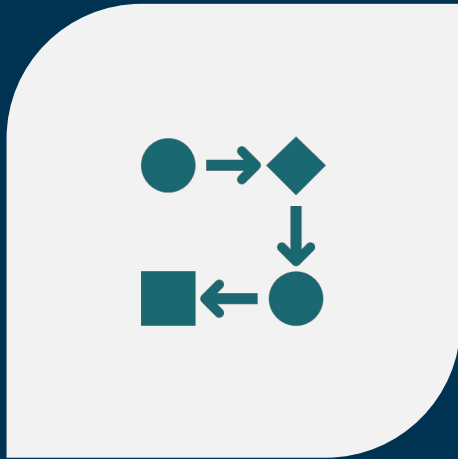




JavaScript

Functional Programming

What is Functional Programming?



PROGRAMS ARE
CONSTRUCTED BY APPLYING
AND COMPOSING FUNCTIONS



DECLARATIVE – PROGRAMS
TELL THE COMPUTER WHAT TO
DO, NOT HOW TO DO IT

Application and Composition

- ❖ $f(x)$ means that a function f is applied to a value x
- ❖ $f(g(x))$ means that a function f is composed with a function g , applied to a value x
- ❖ At a surface level, this means functional programs are made of chains of function calls, either on plain values or the results of other function calls.

Declarative vs. Imperative



DECLARATIVE: A PROGRAM IS A TREE
OF *EXPRESSIONS* THAT EACH RETURN
A VALUE



IMPERATIVE: A PROGRAM IS A
SEQUENCE OF *STATEMENTS* THAT
CHANGE THE STATE OF THE PROGRAM

Declarative vs. imperative

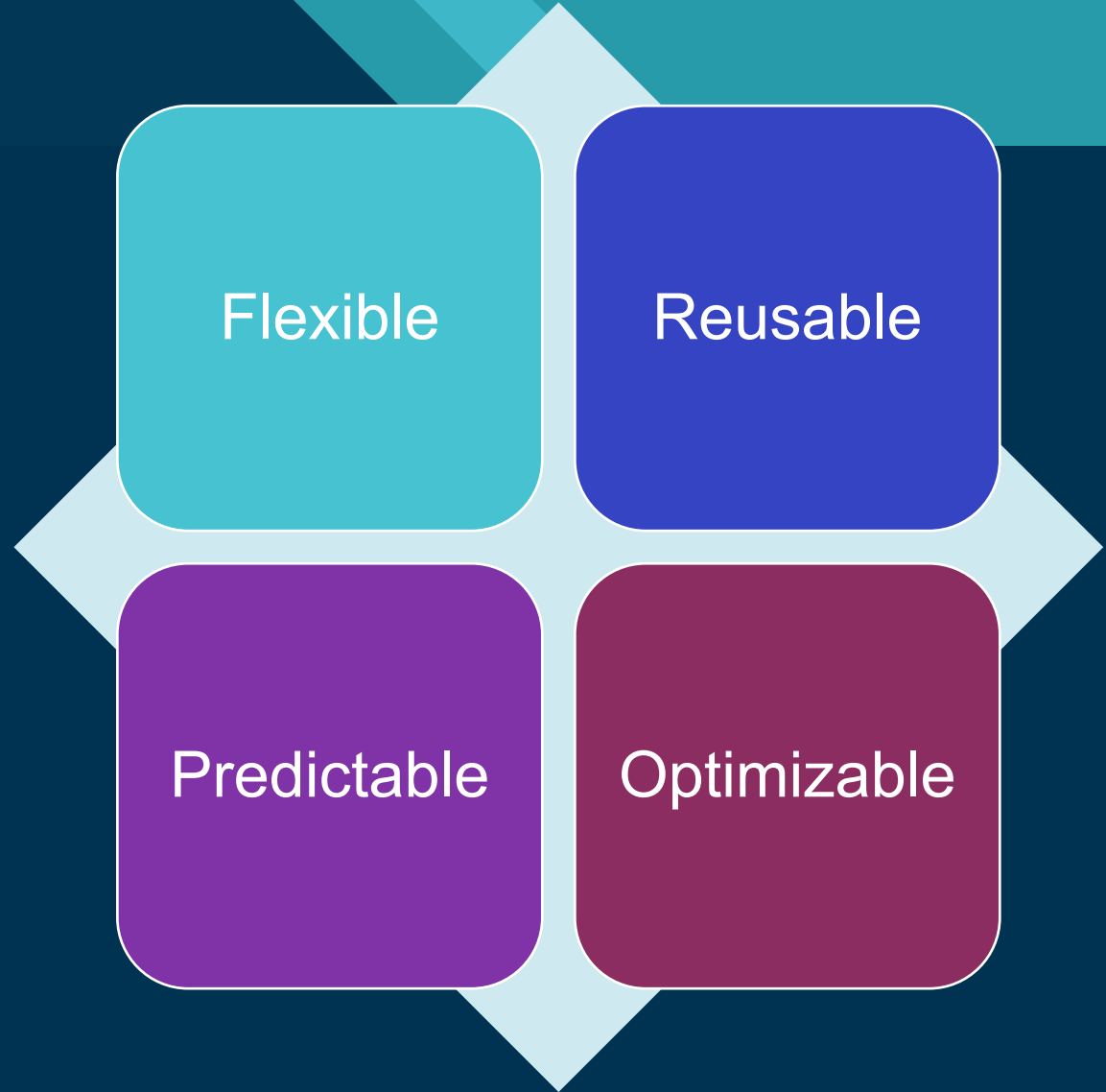
Imperative

```
let x;  
if (someCondition()) {  
  x = 10;  
} else {  
  x = 20;  
}
```

