Haskell

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(adopted from my & Edward Yang's CSE242 slides)

Why Haskell?

The great ideas [Haskell]

Expressive power (say more with less)

First-class functions

Pattern matching

Type inference

Exception handling

Monads

Continuations

Reliability and reuse

Type polymorphism

Type classes

Modules

Objects & inheritance

Cross-cutting concerns

Memory management

Concurrency

What is Haskell?

a typed, lazy, purely functional language

Haskell is statically-typed

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- Everything has a type
- Everything must make sense at compile time
  - Unlike JavaScript where f(x) with f=undefined will not complain until you actually evaluate f(x)
- Is JavaScript typed?
  - A: yes, B: no

Why is this cool?

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- Removes whole classes of bugs
- Address bugs early vs. after they have been triggered
  - Prevent weird errors from creeping up on you
  - Important for safety, security, and compositionally
- Easier to optimize and write faster code
  - You can remove your typeof checks; compiler can do fast things. V8 relies on types to makes things fast!

Haskell is functional

- This means no“side-effects”?
  - A: yes, B: no

Haskell is functional

Haskell is functional

- Support for high-order, first-class functions
- Meaning of programs centered around:
  - evaluating expressions
  - not executing instructions

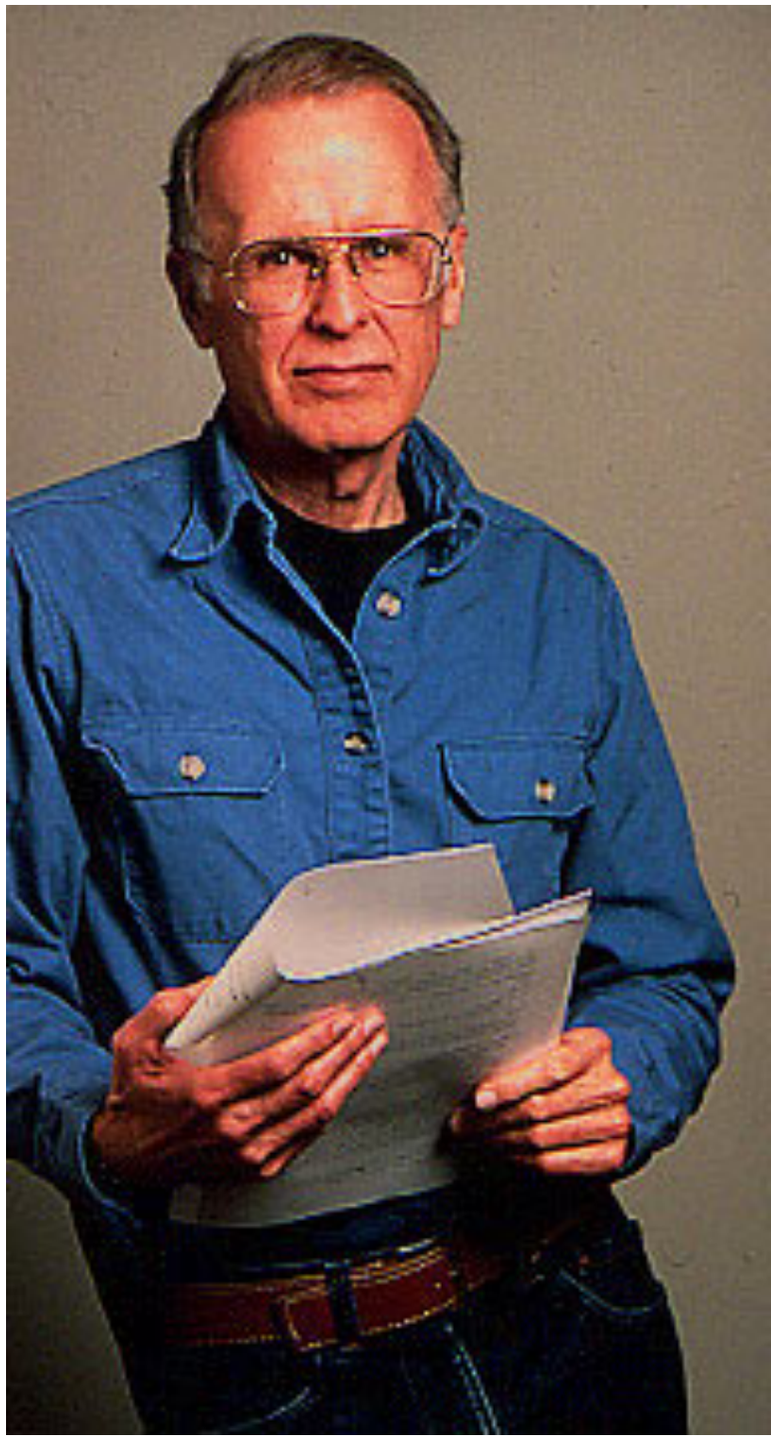
Haskell is pure

Haskell is pure

- Expressions (e.g., functions) don't have "side effects"
  - Is JavaScript pure? A: yes, B: no
- Everything is immutable: mutation is a side-effect!
- What does it mean for an expression to not have side-effects?
  - In scope where x_1, ..., x_n are defined all occurrences of e (where $FV(e) = \{x_1, ..., x_n\}$) have the same value

Why is this cool?

Don’t take it from me, take it from Backus



Why is this cool?

- Algebraic laws: equational reasoning & optimizations
  - Can always replace things that are equal, λ calculus!
- Easier to think about
  - e.g., don't need to worry if x changed after calling f
- Parallelism
  - Can evaluate expressions in parallel!

Haskell is lazy

Haskell is lazy

- You don't evaluate an expression until its result is absolutely necessary: in contrast to JavaScript
  - Remember: call-by-name
- Haskell's evaluation strategy is called call-by-need
  - Because of the other properties: you actually only evaluate an expression once and cache the result

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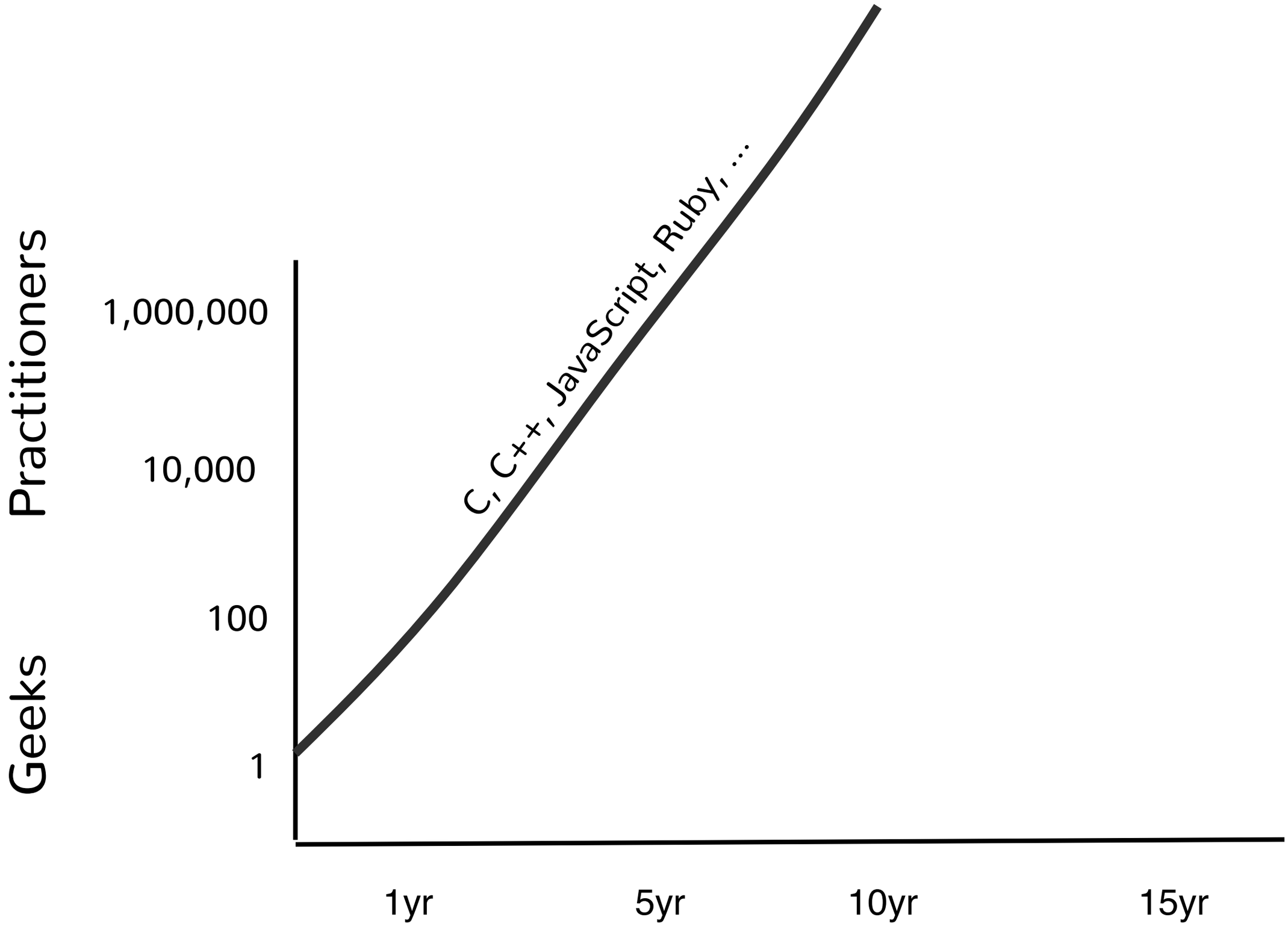
- Can define your own control structures using functions
  - E.g., defining if-then-else is much easier in Haskell can be done naturally; less so in JavaScript; why?
- Can define infinite data structures
  - E.g., infinite lists, trees, etc.
  - Can solve general problem and then project solution

