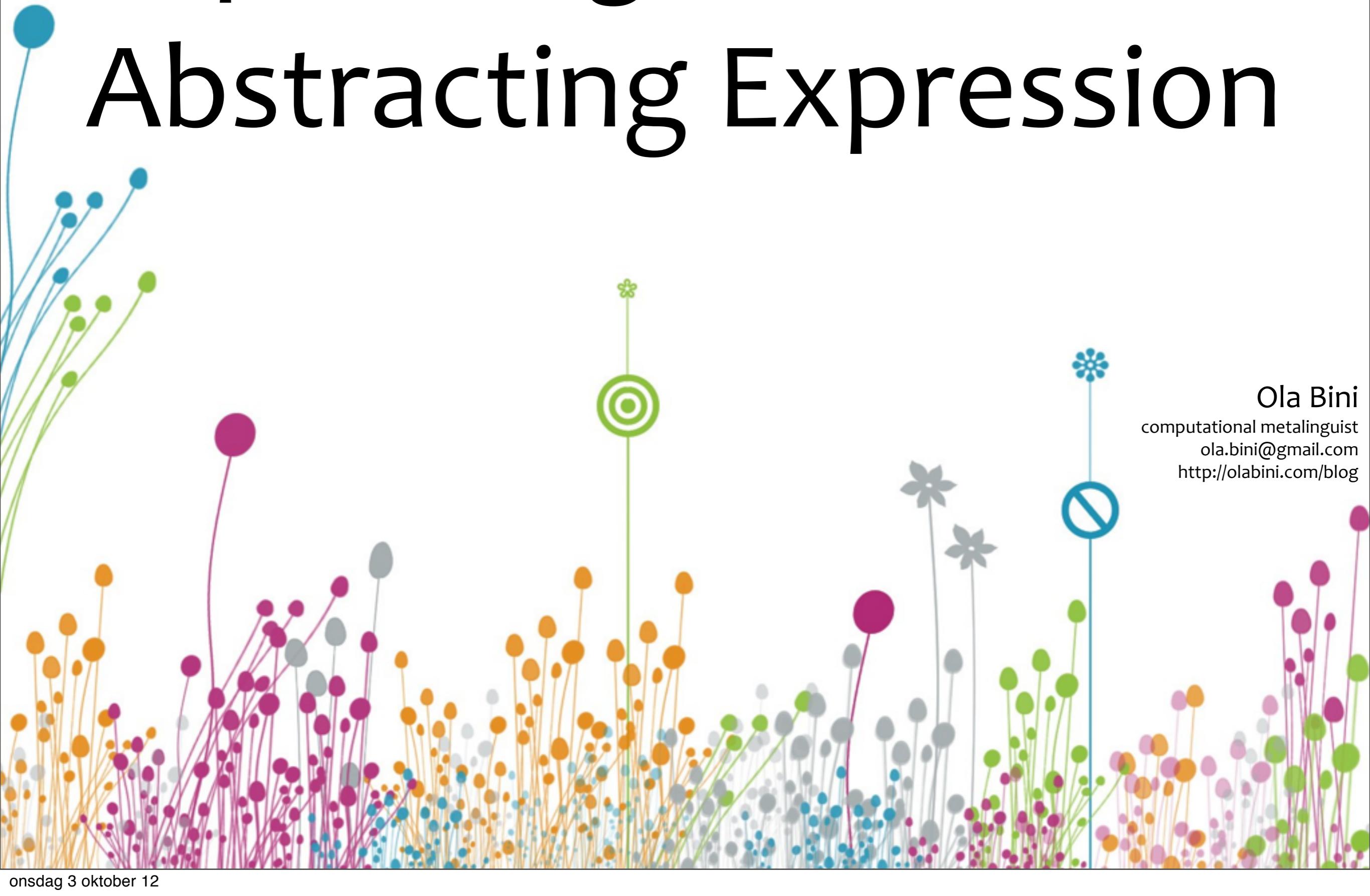


Expressing Abstraction

Abstracting Expression



Ola Bini
computational metalinguist
ola.bini@gmail.com
<http://olabini.com/blog>

Why are new languages still being created?

Is it worth choosing languages strategically?

