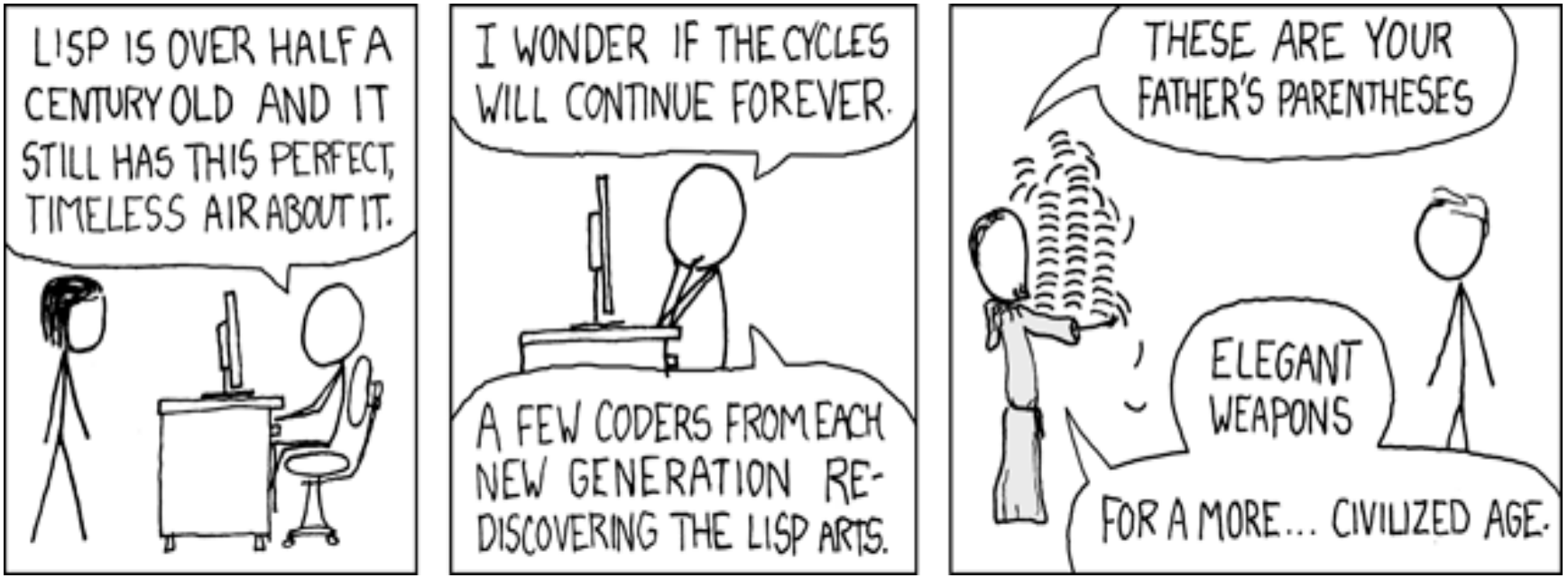


COS 326 Functional programming: an elegant weapon for the modern age

Alonzo Church
Princeton Prof
1929-1967

In 1936, Alonzo Church invented the lambda calculus. He called it a logic, but it was a language of pure functions -- the world's first programming language.

He said:

"*There may, indeed, be other applications of the system than its use as a logic.*"

Alonzo Church
1936 -- developed lambda calculus

Alan Turing
1936 -- developed Turing machines

Robert Harper (CMU): *The lambda directly and immediately relevant to this day, rather than something that collects dust on the shelf. No one cares one bit about the details of a Turing Machine; for it fails to address the central issue of modularity.*

Vastly Abbreviated FP Designer History

Alonzo Church:
lambda calculus
1930's

Guy Steele & Gerry Sussman:
Scheme
late 1970's

Xavier Leroy:
Ocaml
1990's

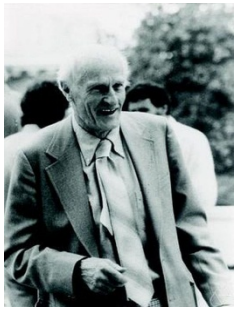
John McCarthy:
LISP
1958

Robin Milner, Mads Tofte, & Robert Harper
Standard ML
1980's

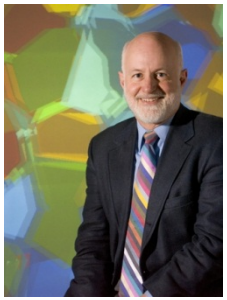
Don Syme:
F#
2000's

Where do I fit in?