Haskell is a committee language

Why is this interesting? [SPJ]



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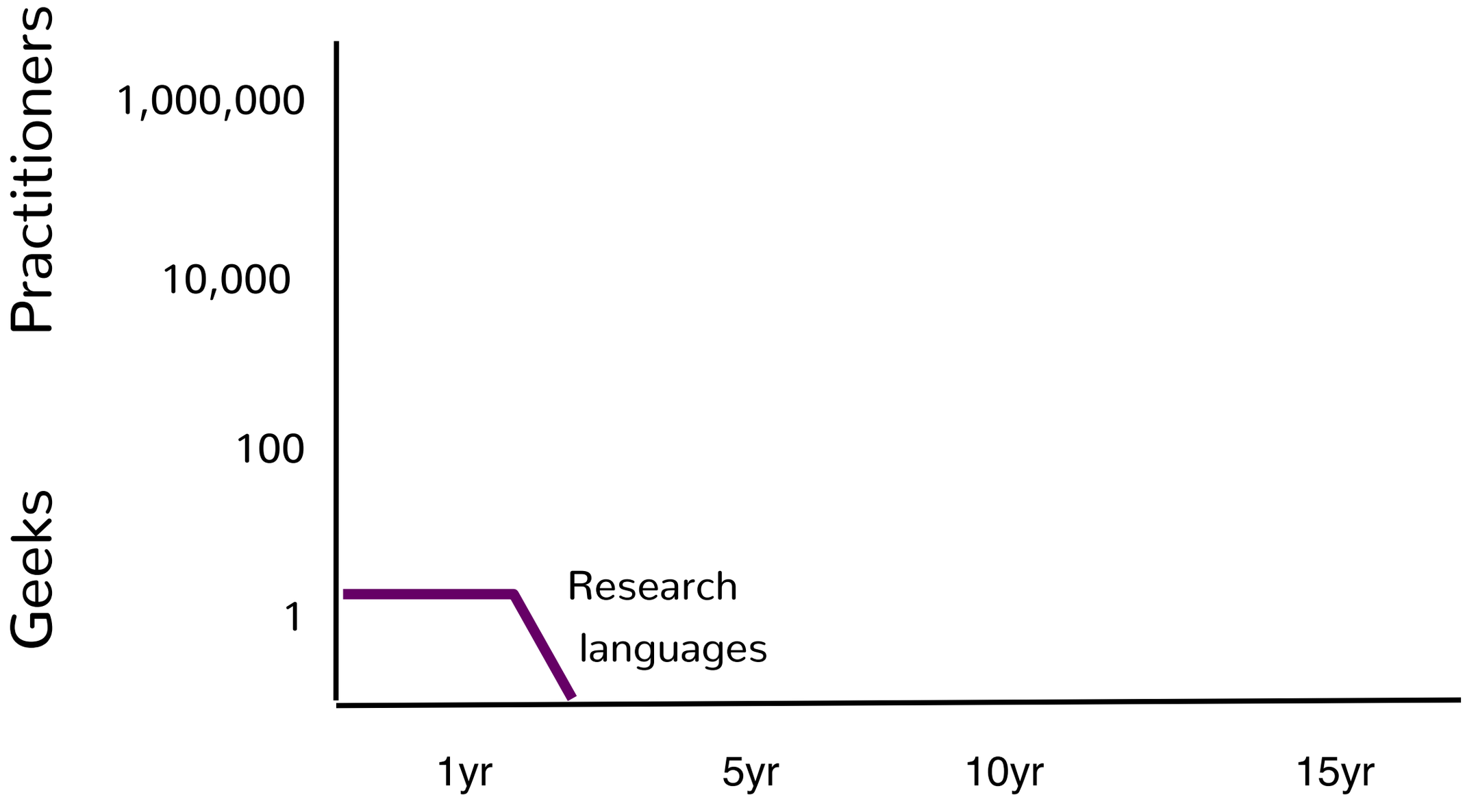