Does language actually matter?



ex·pres'sive·ness



A language construct is expressive if it enables you to write (and use) an API that can't be written (and used) without the construct



Any sufficiently complicated C or Fortran program contains an ad hoc, informally-specified, bug-ridden, slow implementation of half of Common Lisp.



Beware of the Turing tar-pit
in which everything is
possible but nothing of
interest is easy

The Blub Paradox

Expressiveness?

Aspects of Expressiveness

Aspects of Expressiveness

Regularity

Readability

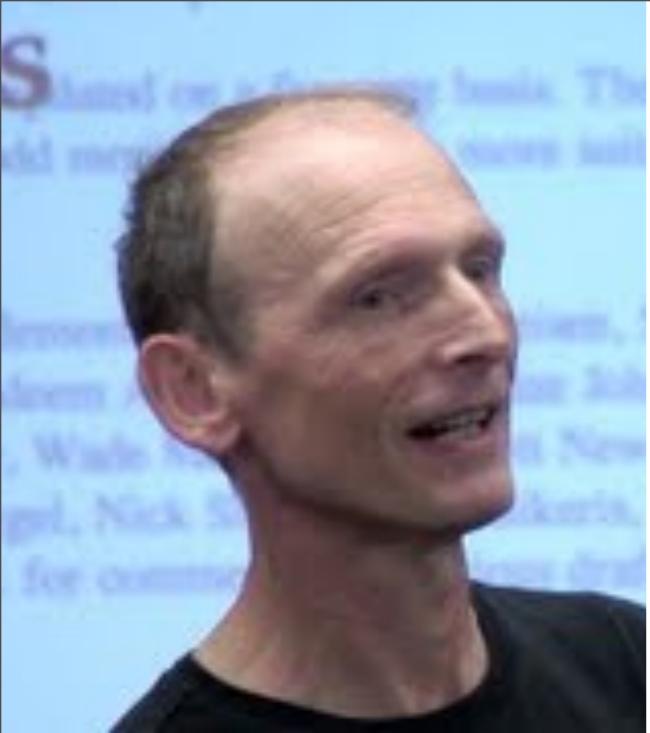
Learnability

Essence vs Ceremony

Precision vs Conciseness

Expressiveness
over
Performance

Theoretical Expressiveness



More expressive means that the translation of a program with occurrences of one of the constructs C to the smaller language require a global reorganization of the entire program

Practical Expressiveness



ab·strac·tion

Abstraction?

Types of Abstraction

Types of Abstraction

Abstracting Objects

Abstracting Classes of Objects

Abstracting Functionality

Abstracting Structure (of data)

Abstracting Structure (of code)

Abstracting Relationship

Abstracting Paradigm

Elaboration

Macros

```
#define max(A, B) ((A) > (B) ? (A) : (B))
```

```
(defmacro max [a b]
  `(let [left# ~a
        right# ~b]
    (if (> left# right#) left# right#))))
```

```
template<class T> T min (T i, T j)
{
    return ((i < j) ? i : j)
}
```

