Practical ReasonML

codecentric

@MarcoEmrich

HELLO
WORLD

BS

BUCKLESCRIPT

REASONML / OCAML

↓

↓

JAVASCRIPT

REASONML / OCAML

↓

BSB-NATIVE

↓

NATIVE / BACKEND / MICRO KERNEL / REACT NATIVE

TRANSPILE TO JS

BLOOMBERG

- 176 Offices
- 19000 Employees

HELLO WORLD

```
npm -g i bs-plattform
bsb -init sample -theme basic-reason
```

DEMO

COMPUTER OR HUMAN?

stolen from Sean Grove

WRITTEN BY A MACHINE? (1/2)

```
var Int_map = require("./int_map.js");
function test() {
  var m = /* Empty */0;
  for(var i = 0; i <= 1000000; ++i) {
    m = add(i, i, m);
  }
  for(var j = 0; j <= 1000000; ++j) {
    find(j, m);
  }
  return /* () */0;
}
```

WRITTEN BY A MACHINE? (2/2)

```
var Pervasives = require("bs-plattform/lib/js/pervasives");
var Http       = require("http");

var hostname = "127.0.0.1";

function create_server(http) {
  var server = http.createServer(function (_, resp)) {
    resp.statusCode = 200;
    resp.setHeader("Content-Type", "text/plain");
    return res.end("Hello World\n");
  });
  return server.listen(3000, hostname, function () {
    console.log("Server running at http://") +

...
```

SOLUTION

GENERATES IDOMATIC JS

REASON

?

TypeScript

❤

DEADLINES?

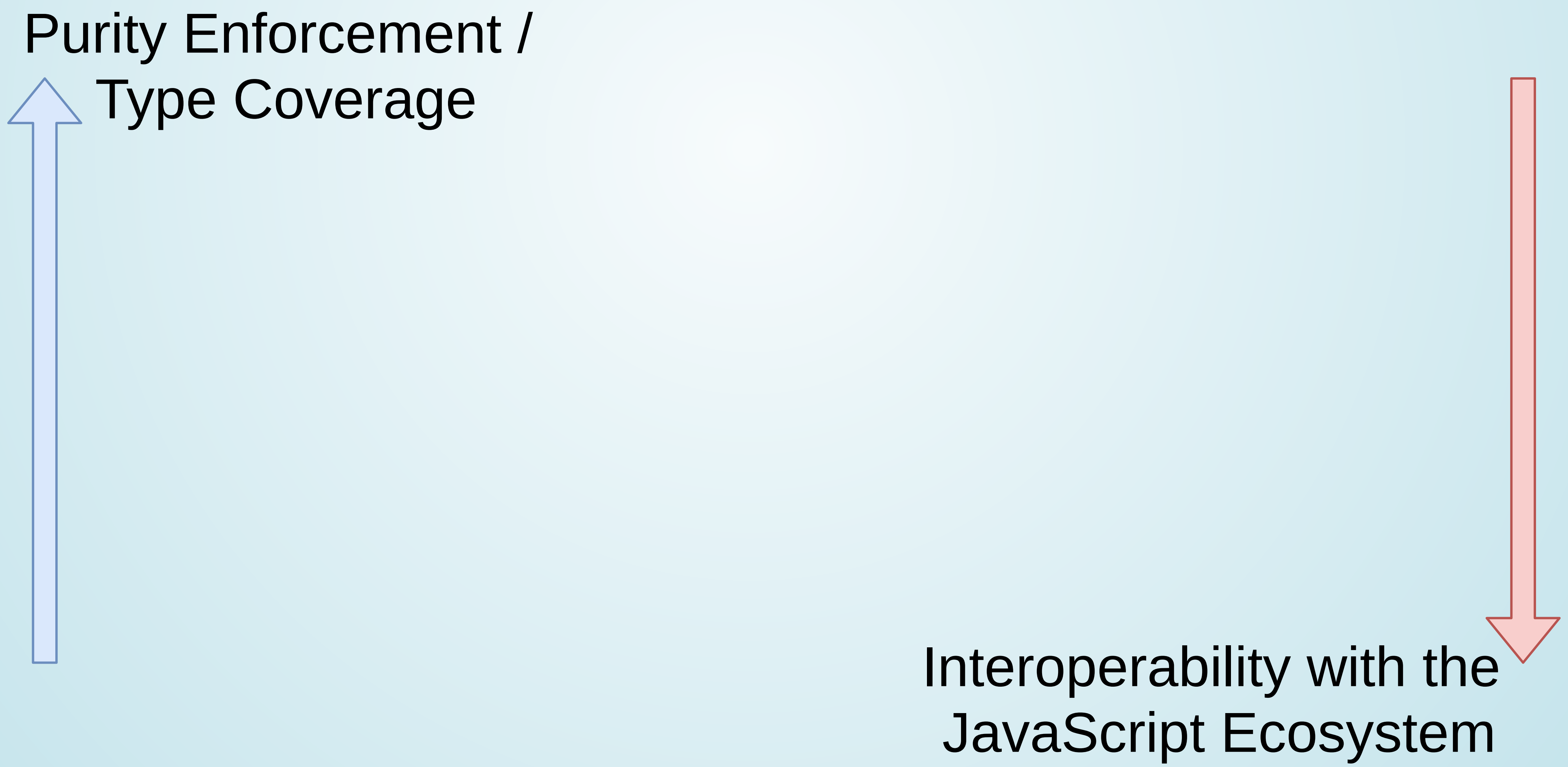
TIME PRESSURE?