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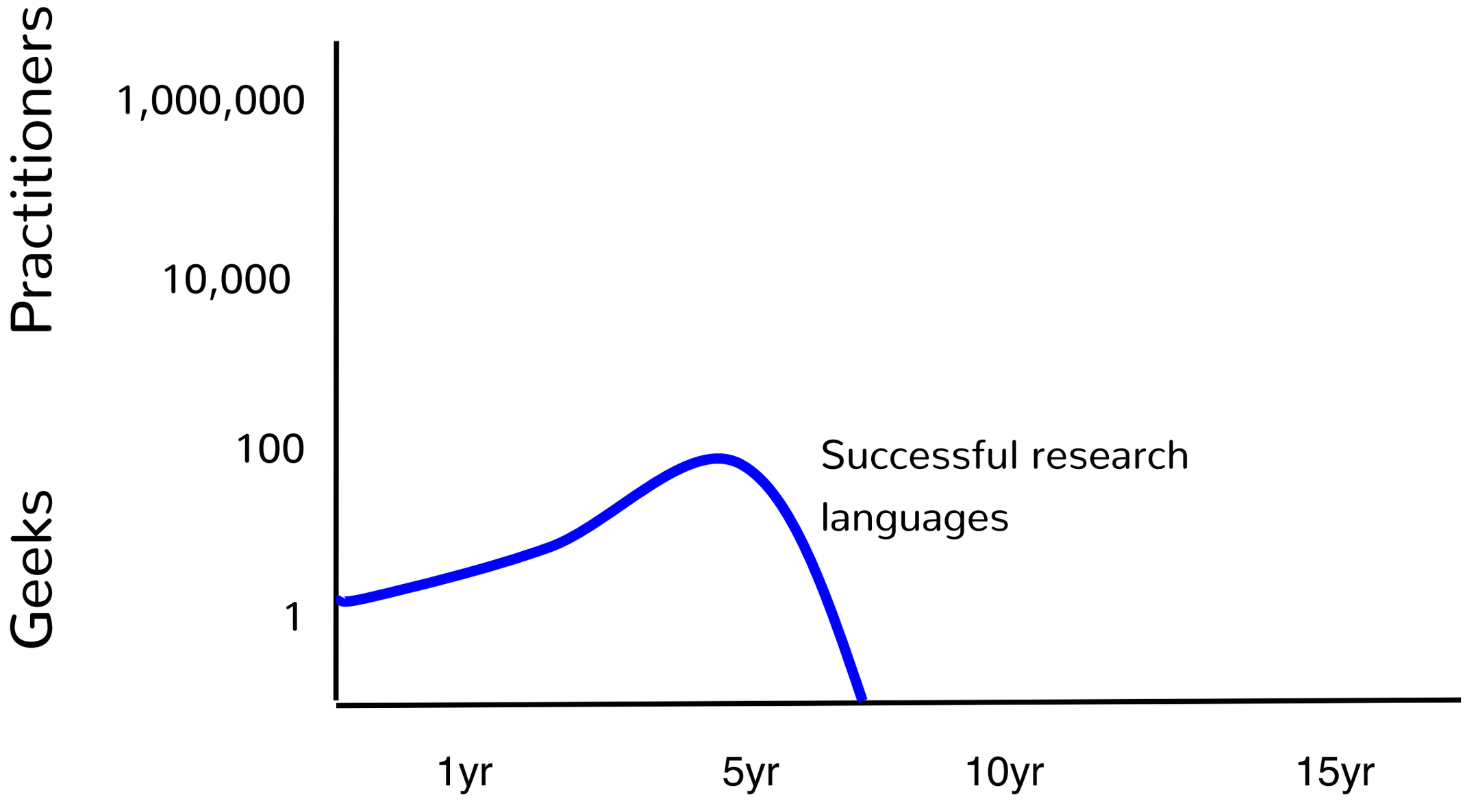