Modularity

Static typing

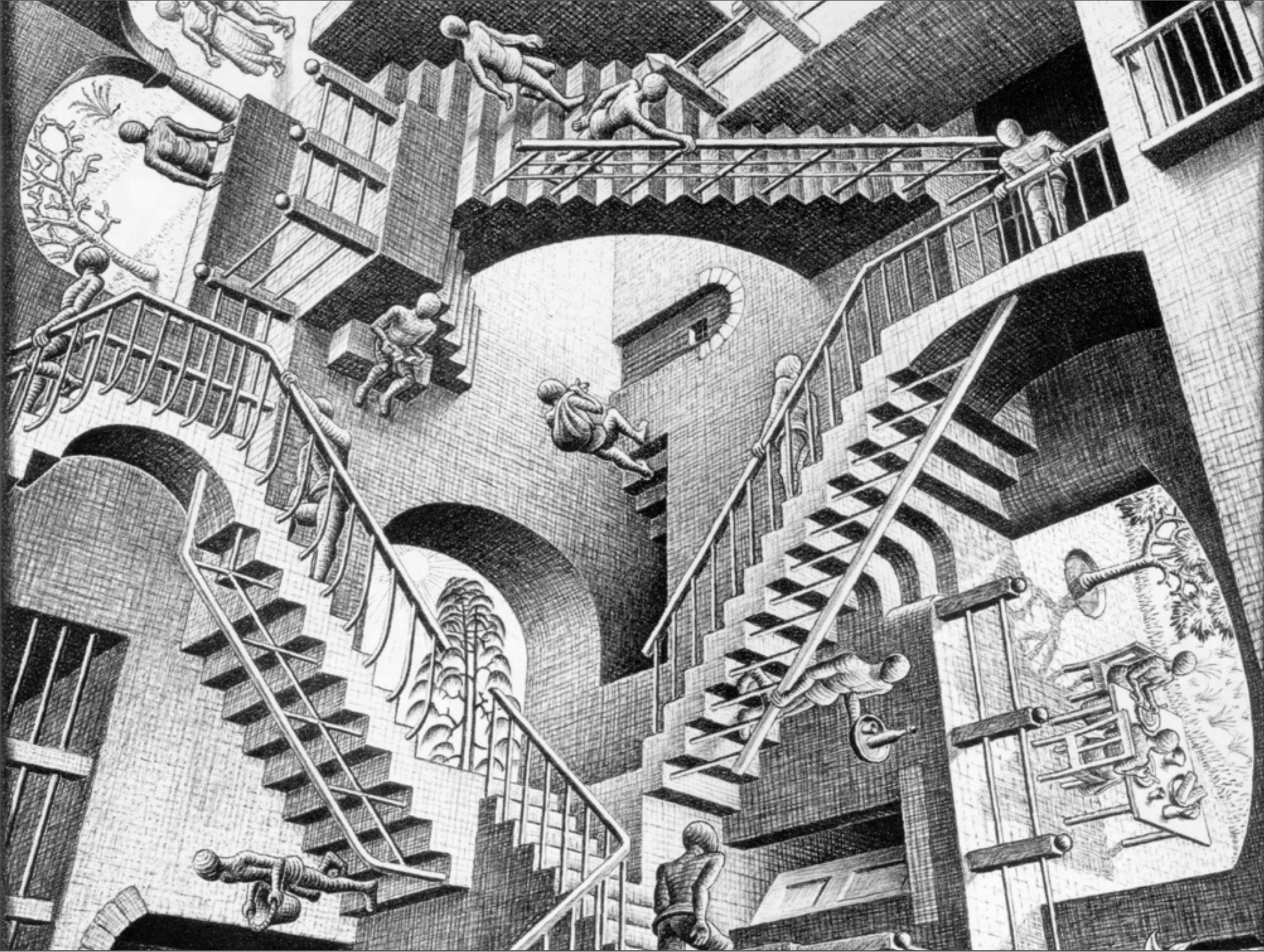
Generics

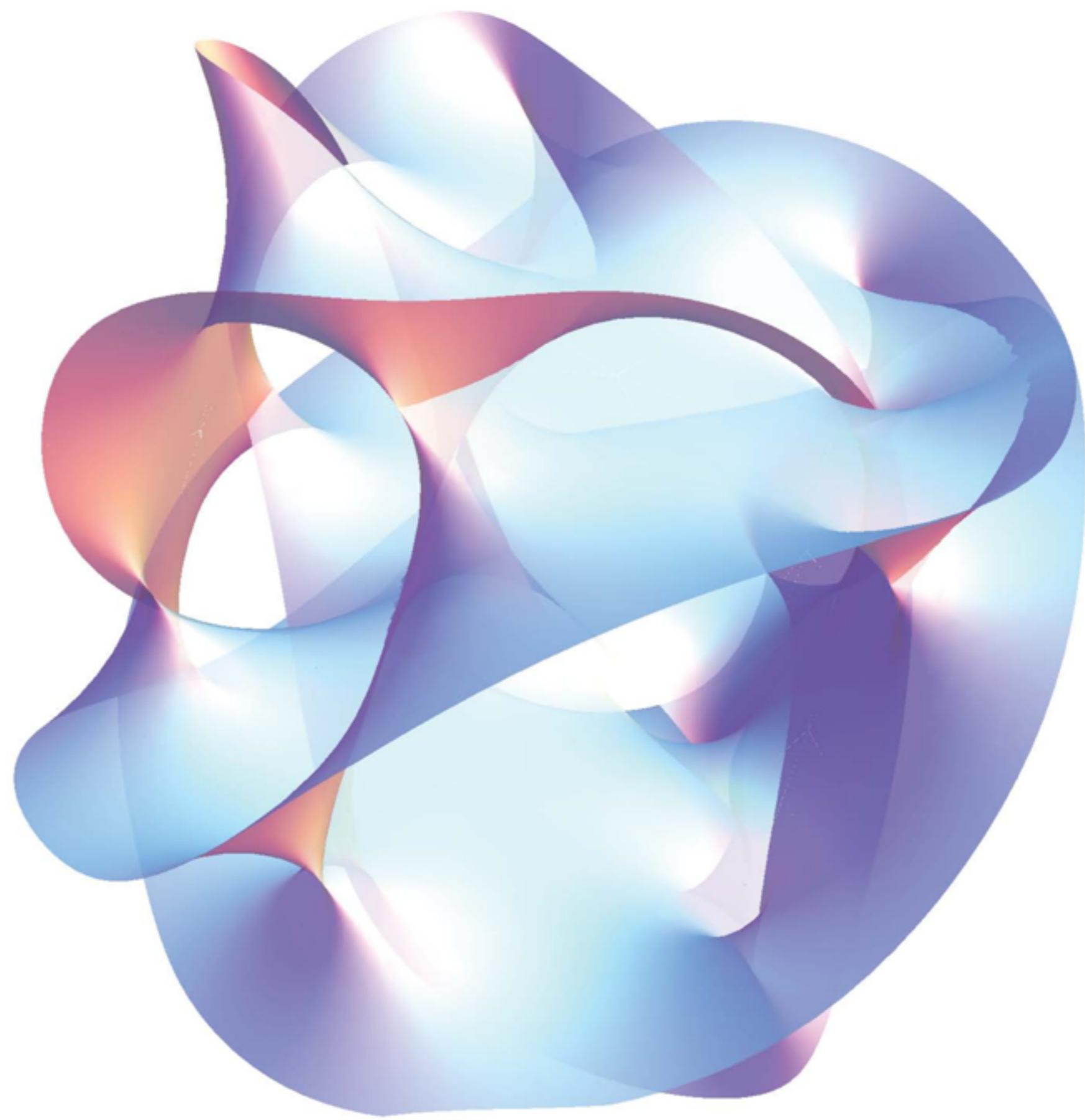
Type Classes





All non-trivial abstractions, to some degree, are leaky





Abstractions may be formed by
reducing the information content
of a concept, to retain information
only relevant for a specific
purpose

Thus **effective** communication about things in the abstract requires an **intuitive or common experience** between the communicator and the communication recipient

Referents

Generic

VS

Specific

**Abstractions
remove duplication**

Abstraction



lin·guis·tics

Some Interesting Features of Natural Languages

*Thoughts come like
a plague to the head*

*the wind light
as a thief*

*And like some
ragged stranger*

I'm happy as a lark

*Where the viaduct
looms, like a bird of
doom*

I straight as an arrow

*We are all shadows
on the wall of time.*

*She cut him down
with her words.*

*Laughter is the
music of the soul.*

Time, you thief

*Words are the weapons
with which we wound.*

My life is a dream

*Information is the oxygen
of the modern age*

*What a cobra is to a mongoose,
a cat is to a dog.*

*a rose by any other name
would smell as sweet*

Life is like a box of chocolates.

History is a vast early warning system.

I feel like a fish out of water.

a variety of different items

an added bonus

future plans

unconfirmed rumor

I'm going down south.

Qu'est-ce que c'est?

awful

skyline

broadcast

Your answer is expected.

Reply!

Your reply would be appreciated.

I am expecting a reply from you.

I hope you will write an answer.

*Despite writing so many letters,
I still have had no reply.*

Someone has a problem.

Someone has a medical issue.

Anders Svensson has a medical issue.