ENEMIES OF THE TYPE-SYSTEM

```
: any

@ts-ignore
```

AnyScript™

JS-TRANSPILER LANGUAGES

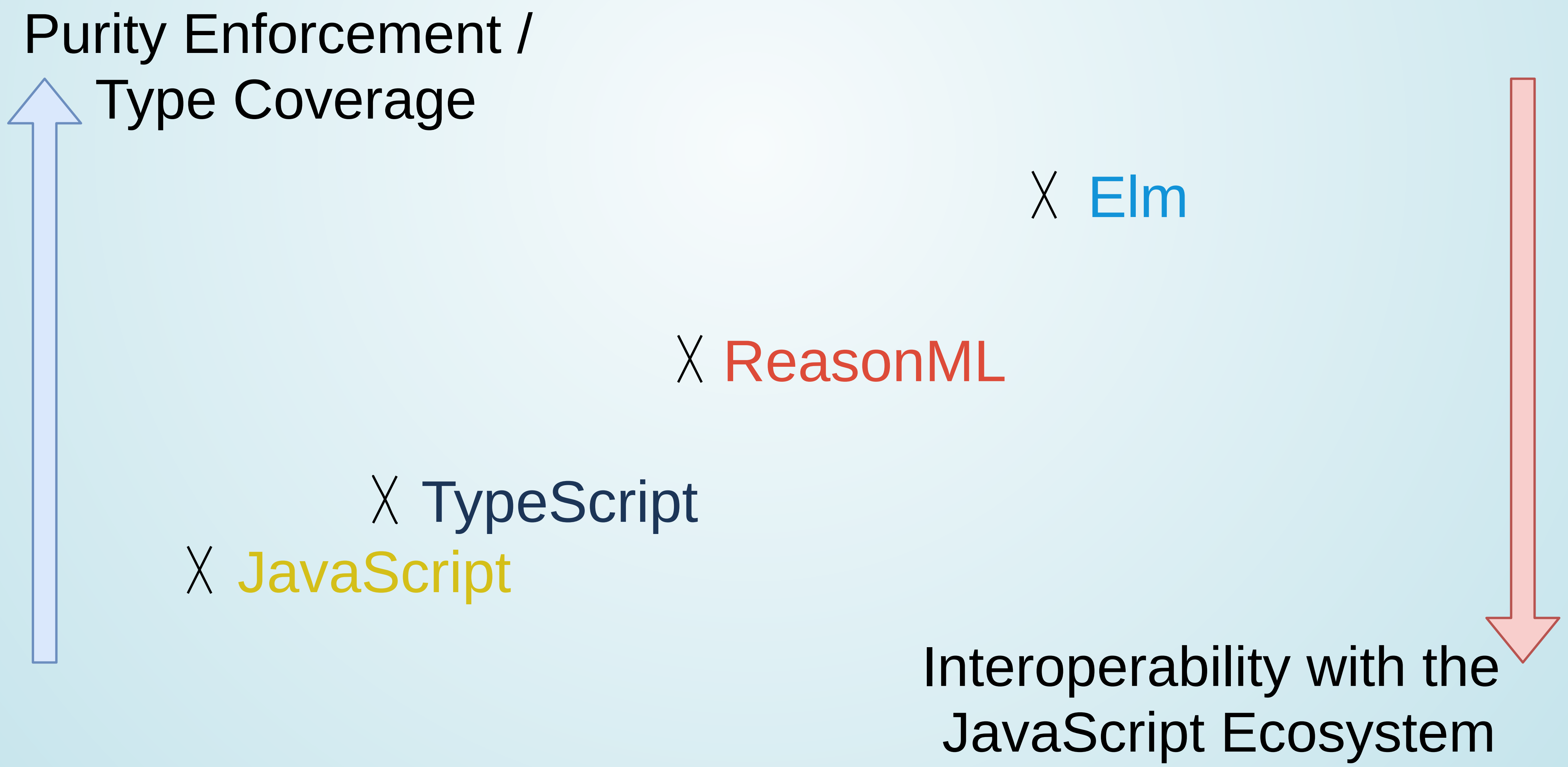

Purity Enforcement / Type Coverage
Interoperability with the JavaScript Ecosystem

ELM

ELM

♥

JS-TRANSPILER LANGUAGES


Purity Enforcement / Type Coverage
Elm
ReasonML
TypeScript
JavaScript
Interoperability with the JavaScript Ecosystem

CHOOSE BEST TOOL FOR THE JOB

Need a lot of crazy JS-Libraries?

Need no JS-Libraries at all?

Somewhere in between?

REASON

THREE WISHES

①

BENEFIT OF

FUNCTIONAL PROGRAMMING

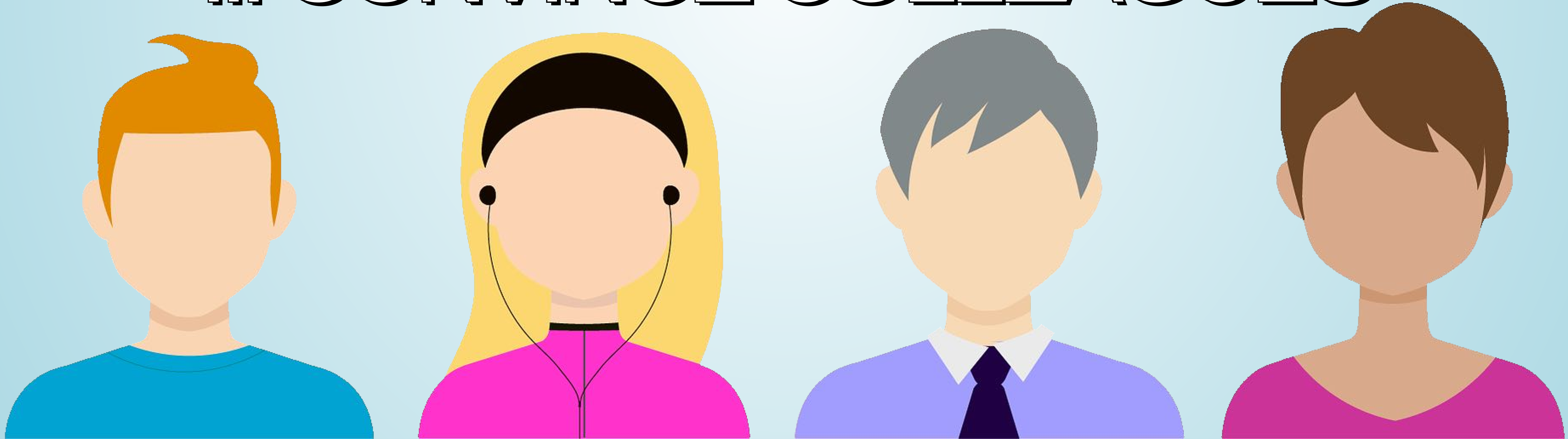
... (IN THE FRONT END)

♥

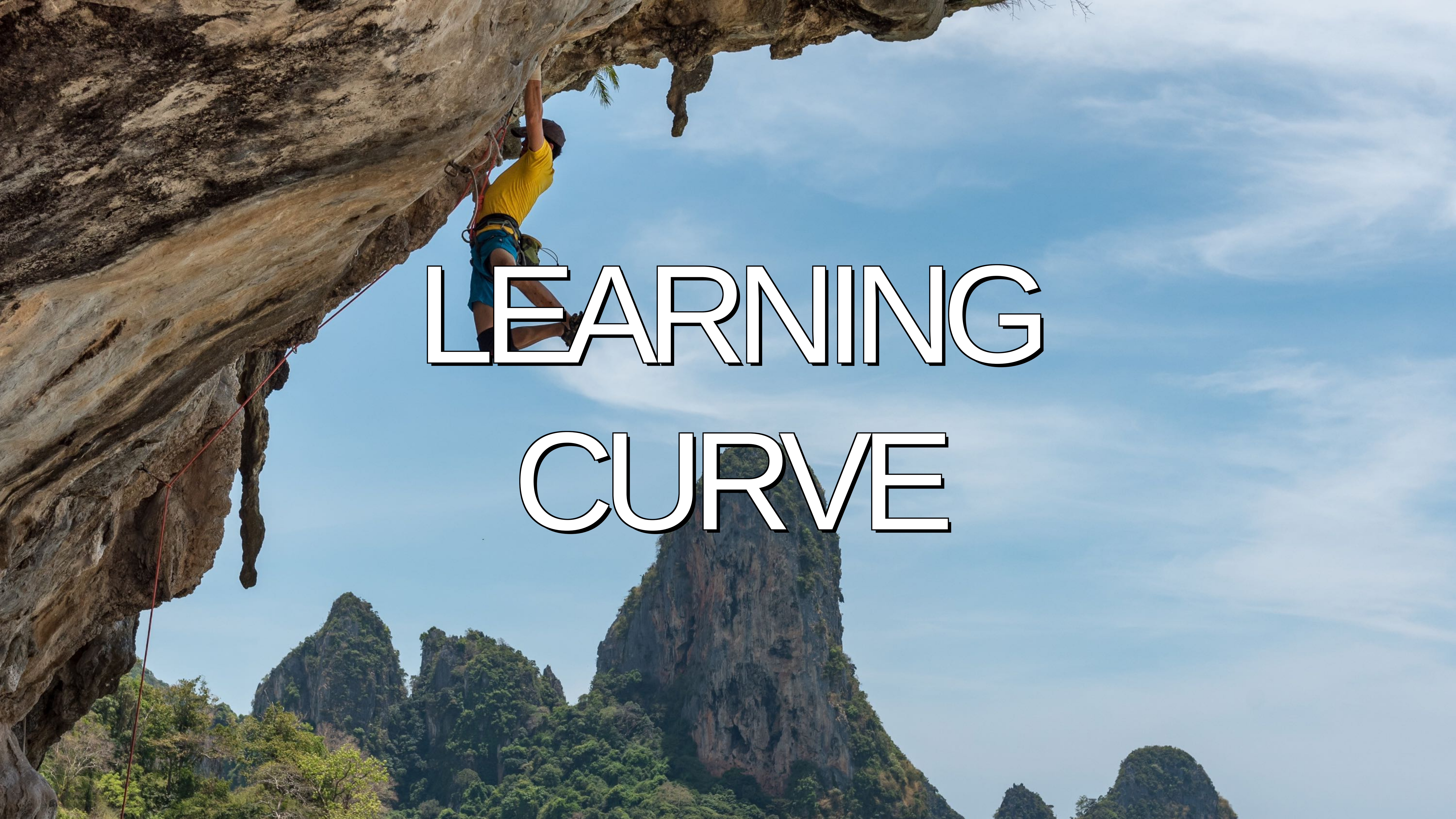
PURESCRIPT, ELM,
HASKELL ...

