

Topic 2:

Concepts of Programming Language Design

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What Makes a Language Successful?

Some possibilities:

- Makes its designer(s) famous and wealthy?
- Fulfills the designers' objectives?
- Widely adopted by developers?
- Is the standard language for a class of software?
- Starts a family of related languages?

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Historical Perspectives (1 / 4)

The earliest languages:

...ran on slow, expensive, and unreliable hardware, making the only real concern ...

Historical Perspectives (2 / 4)

By the 1960s:

...computers were more prevalent, capable, and reliable (transistors!), giving designers freedom to add ...

Historical Perspectives (3 / 4)

By the 1970s:

... many more characteristics were of interest, such as ...

Historical Perspectives (4 / 4)

By the 1980s:

...newer language paradigms had appeared, beyond object-oriented, functional, and logic, such as ...

Desirable Language Characteristics (1 / 10)

(1) Efficiency (1 / 2)

On the computer side:

(a)

(b)

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Desirable Language Characteristics (2 / 10)

(1) Efficiency (2 / 2)

On the programmer side:

(c)

(d)

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Desirable Language Characteristics (3 / 10)

(2) Regularity (1 / 4) — Consists of three sub-ideas:

(a)

Desirable Language Characteristics (4 / 10)

(2) Regularity (2 / 4)

(b)

Desirable Language Characteristics (5 / 10)

(2) Regularity (3 / 4)

(c)

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Desirable Language Characteristics (6 / 10)

(2) Regularity (4 / 4)

(d) Uniformity (continued)

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Desirable Language Characteristics (7 / 10)

(3) **Security / Reliability** — the language's ability to resist errors that could be created by a programmer

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Desirable Language Characteristics (8 / 10)

(4) **Extensibility** — the ability to add constructs to the language

Two potential sources of new features:

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Desirable Language Characteristics (9 / 10)

(5) Readability and Writability

These apply to all of the previous characteristics, but are worth considering on their own, because:

- Language features impact programmers' abilities to express solutions (writability), and
- Language features affect programmers' abilities to comprehend what other programmers — even themselves! — have written (readability).

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Desirable Language Characteristics (10 / 10)

We could go on! For example:

- **Expressiveness** (see also 'Efficiency')
 - Can the language articulate programmers' ideas?
- **Precision** (of a language's definition)
 - Is the behavior of all programs well-defined?
- **Machine Independence**
 - Portability of data precision across architectures?
 - Can we exploit parallel / distributed hardware?
- **Consistency** (with other languages)
 - Can experienced programmers easily learn / use the language?
- **Restrictability**
 - Can a subset of the language be used effectively?

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