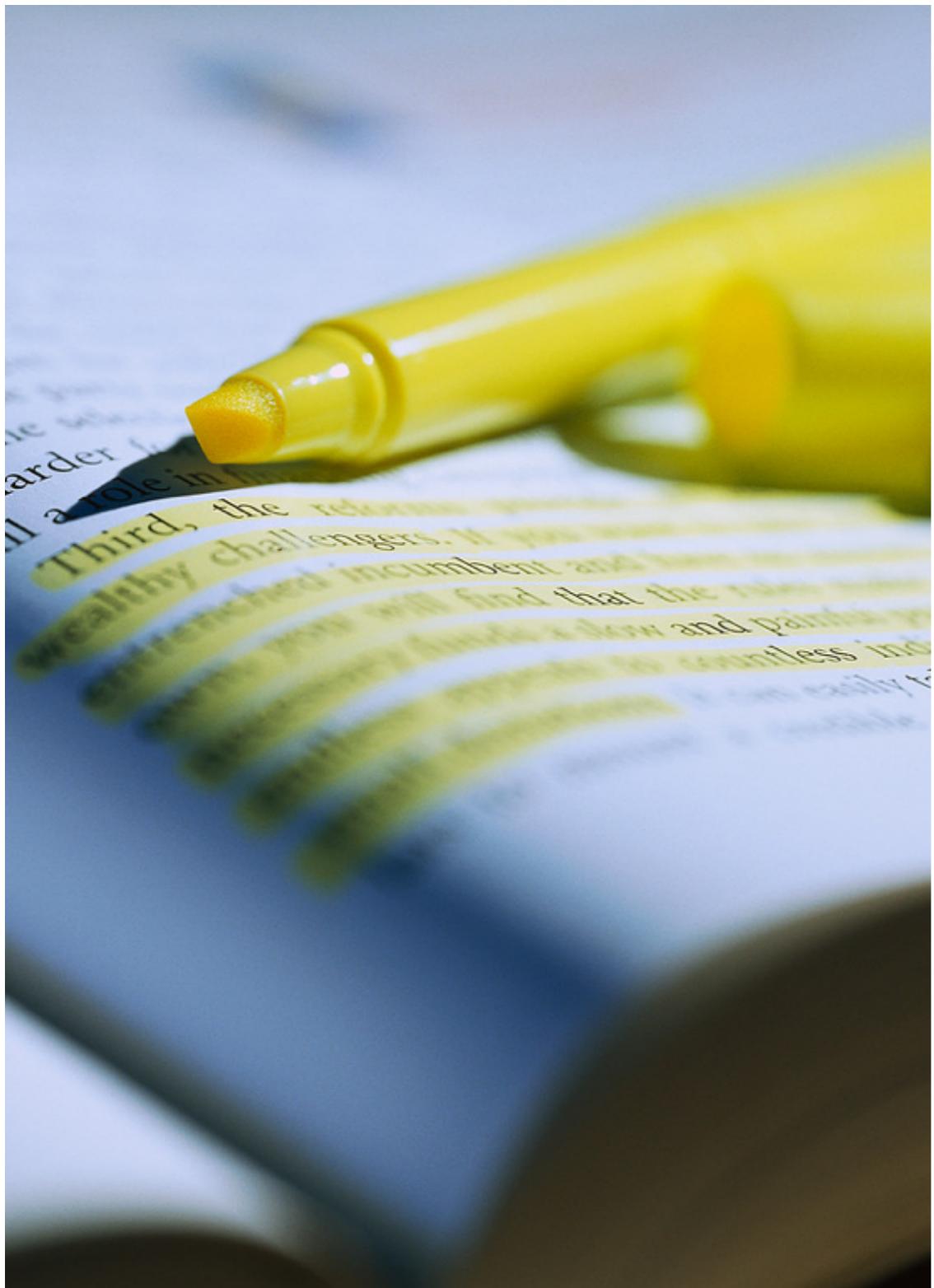
Anders Svensson has a broken right leg.

Anders Svensson has a compound fracture in his right leg.

Anders Svensson has a compound fracture in his right leg, caused by a bad fall.

Syntax Semantics Pragmatics

Communication



syn-tax



```
Foo& Foo::operator+=(const Foo &rhs);
```

Built in

vs

User defined

Optimizing

For writing

For reading

For reading by novice

For reading by expert

Succinctness

Visual distinctiveness

Visual space taken up

Historical decisions
vs
Starting from scratch

Impact

**Does syntax
matter?**

Intent



pro·duc·tiv·i·ty

Productivity?