Declarative

```
const x = someCondition() ? 10 : 20;
```

Functional Benefits



Functional Detriments

Unintuitive

Syntactically
Dense

Too Many
Abstractions

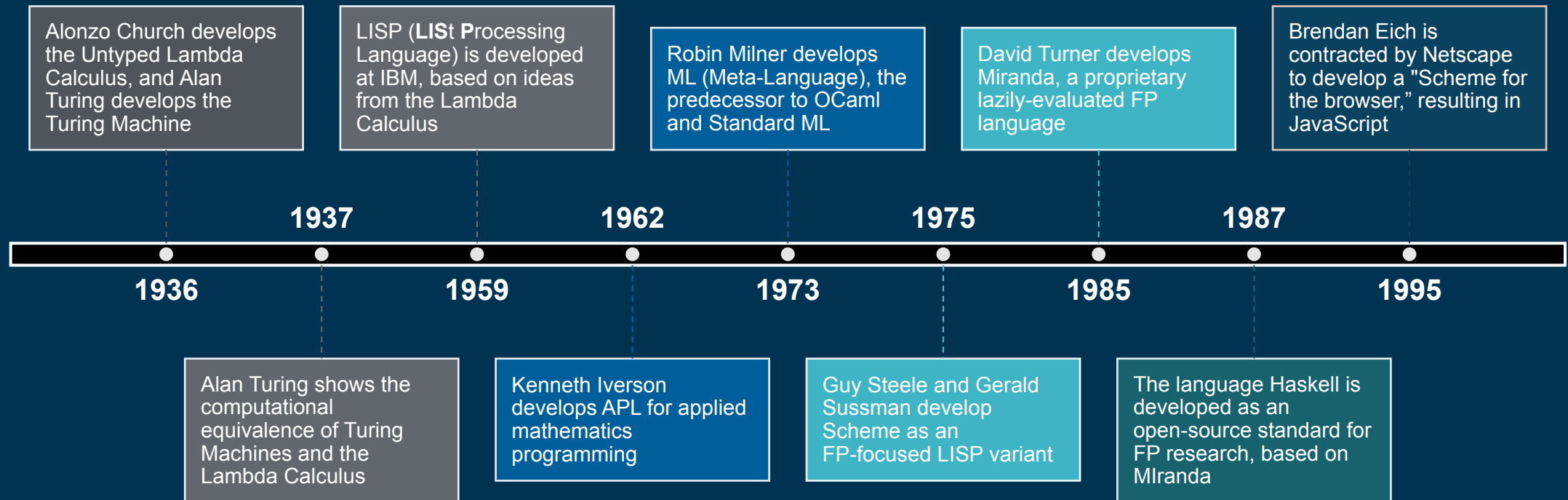
Math 😞

Synthesis

- ❖ FP is just one tool among many.
- ❖ Most modern languages incorporate FP alongside other paradigms, like OOP and imperative programming.
- ❖ Use FP when it makes problems easier to express and understand – which is very much a subjective decision!