Alonzo Church
Princeton Prof
1929–1967



Steven Kleene
Princeton PhD 1934
IAS 1939-1940



Robert Constable
Developed Nuprl
Thereom Prover

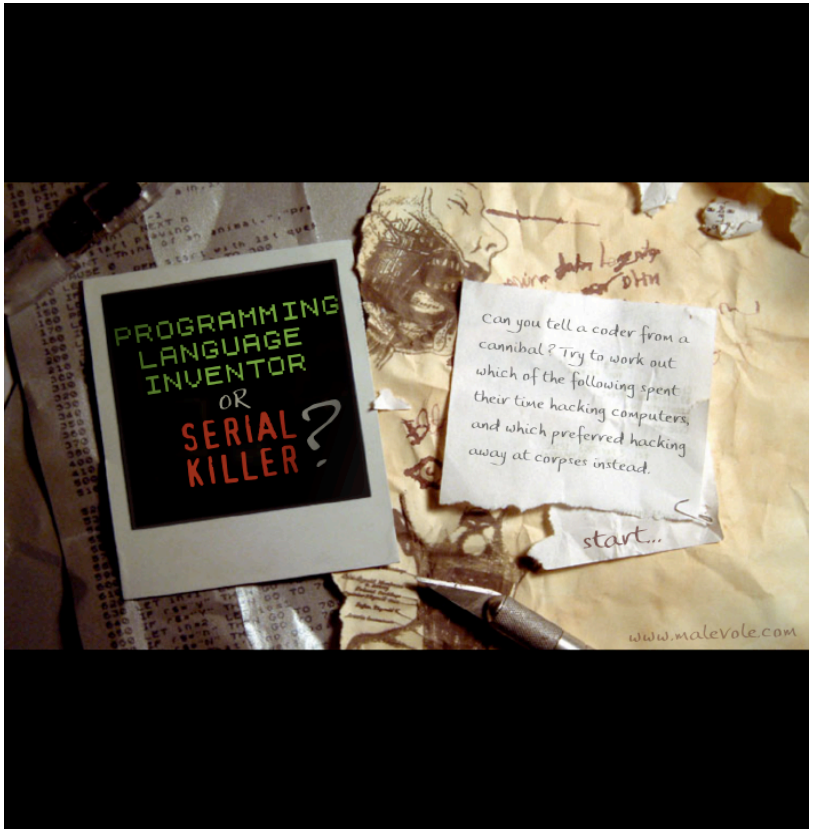
Bob Harper
Developed
Standard ML

Greg Morrisett
Developed
Typed Assembly Language

David Walker
Princeton Prof 2002-

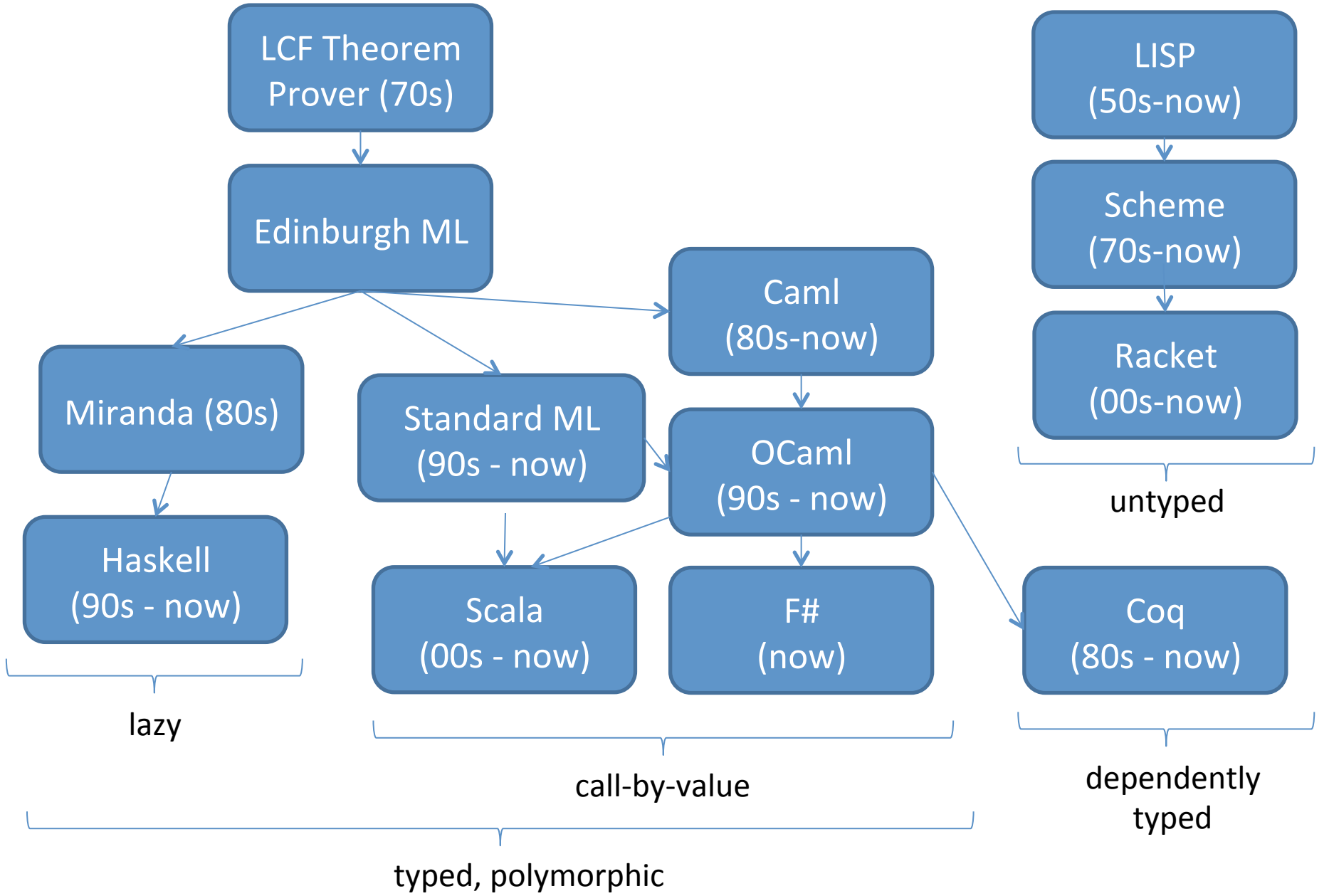
A bit of fun:

