Concepts of Programming Languages, 4th Ed

Chapter 1:
Preliminaries

Reasons to study concepts of Programming Languages

1. **Increased capacity to express programming concepts**
2. **Improved background for choosing appropriate languages**
3. **Increased ability to learn new languages**
4. **Understanding the significance of implementation**
5. **Increased ability to design new languages**
6. **Overall advancement of computing**

Programming Domains

1. **Scientific applications**
2. **Business applications**
3. **Artificial intelligence**
4. **Systems programming**
5. **Scripting languages**
6. **Special purpose languages**

Language Evaluation Criteria
1. Readability

The most important criterium
Factors:
- **Overall simplicity**
  - ***Too many features is bad***
  - ***Multiplicity of features is bad***
- **Orthogonality**
  - ***Makes the language easy to learn and read***
  - ***Meaning is context independent***
- **Control statements**
- **Data type and structures**
- **Syntax considerations**

Language Evaluation Criteria
2. Writability

Factors:
- **Simplicity and orthogonality**
- **Support for abstraction**
- **Expressivity**

Language Evaluation Criteria
3. *Reliability*

- ***Factors:***
  - **Type checking**
  - **Exception handling**
  - **Aliasing**
  - **Readability and writability**

Language Evaluation Criteria
4. Cost

- ***Categories***
  - **Programmer training**
  - **Software creation**
  - **Compilation**
  - **Execution**
  - **Compiler cost**
  - **Poor reliability**
  - **Maintenance**

Language Evaluation Criteria
5. Other Criteria

- **portability**
- **generality**
- **well-definedness**

Primary influences on language design

1. *Computer architecture*
- **We use imperative languages, at least in part, because we use von Neumann machines**

2. *Programming methodologies*
- ***1950s and early 1960s:*** **Simple applications; worry about machine efficiency**
- ***Late 1960s:*** **People efficiency became important; readability, better control structures**
- ***Late 1970s:*** **Data abstraction**
- ***Middle 1980s:*** **Object-oriented programming**

Language Categories

1. **Imperative**
2. **Functional**
3. **Logic**
4. **Object-oriented (closely related to imperative)**

Language Design Trade-Offs

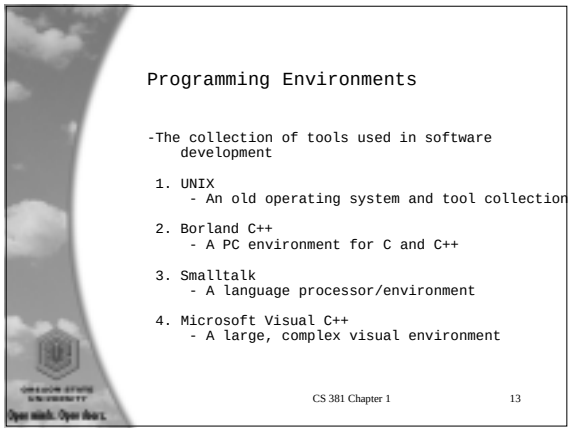
1. **Reliability versus cost of execution**
2. **Writability versus readability**
3. **Flexibility versus safety**

Implementation Methods

1. Compilation
- **Translate high-level program to machine code**
- **Slow translation**
- **Fast execution**

2. Pure interpretation
- **No translation**
- **Slow execution**
- **Becoming rare**

3. Hybrid implementation systems
- **Small translation cost**
- **Medium execution speed**


Programming Environments
-The collection of tools used in software development
1. UNIX
- An old operating system and tool collection
2. Borland C++
- A PC environment for C and C++
3. Smalltalk
- A language processor/environment
4. Microsoft Visual C++
- A large, complex visual environment
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