BUT...

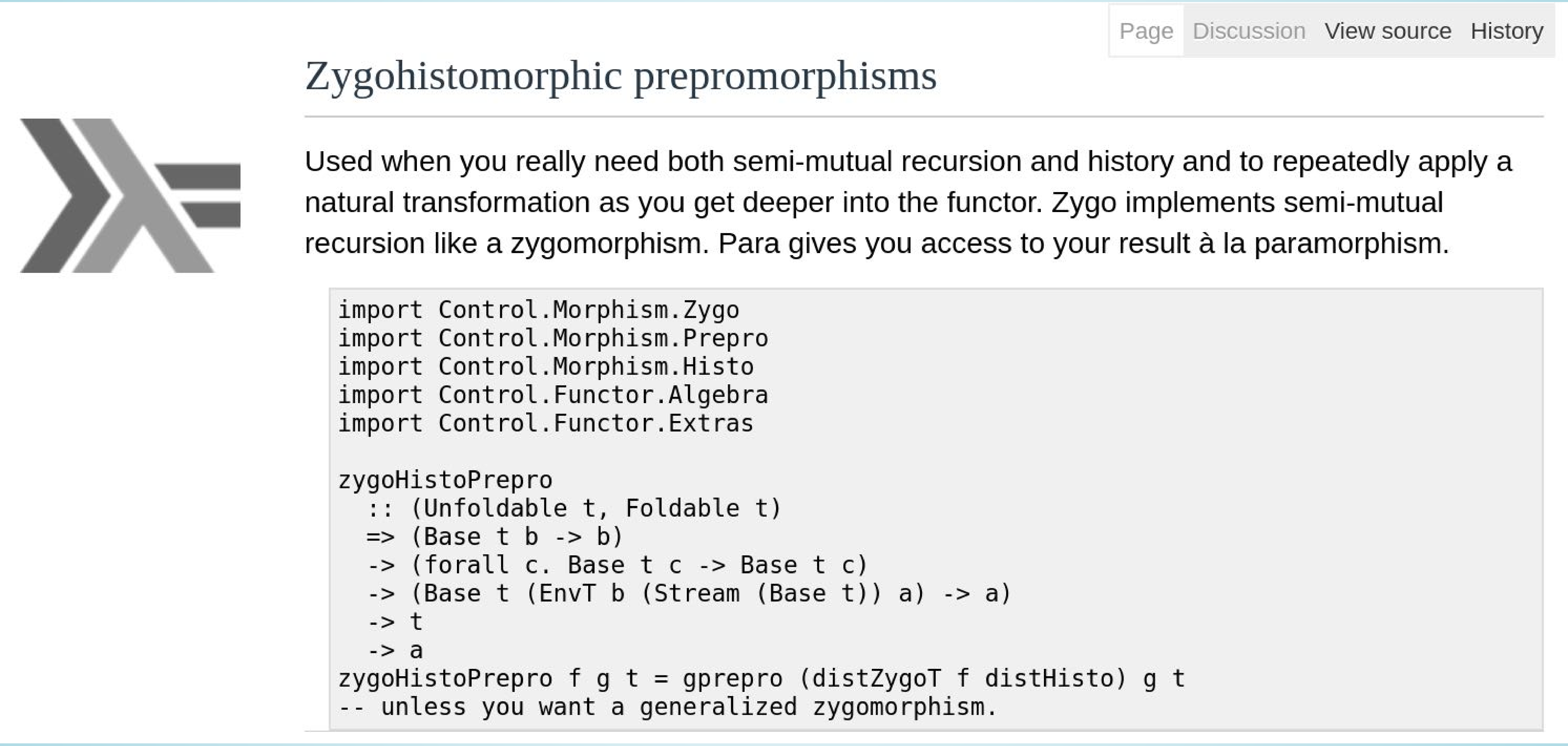
... CONVINCE COLLEAGUES



LEARNING CURVE



CURSE OF THE MONAD



Zygohistomorphic prepromorphisms

Used when you really need both semi-mutual recursion and history and to repeatedly apply a natural transformation as you get deeper into the functor. Zygo implements semi-mutual recursion like a zygomorphism. Para gives you access to your result à la paramorphism.

```haskell
import Control.Morphism.Zygo
import Control.Morphism.Prepro
import Control.Morphism.Histo
import Control.Functor.Algebra
import Control.Functor.Extras

zygoHistoPrepro
  :: (Unfoldable t, Foldable t)
  => (Base t b -> b)
  -> (forall c. Base t c -> Base t c)
  -> (Base t (EnvT b (Stream (Base t)) a) -> a)
  -> t
  -> a
zygoHistoPrepro f g t = gprepro (distZygoT f distHisto) g t
-- unless you want a generalized zygomorphism.
```

FP

EASY TO LEARN

2

VERY, VERY, VERY, VERY,
VERY

AWESOME

TYPE SYSTEM

③

SHOVEL S**T

REASON ... WISHES BECOME TRUE

1. Functional Programming
2. Awesome Type System
3. Ability to Shovel S**t

HISTORY

JORDAN WALKE

@ JSConfUS 2013

REACTJS

OCaml

OCaml is an industrial strength programming language supporting functional, imperative and object-oriented styles

How about OCAML in the Frontend?

WAT?

WTF?

> *yan batlhchaj semi-mutual recursion 'ej qun qar bImejnIS 'ej natural transformation qeSmeyllj Suq deeper vaj functor. semi-mutual recursion rur zygomorphism implements zygo. naw' SoH nob para ghot'e' à De la paramorphism.*

— zygohistomorphic prepromorphisms

(official Haskell Documentation)

[Klingon Translation]

SYNTAX MATTERS!

