

CSCI-UA 490 Spring 2022

Special Topics In

Programming Languages

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What is this course?

It is **NOT** "Let's learn how to write
Java and C++ and Haskell and
JavaScript and..."

(though, there will be some of that!)

What is this course?

Languages are a conceptual universe [Perlis]

The original quote is: "A good programming language is a conceptual universe for thinking about programming."

Concepts

over

Syntax and Sales Pitch



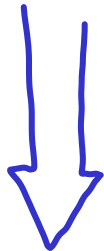
HEAVENLY REALM OF



Mathematics

APPROACH 1

Build languages
from first principles
to eliminate superficial
differences



Concepts



APPROACH 2

Distill concepts
from diverse existing
languages.



EARTHLY MATTERS

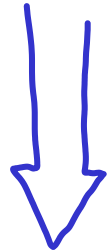
Real World Languages

HEAVENLY REALM OF

Mathematics

APPROACH 1

Build languages
from first principles
to eliminate superficial
differences



Concepts

This class ★

APPROACH 2

Distill concepts
from diverse existing
languages.



↑
but there's something
to be said for this
approach too!

EARTHLY MATTERS

Real World Languages

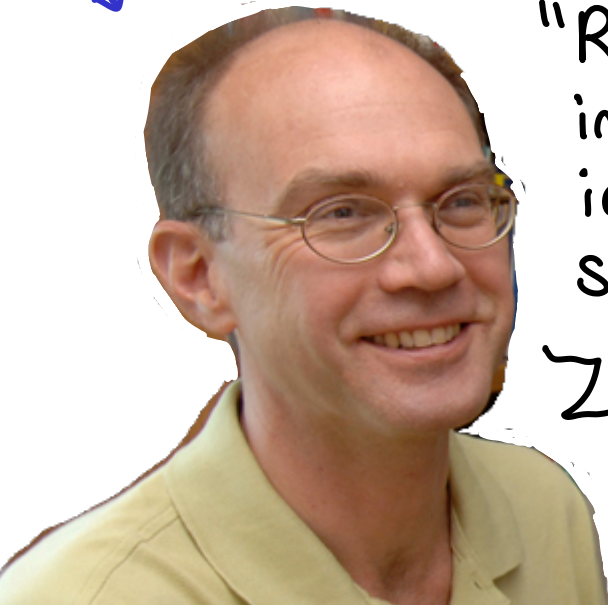
Themes:

- Concepts understand history, diversity of ideas in programming
- Critical Thought basis to draw comparisons, assess properties of language
- Implementation all features have trade offs and costs

↑ you don't really understand something until you build it!

Why should you care?

My PhD
advisor!



My algorithms instructor said:
"Recursion is a good idea though
inefficient. You can use the
idea in Fortran by storing the
stack in an array."

no recursive
functions in the 70s

Why should you care?

Futuristic ideas may be
useful problem-solving methods now
and part of languages you use
in the future.

More recently: higher-order functions, continuations,
monads, memory models...

Syllabus: The Big Ideas [Ramsey]

Say more with less!

| | |
|-----------------------|------------------|
| First-class functions | Pattern matching |
| Type inference | Type classes |
| Monads | Continuations |

Reliability and Reuse!

| |
|-----------------------|
| Objects & Inheritance |
| Modules Generics |

Cross-cutting concerns

| | |
|-------------------|-------------|
| Memory management | Concurrency |
|-------------------|-------------|

Syllabus: The Big Ideas

[Ramsey]

Say more with less!

First-class functions

Pattern matching

Type inference

Type classes

Monads

Continuations

- Midterm
Mar 9

Reliability and Reuse!

Objects & Inheritance

Modules

Generics

Cross-cutting concerns

Memory management

Concurrency

Final

Logistics

* except Feb 21 2nd 28, pushed to Wednesday on account of President's day

40% Weekly homework due **Monday***
immediately **before** class.

3 Late Days: No questions asked
(But you can only use one a week)

Collaboration: **Yes!**

You may submit solutions in pairs.
(But try to do it on your own first!)

25% Midterm & Final 35%

Take home, pencil and paper

Course website on Brightspace

Discussion, homework and announcements