Language Design: Back to the Future?

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Overview

1. Where are we at today?
2. Why are we where we are?
3. A glance backwards and sideways.
4. A gaze forward.

Part I: Where are we at today?

Where are we at today?

We've come a long way

- Always remember: software today is pretty good.
- Many programming languages to choose from.

Facing reality

Lisp sucks

Facing reality

Smalltalk sucks

Facing reality

Python sucks

Facing reality

Ruby sucks

Converge sucks

Facing reality

It sucks too!

The situation

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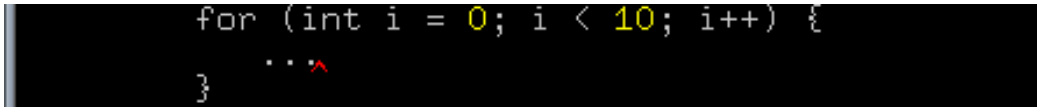

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- Is this a problem?
- If language A isn't good for your problem, language B probably isn't either...

Part II: Why are we where we are?

History is written by the victors.

- Winston Churchill (1874 - 1965)

The gene pool

Source: Wikipedia

Homogeneity

- Most languages draw influences from the same small pool.
- A cliché (but true): syntax is often the main differentiator.
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- Most languages draw influences from the same small pool.
- A cliché (but true): syntax is often the main differentiator.
- Differences are perceived as much larger than they really are.
- Why do languages vary so little?

Language communities

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- Language communities are *tribal?*
- Informed comparisons are rare.
- Language communities beget language designers.

Language designers

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- Problem #1: *really* learning a language is hard.
- Tend to have one dominant influence.

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- The obvious culprit?
- Problem #1: *really* learning a language is hard.
- Tend to have one dominant influence. Sometimes *only* one influence.
- Problem #2: designer vs. implementer.
- Implementation considered hard and expensive but vital for feedback.
- Problem #3: fear of failure.

Examples of a narrow perspective

- Scoping.
- Statements vs. expressions.

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- Scoping.
- Statements vs. expressions.
- Python: confusion of class meta-levels.
- Ruby: blocks aren't first-class.
- Converge: brain-dead class hierarchy.

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- New features are risky. Will they work?
- Most languages either:
  1. Have no new features.
  2. Have one or two new features.
  3. Didn't mean to have new features but bad design introduced them.
- Little risk of 'failure' if there are no new features.

An example

- Java checked exceptions.
- Possibly Java 1.0's only novel feature.
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try {
  f();
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- Checked exceptions: a bad idea.
- The fate of most novel language features: ridicule.

Language paper writers

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Language paper writers

- People who write papers: designers, extenders, pedants.
- Nearly always framed in terms of one language...
- ...its syntax, semantics, *and culture*.
- Extracting widely applicable ideas is extremely difficult.

Thesis

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Thesis

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- Language designers are timid and ignorant.
- Paper writers are obfuscators. And ignorant.

Part III: A glance backward ands sideways.

Icon

- The (indirect) successor to SNOBOL4.
- Dynamically typed PASCAL-ish language. But with unique expression evaluation system.
- Particularly intended for string processing.
- Expressions *succeed* (and produce a value) or *fail* and don't.
- ```
  if x := f():
    g(x)
  else:
    // x has no value
  ```
  ```

Icon

- Generators:

```
procedure upto(x)
  i := 0
  while i < x do {
    suspend i
    i := i + 1
  }
end

procedure main()
  every x := upto(10) do write(x)
end
```

- Conjunction:

```
every x := upto(10) & x % 2 == 0 do write(x)
```

Icon

- Print all words (from the Icon book):

```
text ? {
  while tab(upto(&letters)) do
    write(tab(many(&letters)))
  }
```

Icon

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- Pretty cool stuff (ignoring minor, rectifiable, design flaws).
- Integrated pretty much wholesale into Converge.
- Problem #1: `text.split(" ")`.
- Problem #2: regular expressions.
- Conclusion: much innovation, but only generators and failure in `if` useful.

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Compile-time meta-programming

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- ...and they ended with Lisp.
- Why?
- Until: MetaML (and Template Haskell).
- Simple inversion of Lisp: ‘macros’ are normal functions but ‘macro calls’ are special.
- `$<f>` is a macro call.
- Code isn’t lists; `[| 2 + 3 |]` evaluates to an AST `plus(int(2), int(3))`.

An example

```
func expand_power(n, x):
  if n == 0:
    return [| 1 |]
  else:
    return [| $c{x} * $c{expand_power(n - 1, x)} |]

func mk_power(n):
  return [|
    func (x):
      return $c{expand_power(n, [| x |])}
  |]

power3 := $<mk_power(3)>
```

means that `power3` looks like:

```
power3 := func (x):
  return x * x * x * 1
```

by the time it is compiled to bytecode.

The macros dark ages

- Oh the irony.

The macros dark ages

- Oh the irony.
- An example of insularity?
- Sometimes other communities see things our own can't.

XOM

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- XML is simple if you don't care about being correct.
- Standard answer: roll your own.
- Think outside the box: steal from XOM.

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- Converge needed an XML library. XML is easy, right? *No*.
- XML is simple if you don't care about being correct.
- Standard answer: roll your own.
- Think outside the box: steal from XOM.
- Thought: libraries effect users almost as much as languages.

Part IV: A gaze forward.

History will be kind to me, for I intend to write it.

- Winston Churchill (1874 - 1965)

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  - Orthodoxies aren't always right.
- Language designers need to experiment more.
  - Look back as well as sideways.
- Paper writers should focus less on an individual language and more on generic issues.

Success is not final, failure is not fatal: it is the courage to continue that counts.

- Winston Churchill (1874 - 1965)