REASON

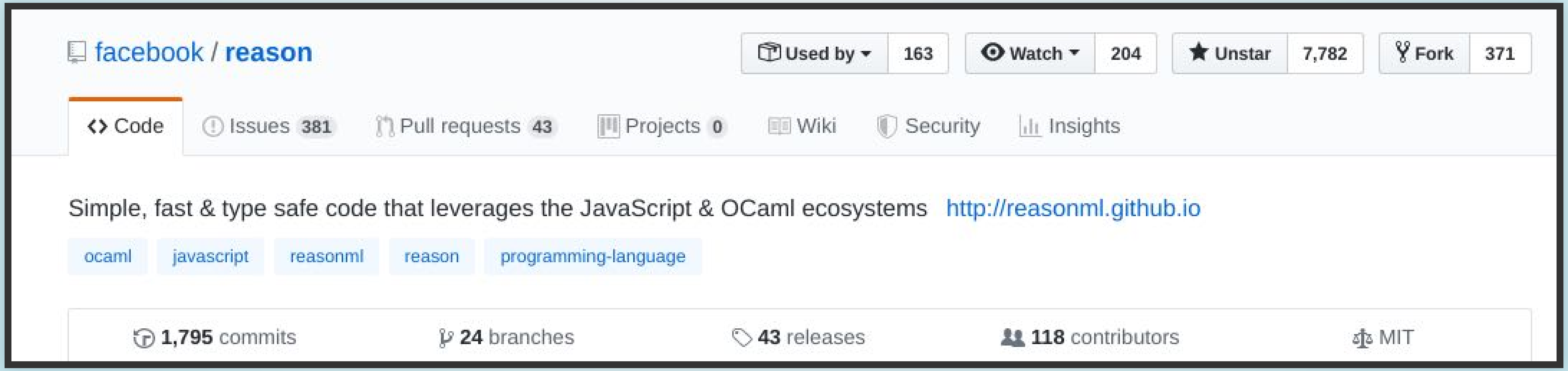
REASONML

=

OCAML + JS-LIKE SYNTAX

STATISTICS

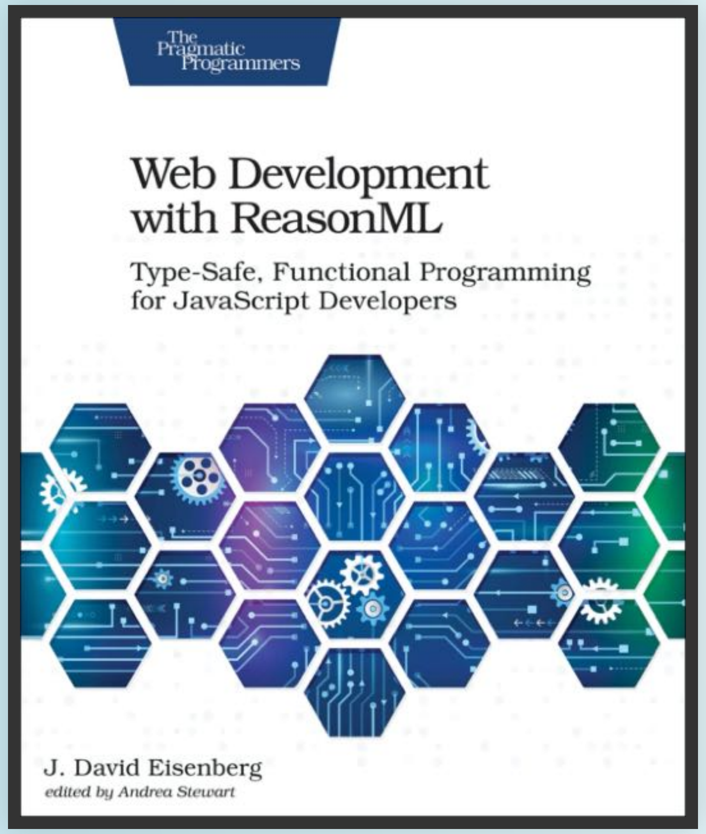
- > 120 Contributers
- > 8500 Stars on Github
- Big Companies
- 25 Years of OCAML



Simple, fast & type safe code that leverages the JavaScript & OCaml ecosystems http://reasonml.github.io

ocaml javascript reasonml reason programming-language

1,795 commits 24 branches 43 releases 118 contributors MIT

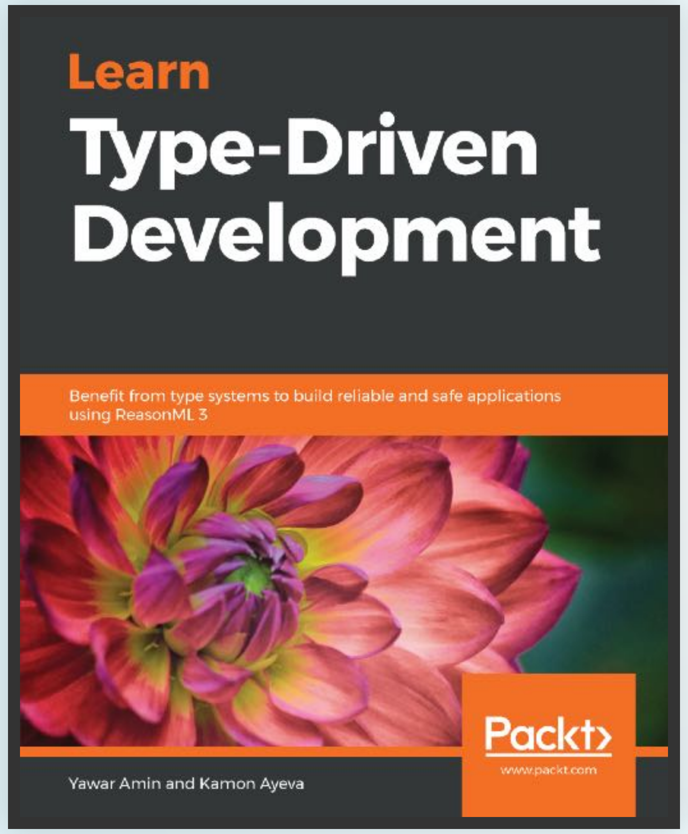

The Pragmatic Programmers

Web Development with ReasonML

Type-Safe, Functional Programming for JavaScript Developers

J. David Eisenberg

edited by Andrea Stewart

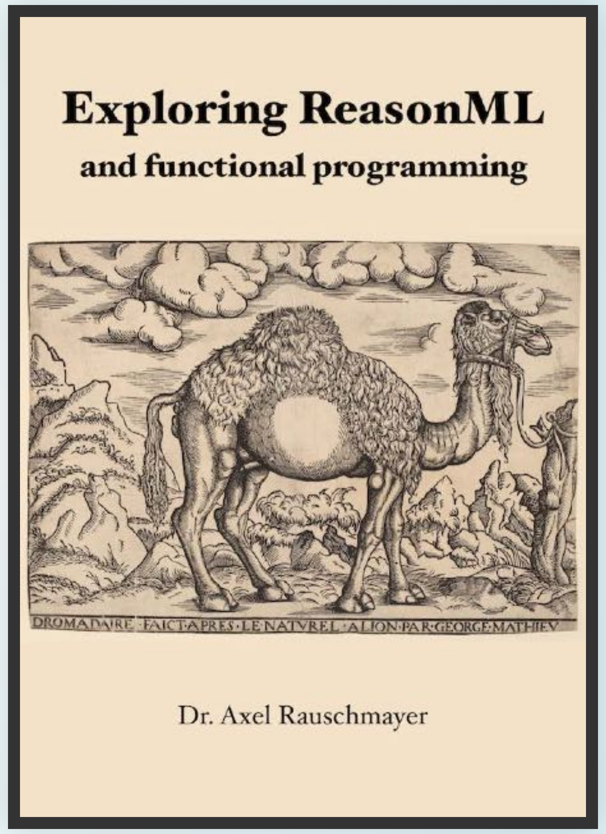

Learn

Type-Driven Development

Benefit from type systems to build reliable and safe applications using ReasonML 3

