User Interaction

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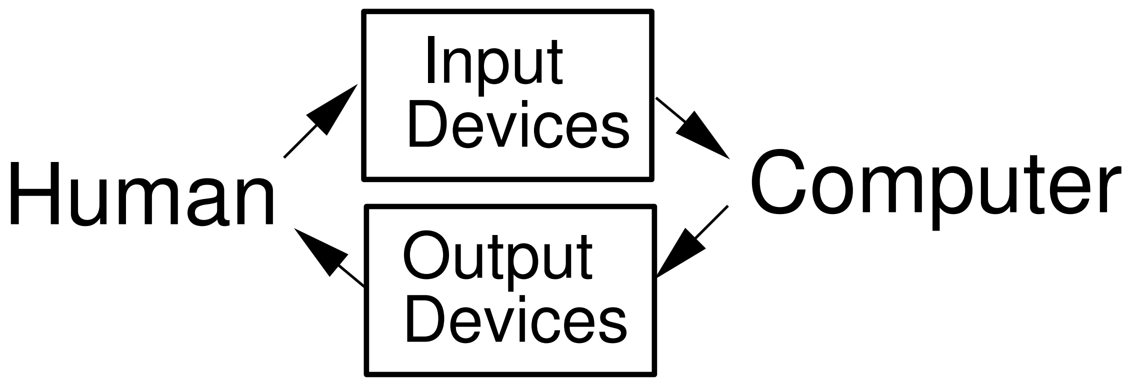
Overview

- **User Interface Design**
  - Levels of abstraction
  - Design considerations
  - Methodology
- **User Interface Software**
  - Interaction models
  - Window systems
  - User interface toolkits
  - UIMS

User Interface Design

- **Underlying idea:**
  "Human – computer interaction
  should be similar to
  human – human interaction"



- **Human conversation:**
  – Language
  – Continual feedback
  – Allows interruption
  – Shared background knowledge
  – Definition of new terms
  – Threads of conversation (modes)

User Interface Design

- **Levels of Abstraction**
  - Conceptual Abstraction
  - Functional Abstraction
  - Syntactic Abstractions
  - Lexical Abstractions

Conceptual Abstraction

- **User Model**
  - The metaphor or analogy

- **Defines ...**
  - Objects
  - Properties of objects
  - Relationships between objects
  - Operations on objects

- **Considerations**
  - Know your problem
    e.g., user requirements, ...
  - Know your user
    e.g., typing skills, ...

Functional Abstraction

- **Interaction Specification**
  - Command sequences
  - Command parameters
  - Command errors
  - Modes
  - Help

- **User Interface Styles**
  - Command languages
    (type commands)
  - Iconic interfaces
    (menus, buttons, icons, etc.)
  - Direct Manipulation
    (manipulate visual objects)
  - What you see is what you get
    (WYSIWYG)

Syntactic Abstractions

- **Input Tasks**
  - Text input
    e.g., type text, point text, ...
  - Position input
    e.g., point, type coords, valuators, ...
  - Selection input
    e.g., point, type name, ...
  - Choice input
    e.g., menu, function keys, ...
  - Quantity input
    e.g., type value, valuators, ...

- **Output Tasks**
  - Prompts
  - Results
  - Status

Lexical Abstractions

- **Input Devices**
  - Keyboard devices
    e.g., keyboard, keypad, ...
  - Locator devices
    e.g., mouse, tablet, trackball, ...
  - Valuator devices
    e.g., knobs, ...
  - Choice devices
    e.g., function keys, ...

- **Output Devices**
  - Display devices
    e.g., CRT, LCD, ...

Design Considerations

- Be consistent
- Provide feedback
- Minimize error possibilities
- Provide error recovery
- Accomodate multiple skill levels
- Minimize memorization
- Clearly indicate current mode. Provide easy exit from modes.

Visual Layout

- **Visual Clarity**
  - Proximity, similarity,
- **Visual Coding**
  - Color, shape, size, typeface, orientation, intensity, texture, line width, line style, location
- **Visual Consistency**

Methodology

- **Top–Down Design**
  - Develop user model
  - Choose user interface styles
  - Write functional specification
  - Map function to syntax
  - Assign devices
- **Prototype & Experiment**
  - Rapid prototypes
  - User studies

User Interface Software

- Interaction models
- Window systems
- User interface toolkits
- UIMS

Interaction Models

- **Request mode**
  - Synchronous
  - Blocking
- **Sample mode**
  - Synchronous
  - Non–blocking
  - Poll many devices
- **Event mode**
  - Asynchronous
  - Non–blocking
  - Interrupts from many devices
  - Manage event queue

Window Systems

- **Key idea:**
  - Manage shared keyboard, mouse, and screen resources
    e.g., X, Windows95, NeWS, ...
- **Window system events:**
  - Keyboard events
    e.g., key press, key release,...
  - Mouse events
    e.g., button press, motion, ...
  - Window events
    e.g., window expose, window resize, ...
- **Considerations**
  - Input routing
    e.g., keyboard focus
  - Client–Server

User Interface Toolkits

- **Key idea:**
  - Software libraries for typical user interaction techniques
    e.g., Xt, Motif, Tk, ...
- **Widgets:**
  - Dialog box, menu, text box, toggle button, message box, radio button, list box, ...
- **Considerations**
  - Object–oriented
  - Direct manipulation editors

UIMS

- **Key idea:**
  - High level tool for user interface design
- **Sequence control tools:**
  - State diagrams
  - BNF
- **Automatic generation:**
  - Visual layout
  - Iconic interfaces

Summary

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  - Design considerations
  - Methodology
- **User Interface Software**
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  - Window systems
  - User interface toolkits
  - UIMS
- **Related Reading**
  - Foley, Van Dam (ch 8, 9, 10)
  - Hearn & Baker (ch 8)