Impact

START

HOPP

V

V

V

Design principles

One paradigm

Minimal core/set of concepts

Simplicity

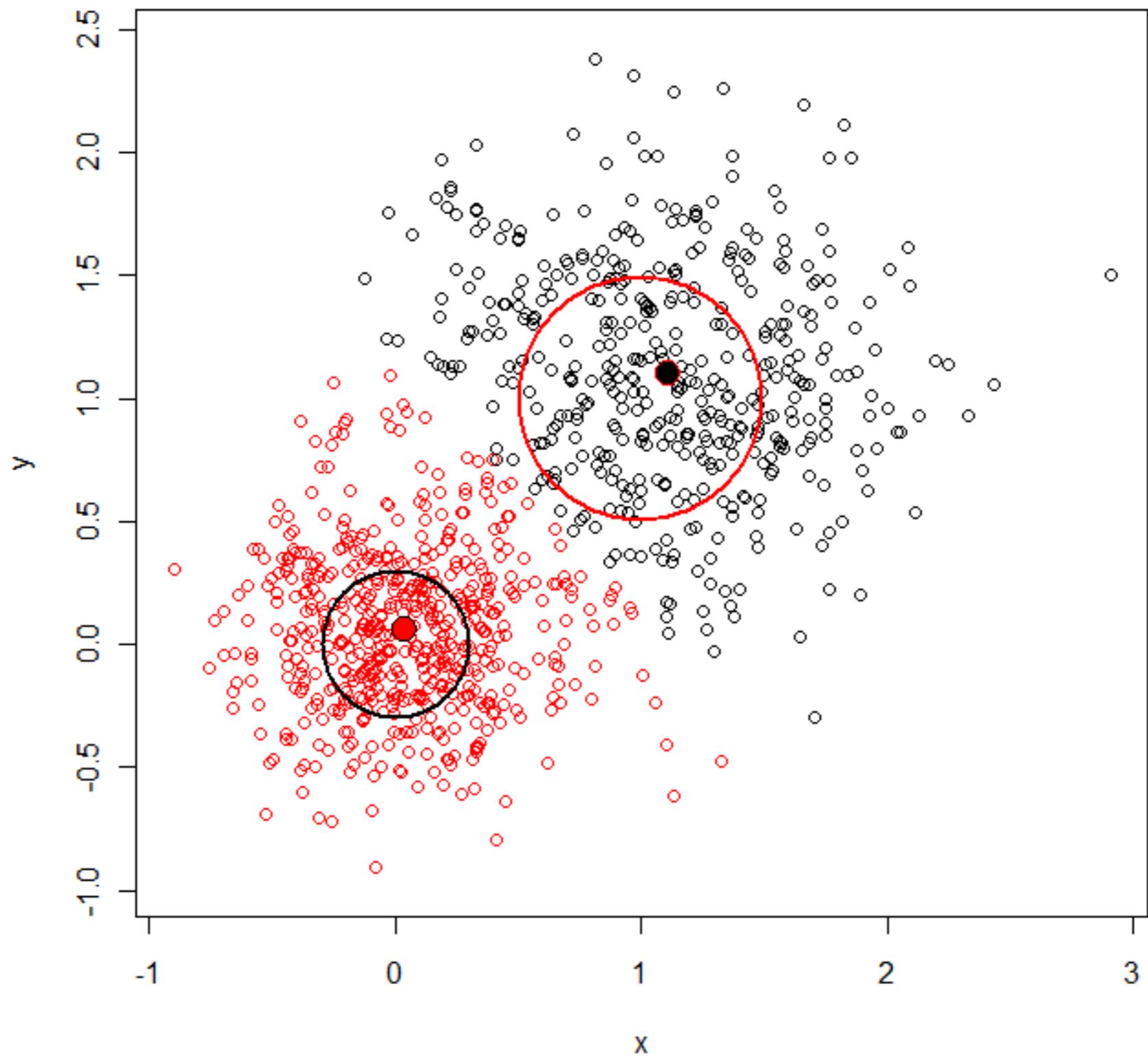
First class

Flexibility

Skinnable type system

How far away are we from a
truly expressive language?

Expressiveness is not
always better



Expressiveness and
abstractions are relative

You want a
meta-expressive language

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Questions?

OLA BINI

ThoughtWorks®

<http://olabini.com>
olabini@thoughtworks.com

@olabini