Packt> www.packt.com

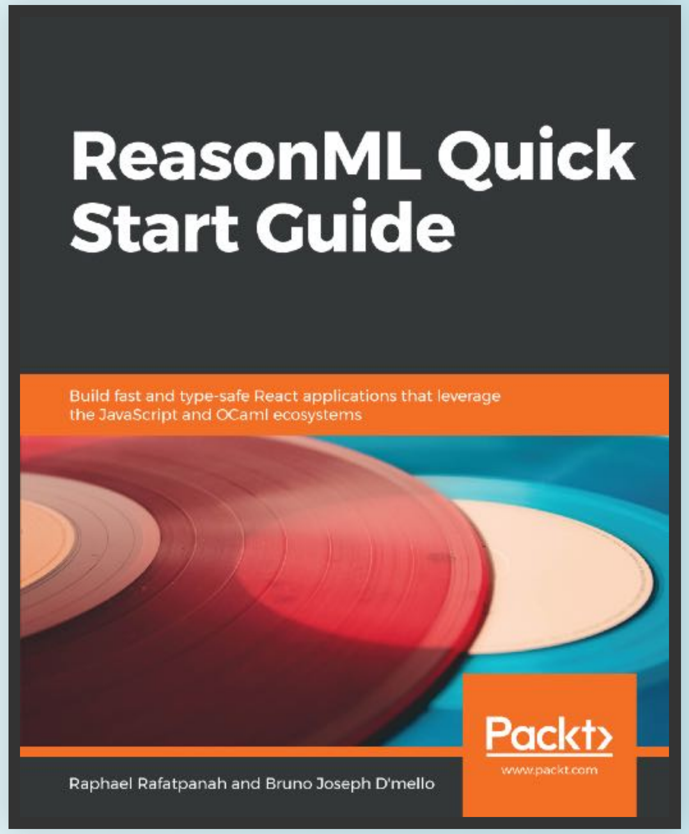
Yawar Amin and Kamon Ayeva


Exploring ReasonML

and functional programming

DROMADAIRE FAICT APRES LE NATVREL A LION PAR GEORGE MATHIEV

Dr. Axel Rauschmayer

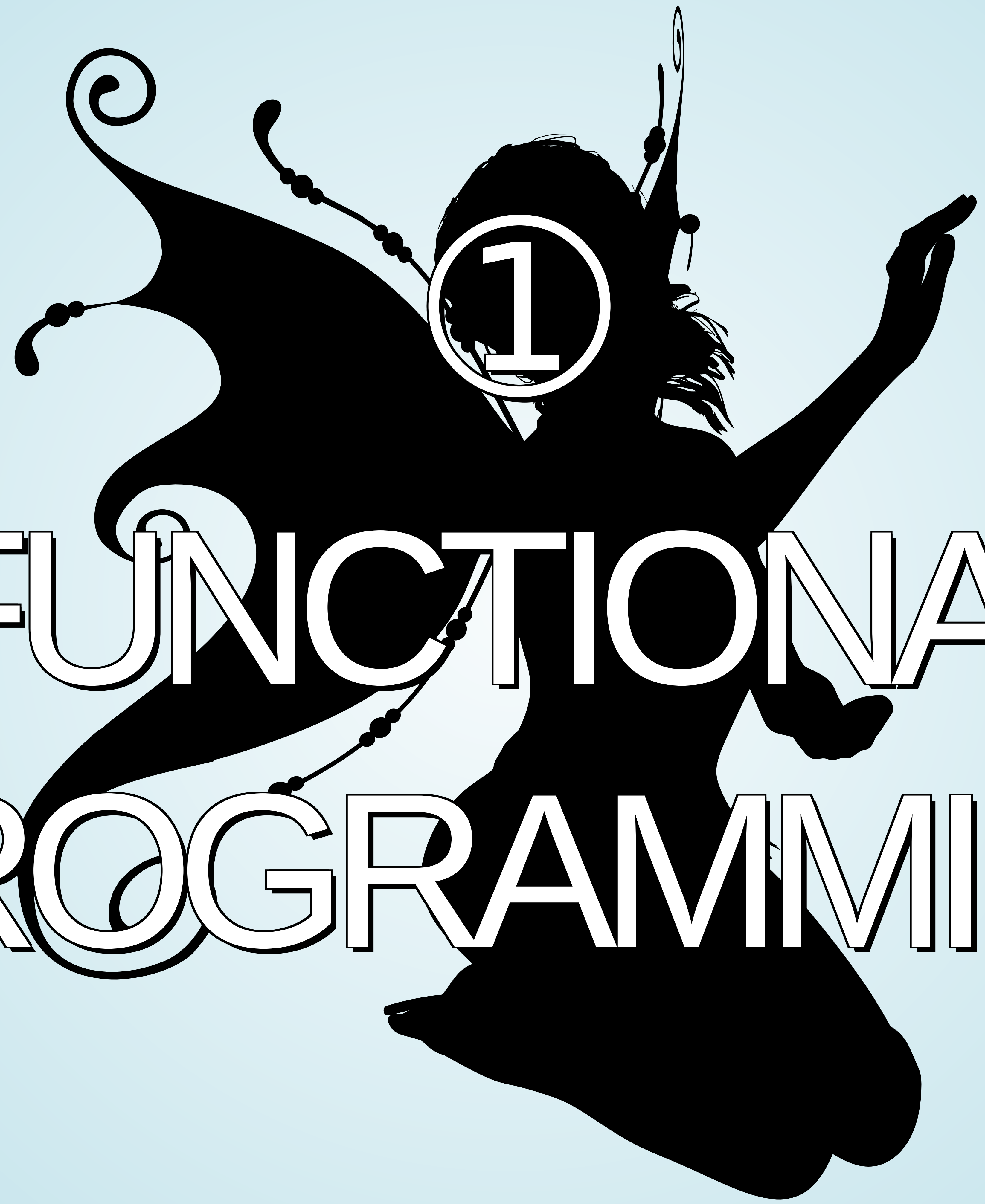

ReasonML Quick Start Guide

Build fast and type-safe React applications that leverage the JavaScript and OCaml ecosystems

Packt> www.packt.com

Raphael Rafatpanah and Bruno Joseph D'mello

REASON IN PRODUCTION



①

FUNCTIONAL PROGRAMMING

STRING CALCULATOR KATA

BY ROY OSHEROVE

"1,2,3" ⇒ 6

NEW REQUIREMENT

IGNORE >= 1000

$"1{,}1000{,}2" \Rightarrow 3$

```
let splitByComma = str => Js.String.split(",", str);

let mapToInt = numbers => List.map(int_of_string, numbers);

let lessThan1000 = numbers => List.filter(n => n < 1000, numbers)

let sum = numbers => List.fold_left((+), 0, numbers);
```

AUTO-CURRYING

```
let splitByComma = str => Js.String.split(",", str);

let mapToInt = numbers => List.map(int_of_string, numbers);

let lessThan1000 = numbers => List.filter(n => n < 1000, numbers)

let sum = numbers => List.fold_left((+), 0, numbers);
```

⬇

```
let splitByComma = Js.String.split(",");

let mapToInt = List.map(int_of_string);

let lessThan1000 = List.filter(n => n < 1000);

let sum = List.fold_left((+), 0);
```

COMPOSITION

```
let stringCalc = str =>
  sum(lessThan1000(mapToInt(splitByComma(str))));
```

(((((((WTF???)))))))

