04 Interaction

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What is Interaction?

- Interaction : Communication between user and system
- Several ways that a user can communicate with a system
  - Batch Input
    - User provides all the information to the computer at once and leaves the machine to perform the task
  - Highly interactive input devices and paradigms
    - Direct manipulation
      - E.g.: Resizing a graphical shape
    - Applications of virtual reality

Models of Interaction

- Involves at least two participants
  - User
  - System
- Both are complex; different from each other in the way that they communicate and view the domain and the task
- Then the interface is used
  - Effectively translate between them to allow the interaction to be successful

Models of Interaction cont.

- Two models are used in this lecture to describe the interaction in terms of the goals and actions of the user
  - Norman's execution-evaluation cycle
  - The Interaction Framework

Terms of Interaction

- Domain
  - Defines an area of expertise and knowledge in some real-world activity
- Tasks
  - Operations to manipulate the concepts of a domain
- Goal
  - The desired output from a performed task
- Intention
  - A specific action required to meet the goal

Terms of Interaction cont.

- Task Analysis
  - Involves the identification of the problem space for the user of an interactive system in terms of the domain, goals, intentions and tasks
- Core Language
  - Describes computation aspects of the domain
- Task Language
  - Describes psychological aspects of the domain

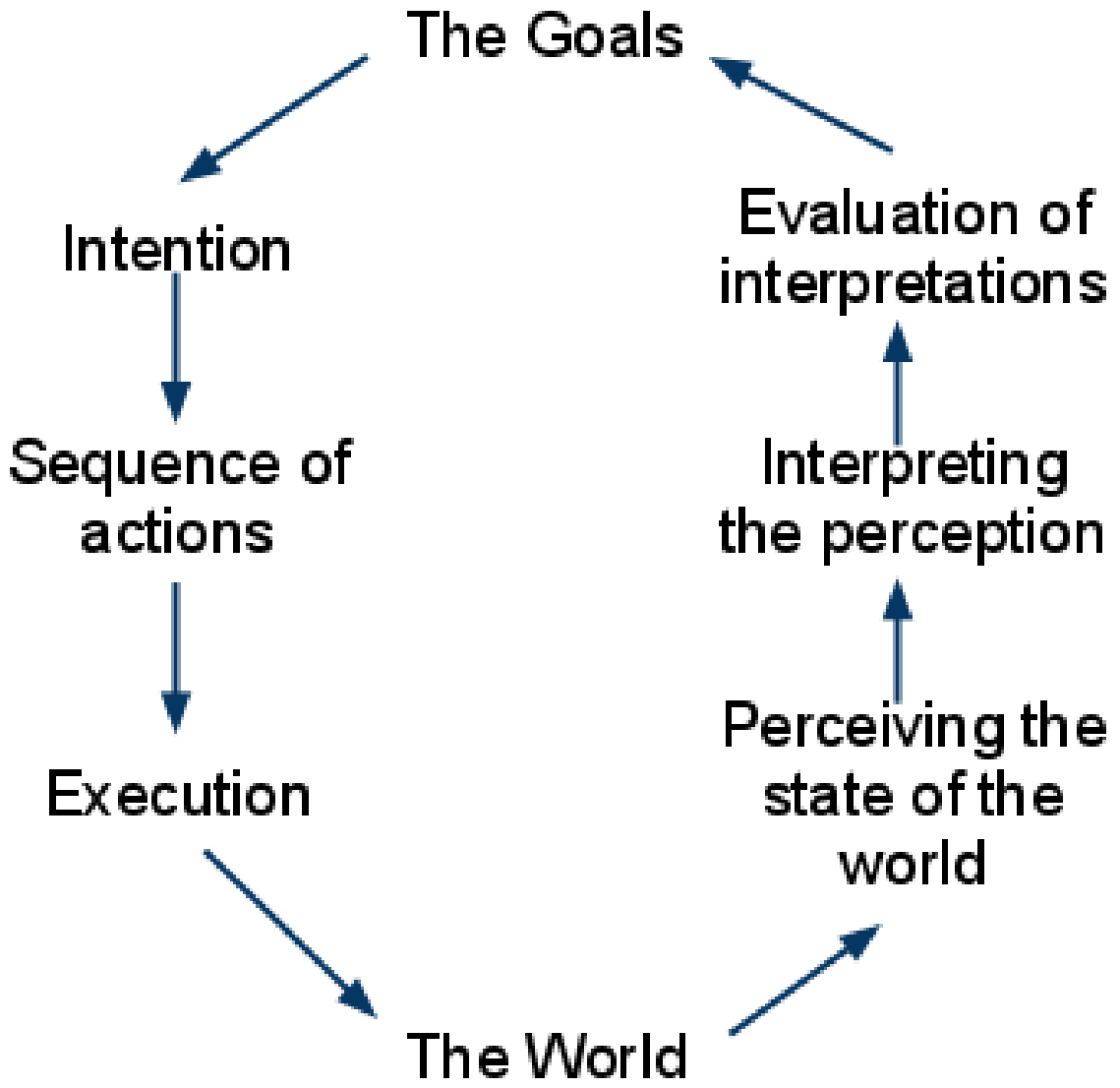
Norman's Model

- Norman's model of interaction is perhaps the most influential in Human–Computer Interaction
- Interactive cycle can be divided into two major phases
  - Execution
  - Evaluation