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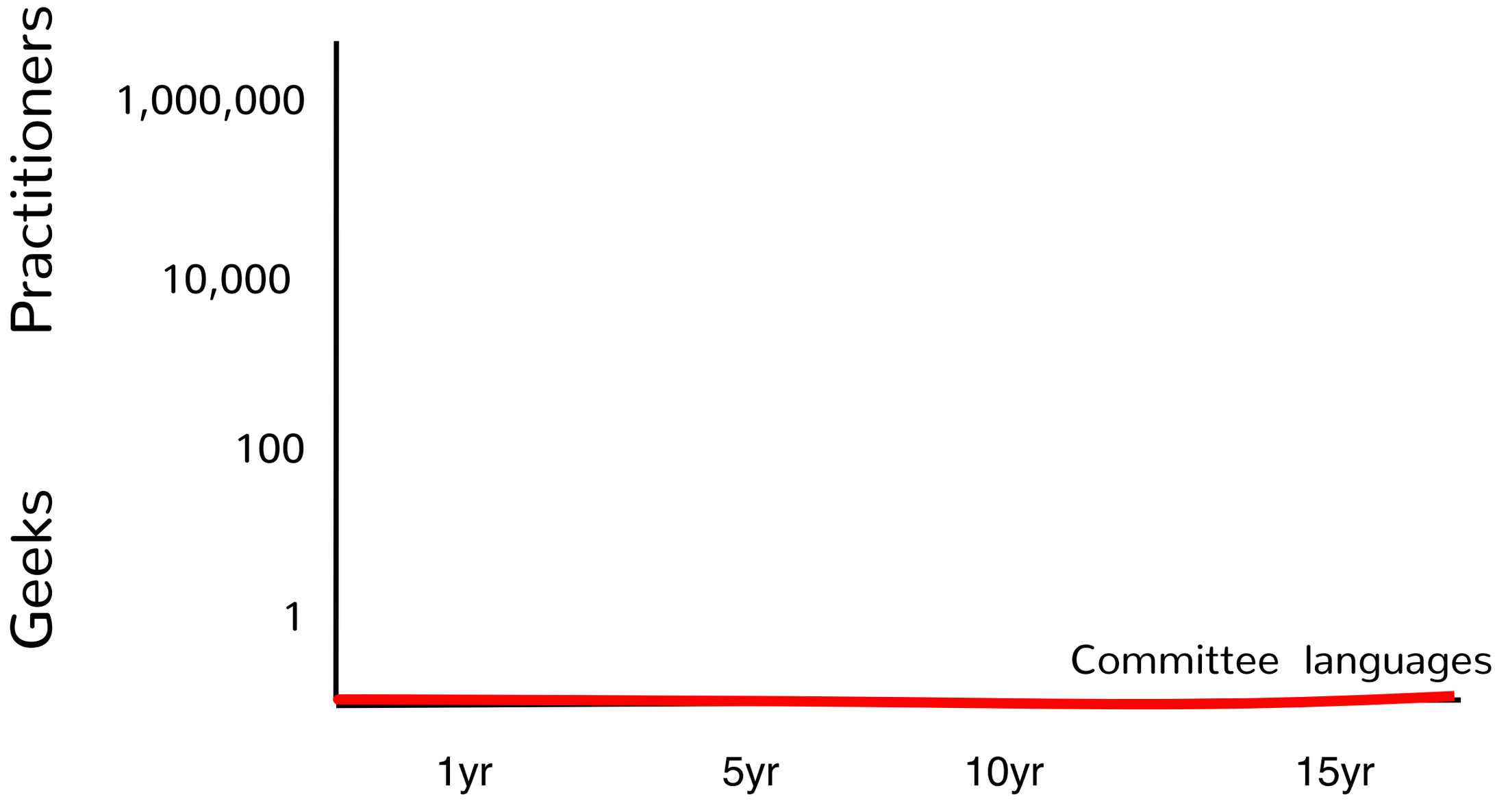