PIPELINE

|>

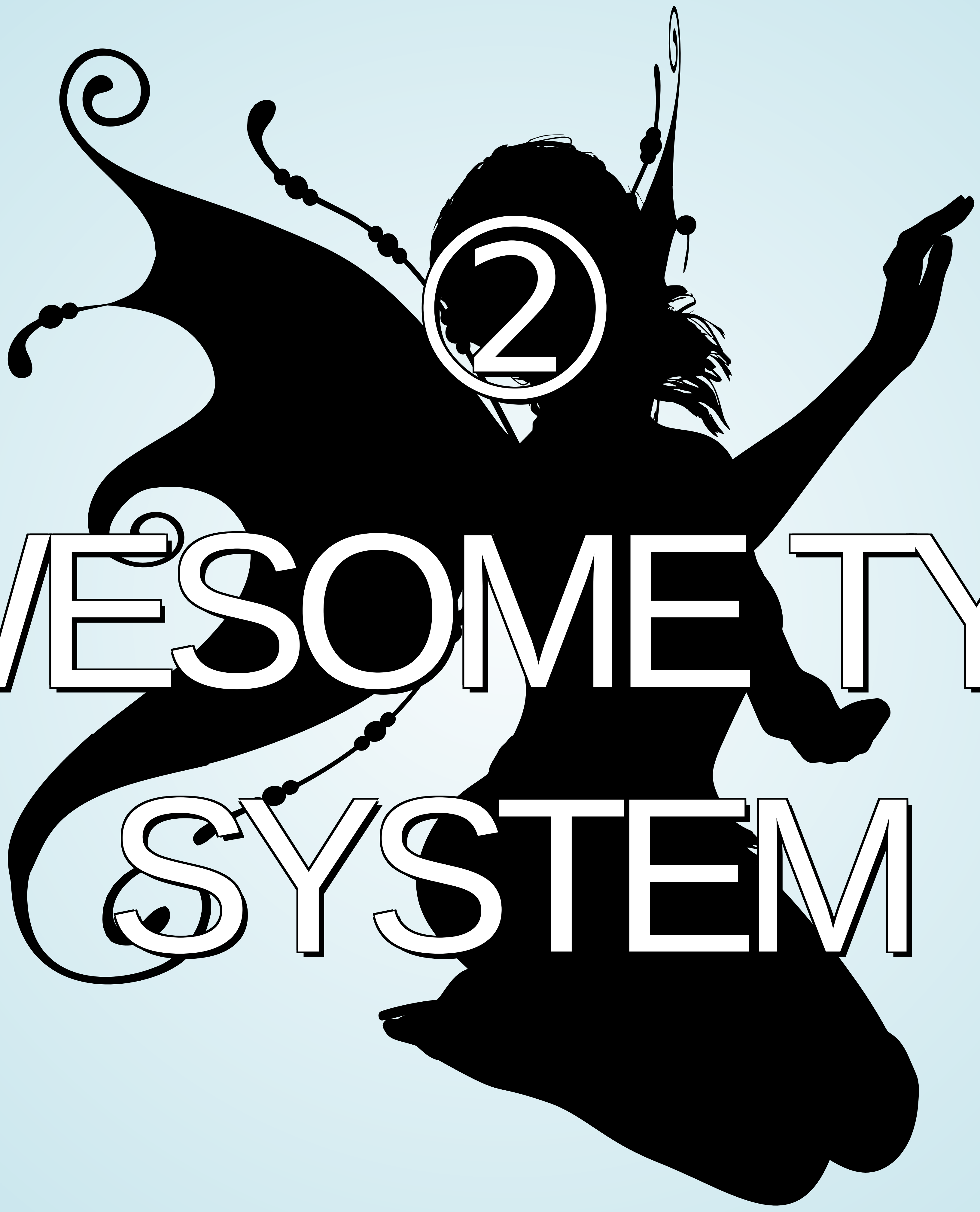
```
let stringCalc = str => str
  |> splitByComma
  |> mapToInt
  |> lessThan1000
  |> sum;
```

POINT FREE

```
open Rationale.Function;

let stringCalc =
  ||> splitByComma
  ||> mapToInt
  ||> lessThan1000
  ||> sum;
```

②

AWESOME TYPE SYSTEM



WAR OF TYPES

STATIC VS DYNAMIC

DYNAMIC TYPING
STATIC TYPING
DONE!

MAKE
LET
NOT
VAR
JS

TYPE SYSTEMS

- Benefits
- Cost

COST

- Noise
- Maintenance
- Complexity

BENEFITS

- Type Safety
- Documentation
- IDE-Convenience
- Optimization

BETTER RATIO

- increase Benefits ⬆
- reduce Cost ⬇

REDUCE COSTS ⬇

- Type Inference
- Structural Typing

INCREASE BENEFITS ⬆

- Tagged Types
- Variant Types

BILLION DOLLAR MISTAKE

NULL

Tony Hoare - 1964

https://www.infoq.com/presentations/Null-References-The-Billion-Dollar-Mistake-Tony-Hoare

REASONML

?

REASONML

~~null~~

REASONML

none

OPTION

```
type option('a) = None | Some('a);
```

REASON TYPE SYSTEM

- Types can be inferred
- Coverage is always 100%.
- No need for a "type coverage" tool
- completely "sound"

IDE-SUPPORT

- Language Server
- VS-Code
- Atom
- vim
- Emacs
- Idea / IntelliJ / Webstorm
- Sublime

③ SHOVELING S**T

SHOVEL S**T

SHOVEL S**T

- Easy integration with JS
- Mutability if Needed
- High Performance

JAVASCRIPT INTEROP

```
Js.log("this is reason");

[%bs.raw {| console.log('here is some javascript for you') |}];
```

```
let y = [%bs.raw {| 'something' |}];
Js.log(("a string" ++ y, 10 + y));
```