- http://www.malevole.com/mv/misc/killerquiz/



Have a go at these I recently made for E4: Janey Thomson's Marathon · Captcha Invaders · The Rather Difficult Game

Vastly Abbreviated FP Geneology



But Why Functional Programming *Now*?

- Functional programming will introduce you to new ways to *think about* and *structure* your programs:
  - new reasoning principles
  - new abstractions
  - new design patterns
  - new algorithms
  - elegant code

- Technology trends point to increasing parallelism:
  - multicore, gpu, data center
  - functional programming techniques such as map-reduce provide a plausible way forward for many applications

Functional Languages: Who's using them?

map-reduce in their data centers

Scala for
correctness, maintainability, flexibility

Erlang for
concurrency,
Haskell for
managing PHP

F# in Visual Studio

mathematicians

Coq proof of
4-color theorem

Haskell to
synthesize hardware

Haskell
for specifying
equity derivatives

www.artima.com/scalazine/articles/twitter_on_scala.html
gregosuri.com/how-facebook-uses-erlang-for-real-time-chat
www.janestcapital.com/technology/ocaml.php
msdn.microsoft.com/en-us/fsharp/cc742182
labs.google.com/papers/mapreduce.html
www.haskell.org/haskellwiki/Haskell_in_industry

Jane St Info Session

We're strong believes in the value of statically typed functional programming languages like OCaml, Scala and Haskell.

Blogging OCaml: https://ocaml.janestreet.com/

When: Thursday September 12, 7PM
Where: East Pyne 010

Functional Languages: Join the crowd

- Elements of functional programming are showing up all over
  - F# in Microsoft Visual Studio
  - Scala combines ML (a functional language) with Objects
    - runs on the JVM
  - C# includes “delegates”
    - delegates == functions
  - Python includes “lambdas”
    - lambdas == more functions
  - Javascript
    - find tutorials online about using functional programming techniques to write more elegant code
  - C++ libraries for map-reduce
    - enabled functional parallelism at Google
  - Java has generics and GC
  - …

COURSE LOGISTICS

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Resources

- Web:
  - http://www.cs.princeton.edu/courses/archive/fall13/cos326/
- Lecture schedule and readings:
  - $(coursehome)/lectures.php
- Assignments:
  - $(coursehome)/assignments.php
- Precepts
  - first half of semester (intermittent in 2nd half)
- Install OCaml: $(coursehome)/resources.php

Collaboration Policy

The COS 326 collaboration policy can be found here:

http://www.cs.princeton.edu/courses/archive/fall13/cos326/info.php#collab

Read it in full prior to beginning the first assignment.

Please ask questions whenever anything is unclear, at any time during the course.

Assignment 0

Figure out how to download and install OCaml
on your machine by the time precept begins tomorrow.

Resources Page:

http://www.cs.princeton.edu/courses/archive/fall13/cos326/resources.php