Programming Languages as Designed Objects

Science & Technology in Society
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Multitudes...

- There are literally hundreds of different languages
- Why so many?
- Why one versus another?
- Is it language “evolution”?
- How does Science & Technology Studies approach programming language design and selection?
Hello World!

- A common introduction to a new language
- A simple program that displays the text “Hello World!”
  - Possibly the most trivial example of programming…

```java
class HelloWorld {
    public static void main (String args[]) {
        for (;;) {
            System.out.print("Hello World ");
        }
    }
}
```

- All code samples from:
Practitioners & Partisans

with Text_Io; use Text_Io;

procedure hello is
  begin
    put ("Hello world!");
  end hello;

BEGIN
  FILE F (KIND=REMOTE);
  EBCDIC ARRAY E [0:11];
  REPLACE E BY "HELLO WORLD!";
  WHILE TRUE DO
    BEGIN
      WRITE (F, *, E);
    END;
  END.

-- occam
PROC write.string(CHAN output, VALUE string[]) =
  SEQ character.number = [1 FOR string[BYTE 0]]
  output ! string[BYTE character.number]

write.string(terminal.screen, "Hello World!")
Practitioners & Partisans

- IT Trade Literature
  - “General-purpose languages [...] are usually created either to address existing languages' inadequacies, to fill some business need, or both” (Mark Johnson, JavaWorld.com, 2000)
    - Technical objectives and market forces
    - Hidden debate
      - Language categories
      - Definition of “inadequacies”
      - Organizational concerns

- Fan Literature
  - Proliferation alone shows partisanship
    - Corrections to the Hello World! entry for Algol
Technical literature downplays the social
  - Even “comprehensibility” is technical, rather than social

Authoritative Reminiscences
  - Place social motivations outside the scope of designers (e.g., Sun & Java)

Actual histories (internalist)
  - Case of C++
  - Goals for the maintenance of C++: to “keep the language from fragmenting into dialects” and to “keep the language and its community from stagnating” (Bjarne Stroustrup, HOPL III, 2007)
  - However, retains active denial of the social—success is purely technical
Computer Science – Critics & Visionaries

*Elegance*

- Analogy with engineering (Bruce MacLennan, 1997)
  - *The Tower and the Bridge*, David P. Billington
- Promote a “set of values” (MacLennan)
- The exception, rather than the rule
Hello World!

BASIC
10 print"Hello World!"
20 goto 10

C++
#include <iostream>

int main()
{
    std::cout << "Hello, world!\n";
}

LISP
(DEFUN HELLO-WORLD ()
    (PRINT (LIST 'HELLO 'WORLD)))
“It is practically impossible to teach good programming to students that have had prior exposure to BASIC: as potential programmers they are mentally mutilated beyond hope of regeneration.”

Dijkstra, Edsger, “How do we tell truths that might hurt?” ACM Technical Note EWD498 (18 June 1975)
Hello World!

```
IDENTIFICATION DIVISION.
PROGRAM-ID. HELLOWORLD.
DATE-WRITTEN. 02/05/96 21:04.
* AUTHOR BRIAN COLLINS
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SOURCE-COMPUTER. RM-COBOL.
OBJECT-COMPUTER. RM-COBOL.
DATA DIVISION.
FILE SECTION.
PROCEDURE DIVISION.
MAIN-LOGIC SECTION.
BEGIN.
DISPLAY " " LINE 1 POSITION 1 ERASE EOS.
DISPLAY "HELLO, WORLD." LINE 15 POSITION 10.
STOP RUN.
MAIN-LOGIC-EXIT.
EXIT.
```
Dijkstra on COBOL

“The use of COBOL cripples the mind; its teaching should, therefore, be regarded as a criminal offense.”

Dijkstra, Edsger, “How do we tell truths that might hurt?” ACM Technical Note EWD498 (18 June 1975)
Hello World!

Fortran

```fortran
program hello

implicit none
logical done

do while (.not. done)
   write(*,10)
end do

10 format('hello, world. ')
end
```

Pascal

```pascal
program hello (input, output);
begin
   writeln ('hello world!');
end.
```

C

```c
Hello, world.

program hello

implicit none
logical done

do while (.not. done)
   write(*,10)
end do

10 format('Hello, world.')
end
```
“‘The infantile disorder’—, by now nearly 20 years old, is hopelessly inadequate for whatever computer application you have in mind today: it is now too clumsy, too risky, and too expensive to use.”

Dijkstra, Edsger, “How do we tell truths that might hurt?” ACM Technical Note EWD498 (18 June 1975)
Eye of the Beholder: Style & Elegance

Transcript show: 'Hello World'; cr

; LISP
(DEFUN HELLO-WORLD ()
  (PRINT (LIST 'HELLO 'WORLD)))

class HELLO_WORLD

creation make

feature

  make is
do
    io.put_string("Hello World in Eiffel.%N")
  end  -- make
end  -- class HELLO_WORLD
Eye of the Beholder: “Amateurish”

BASIC

10 print"Hello World!"
20 goto 10

Perl

print "Hello, World!\n" while (1);
Social Science Literature

- Methodological / theoretical pieces, but no direct application to programming language design
  - Craft to Architectural tradition in shipbuilding – as a metaphor for IT and programming language design specifically (David McGee)
- Comparing non-programmers to the IT industry (a la Turkle and Papert, 1990)
- Control as the primary factor (a la Turkle)
  - Control of what, though?
    - The computer?
    - The functions?
    - The knowledge?
    - The economy?
Why?

- Technical considerations are critical
  - Platforms (Assembler, C)
  - Specific applications (algorithms, speed - Fortran)
- Languages do not “evolve”, they are constructed
  - Control (Ada, Algol, COBOL, C#, Assembler)
  - Power/Knowledge (Forth, Assembler)
  - Style (Smalltalk, Algol)
  - Philosophy (Haskell, Algol, Forth)
  - Market Forces (Java, C#, J)
  - Organizational Considerations (COBOL, Ada)
How?

- Not at all...
  - Too little Science & Technology focus
  - Languages are a black box
    - Not analyzed in parallel means
  - Tools, methods, theories exist
    - Craft Tradition
    - Knowledge / power relationships
    - Political Economics