⬇

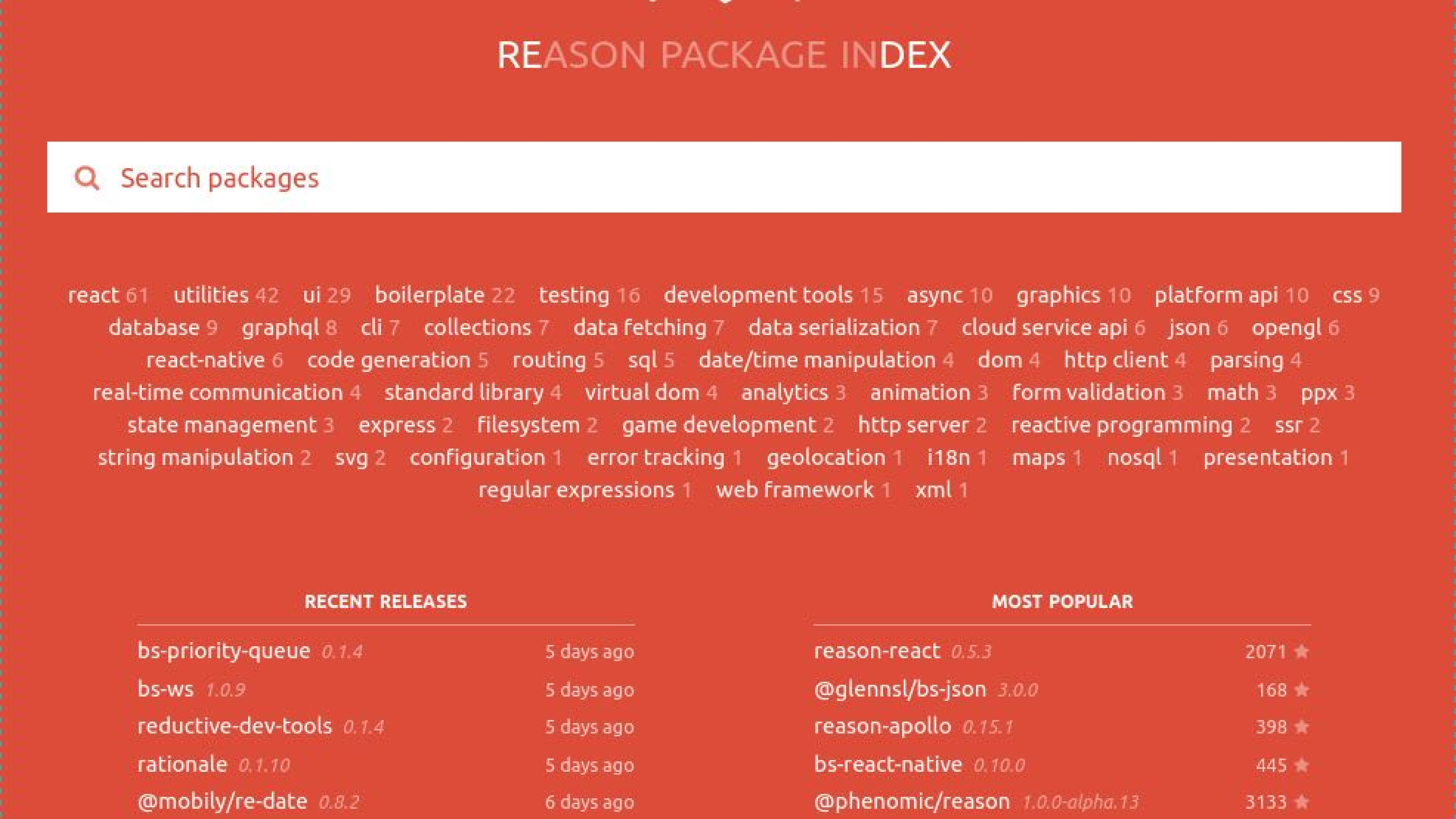
```
let y: string = [%bs.raw {| 'well-typed' |}];
Js.log(("a string" ++ y, 10 + y));
```

```
let jsCalculate: (array(int), int) => int = [%bs.raw
{|
  function (numbers, scaleFactor) {
   var result = 0;
   numbers.forEach(number => {
     result += number;
   });
   return result * scaleFactor;
  }
|}];

let calculate = (numbers, scaleFactor) =>
  jsCalculate(Array.of_list(numbers), scaleFactor);

Js.log(calculate([1, 2, 3], 10)); /* -> 60 */
```

EMBED A JSX-COMPONENT

```
[@bs.module "./LoadingNotification"] [@react.component]
external make: (~unknownCount: int, ~unclearCount: int) =>
  React.element =
    "LoadingNotification";
```

```
<LoadingNotification unkownCount=3 unclearCount=6>
...
```



REASON PACKAGE INDEX

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regular expressions 1 web framework 1 xml 1

RECENT RELEASES

bs-priority-queue *0.1.4*	5 days ago
bs-ws *1.0.9*	5 days ago
reductive-dev-tools *0.1.4*	5 days ago
rationale *0.1.10*	5 days ago
@mobily/re-date *0.8.2*	6 days ago

MOST POPULAR

reason-react *0.5.3*	2071 ★
@glennsl/bs-json *3.0.0*	168 ★
reason-apollo *0.15.1*	398 ★
bs-react-native *0.10.0*	445 ★
@phenomic/reason *1.0.0-alpha.13*	3133 ★

ESCAPE-
HATCHES

PURITY

GETTING S**T DONE

PURE BY DEFAULT

- Immutable by Default
- Compile before Runtime Errors

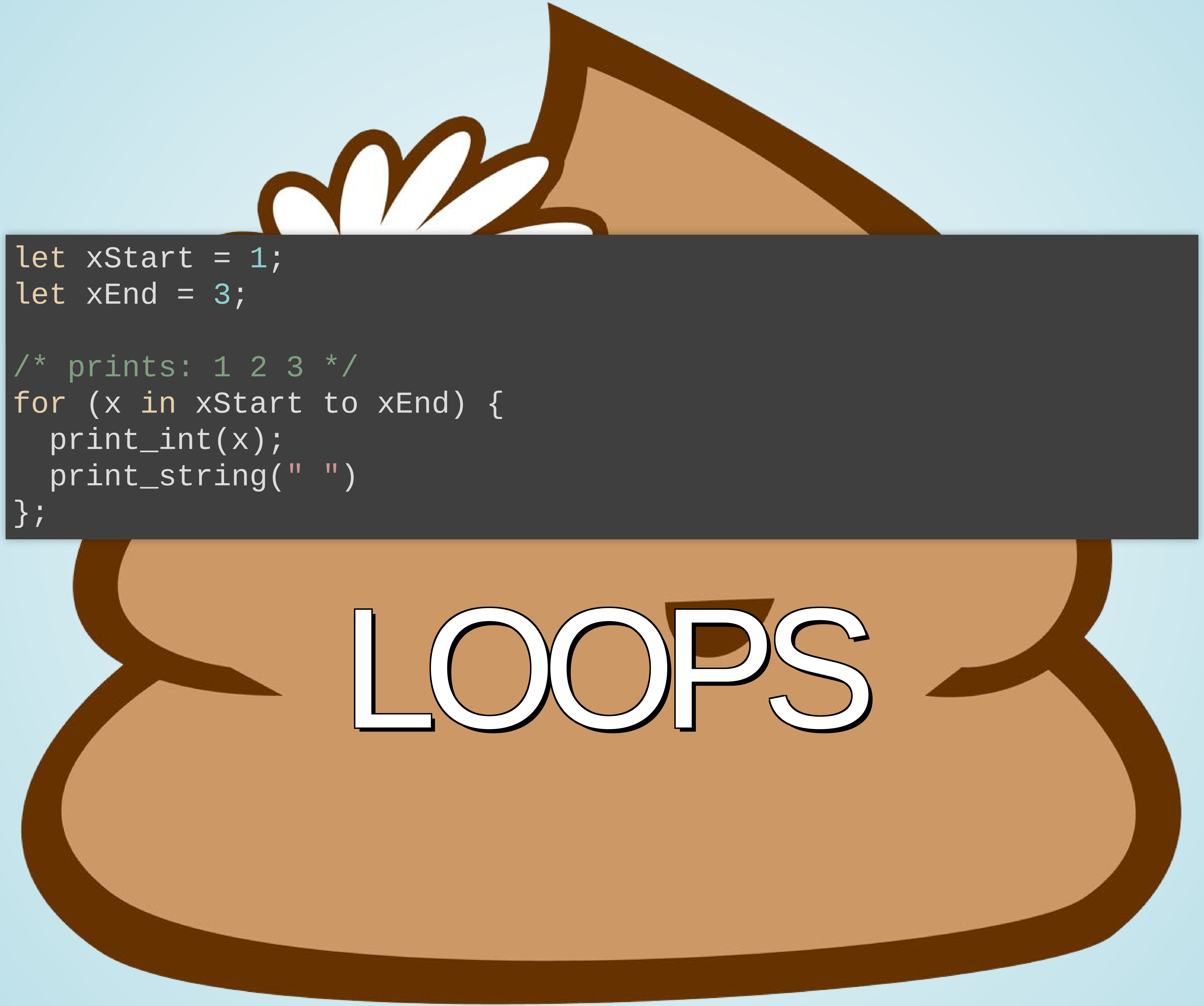
BUT

```
let counter = ref(5);

counter := counter^ + 1

Js.log(counter) // => 6
```