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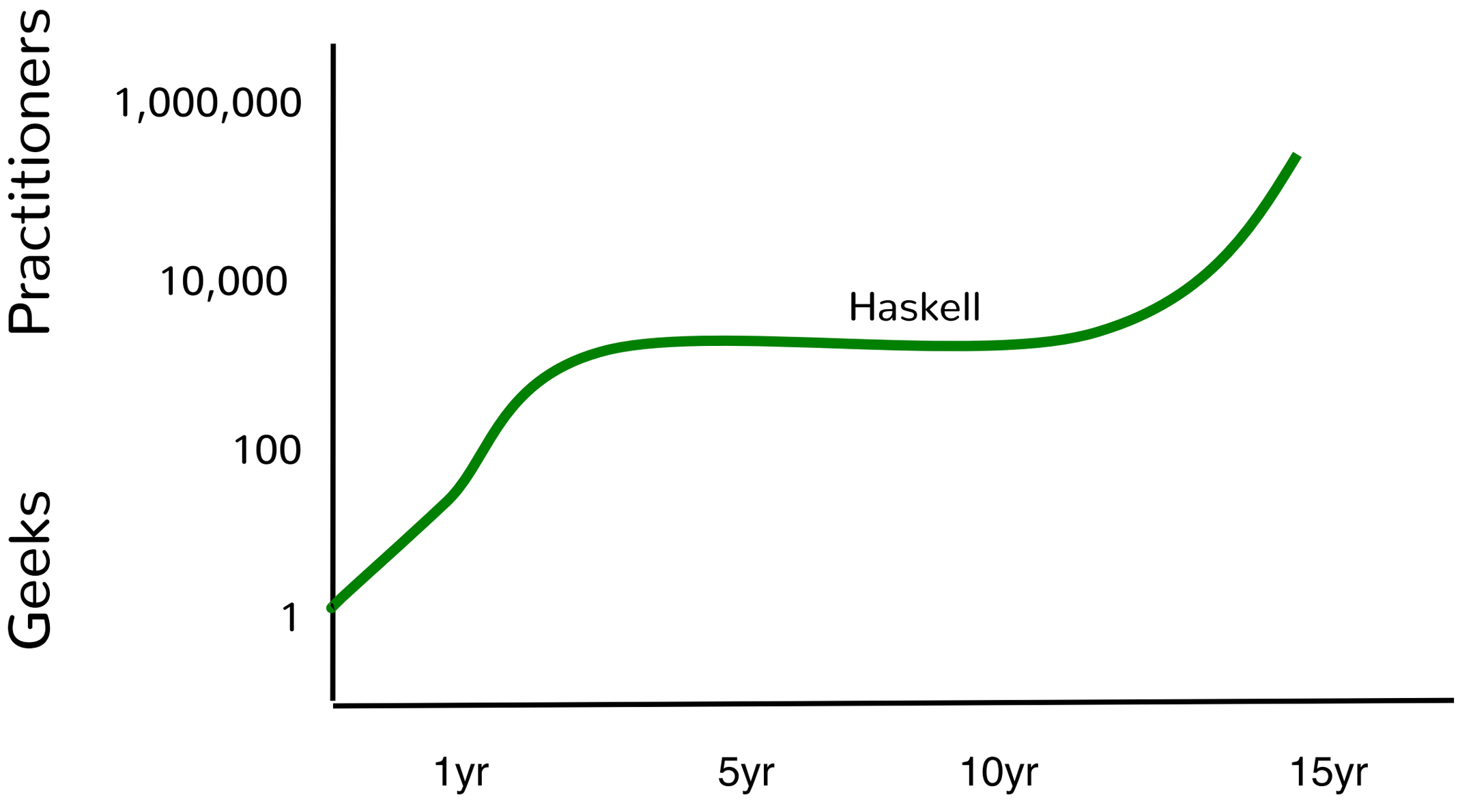

intro.hs