Functional Roots

FP: Early History



Important Early Ideas



Turing Machine / Lambda Calculus Equivalence



Programs as Data, Data as Programs

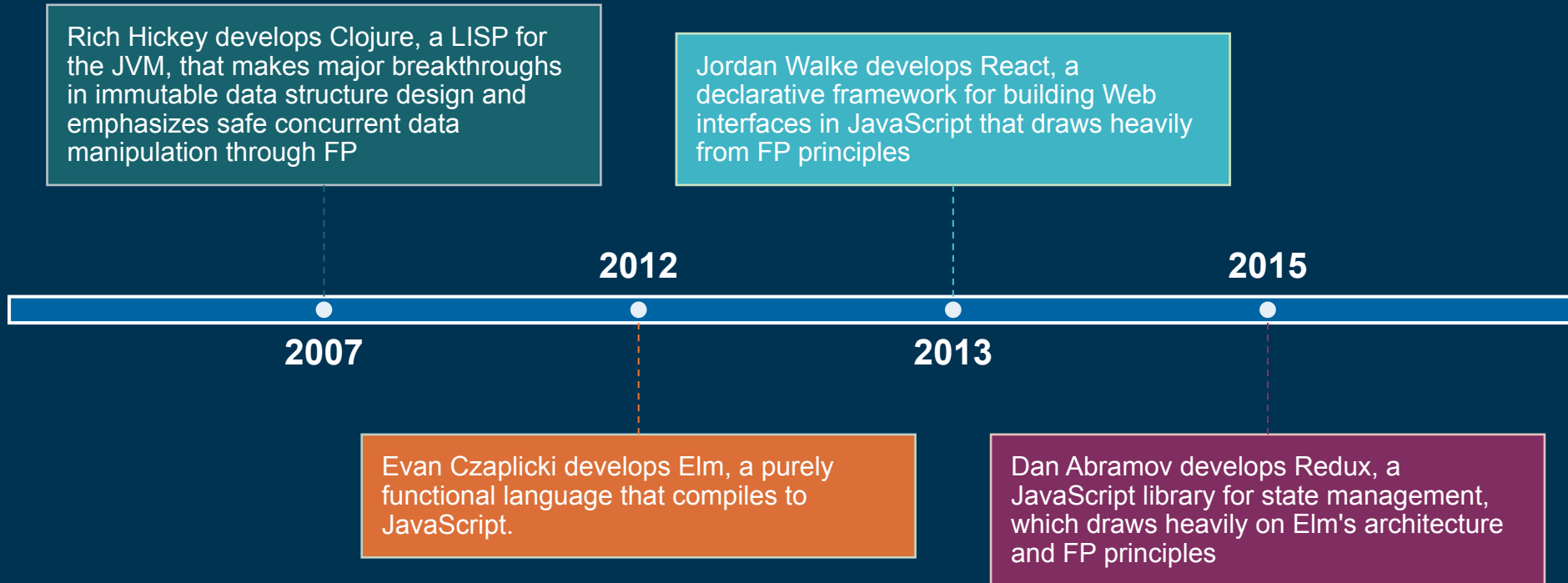


Recursion and Lazy Evaluation



Type Inference

FP in JS: Modern History



Important Modern Ideas



Immutable data is concurrency-safe



Immutable data structures can be copied and compared efficiently



FP reduces concurrency confusion



FP allows for high-level abstraction of complicated ideas

The Elements of FP



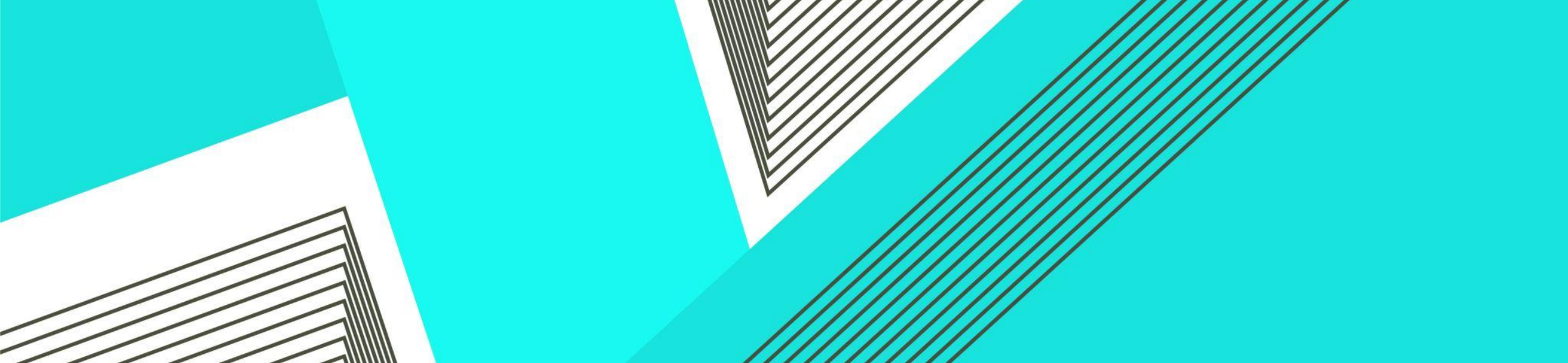
Immutability

Data... Data Never Changes



Referential Transparency

A name is its definition



Pure Functions

Avoiding Side Effects



Higher-order Functions

Currying and Callbacks