MUTATION

```
let getItem = (theList) =>
  if (callSomeFunctionThatThrows()) {
    /* return the found item here */
  } else {
    raise(Not_found)
  };

let result =
  try (getItem([1, 2, 3])) {
    | Not_found => 0 /* Default value if getItem throws */
  };
```

EXCEPTIONS



```
let xStart = 1;
let xEnd = 3;

/* prints: 1 2 3 */
for (x in xStart to xEnd) {
  print_int(x);
  print_string(" ")
};
```

LOOPS

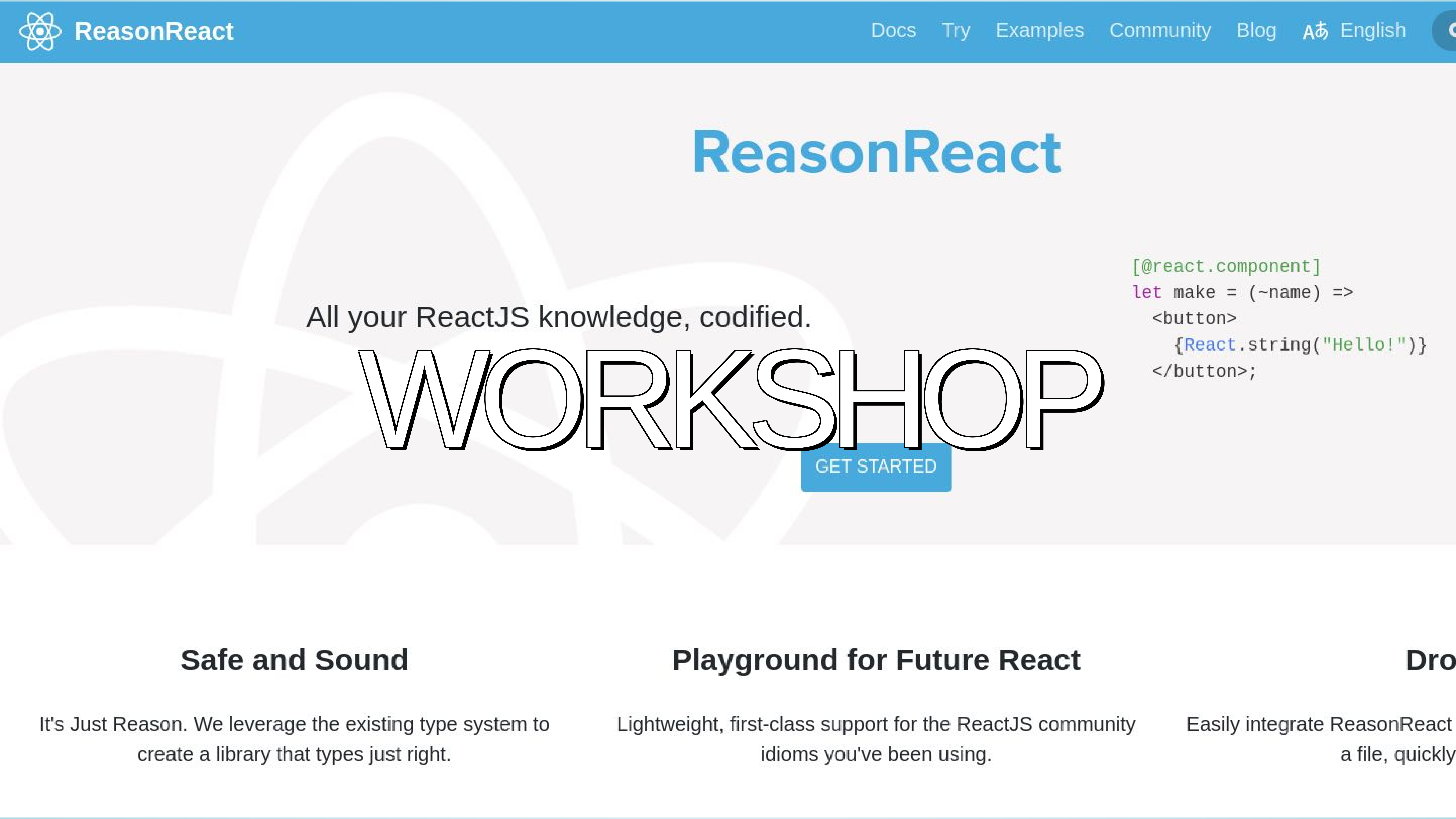
OTHER ADVANTAGES

- Performance
- Compile Speed
- Tooling: refmt, CLI, Scaffolding, IDEs
- Ecosystem: JS/Node + OCAML
- Language Features: e.g. Keyword Params

TRADE-OFF

- Impurity
- Early Documentation
- No Async/Await yet
- Impurity

THREE WISHES



ReasonReact

All your ReactJS knowledge, codified.

WORKSHOP

```
[@react.component]
let make = (~name) =>
  <button>
    {React.string("Hello!")}
  </button>;
```

Safe and Sound

It's Just Reason. We leverage the existing type system to create a library that types just right.

Playground for Future React

Lightweight, first-class support for the ReactJS community idioms you've been using.

Dro

Easily integrate ReasonReact
a file, quickly

REFERENCES

- Why Reason got started, with Jordan Walke: https://reason.town/jordan-interview
- Sean Grove: The Age of ReasonML https://www.youtube.com/watch?v=8LCmLQ1-YqQ
- Axel Rauschmaier: http://reasonmlhub.com/exploring-reasonml

IMAGE CREDITS

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Thank You!

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