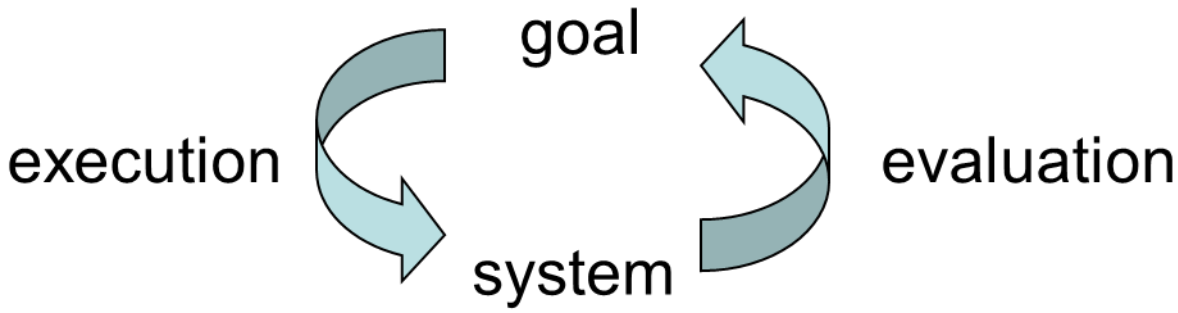
Norman's Model

- The stages in Norman's model of interaction:
  1. Establishing the goal
  2. Forming the intention
  3. Specifying the action sequence
  4. Executing the action
  5. Perceiving the system state
  6. Interpreting the system state
  7. Evaluating the system state with respect to the goals and intentions

Norman's Model



Execution/Evaluation Loop



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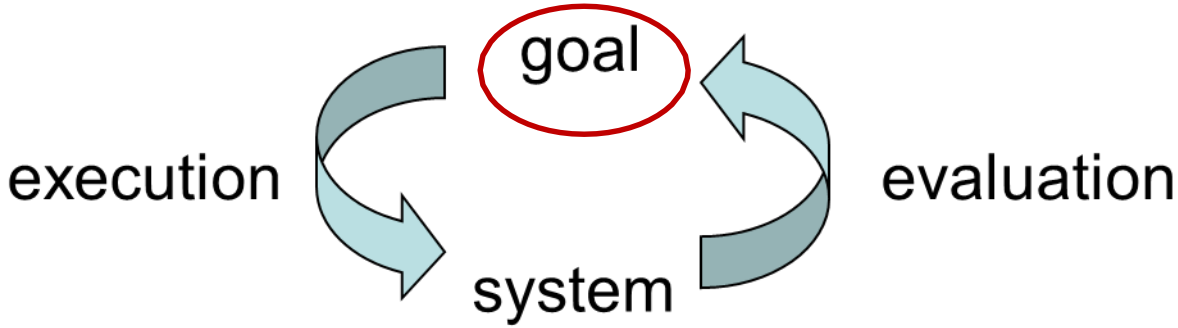

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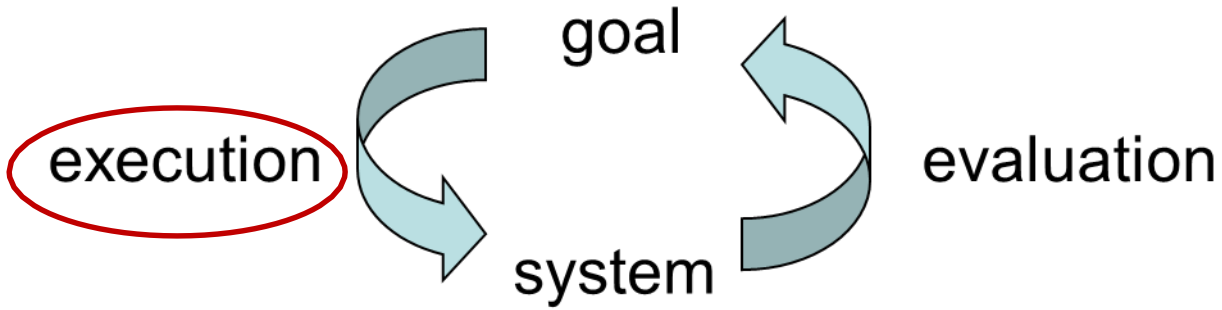

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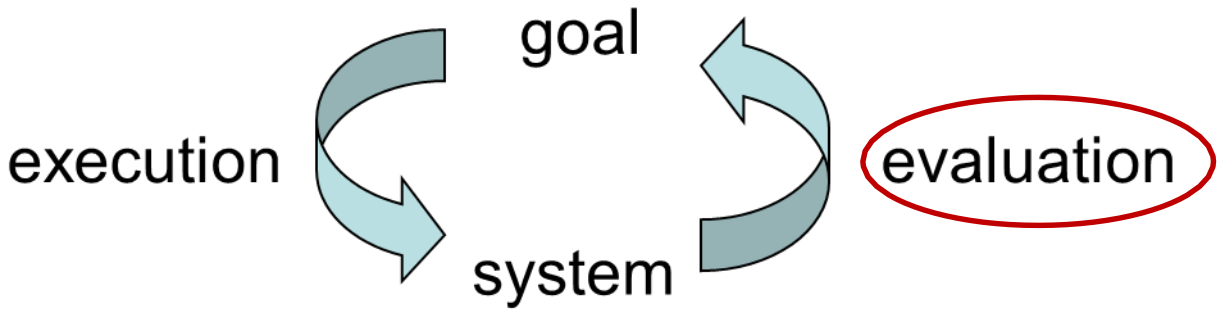

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Norman's Model cont.

- Norman uses this model of interaction to demonstrate why some interfaces cause problems to their users.
  - Gulfs of Execution
    - Difference between the user's formulation of the actions to reach the goal and the actions allowed by the system
  - Gulfs of Evaluation
    - The distance between the physical presentation of the system state and the expectation of the user

Human Error – Slips and Mistakes

- Human errors are often classified into two.
- **Slips**
  - You have formulated the right action, but fail to execute that action correctly
- **Mistakes**
  - You don’t know the system well you may not even formulate the right goal

Slips and Mistakes

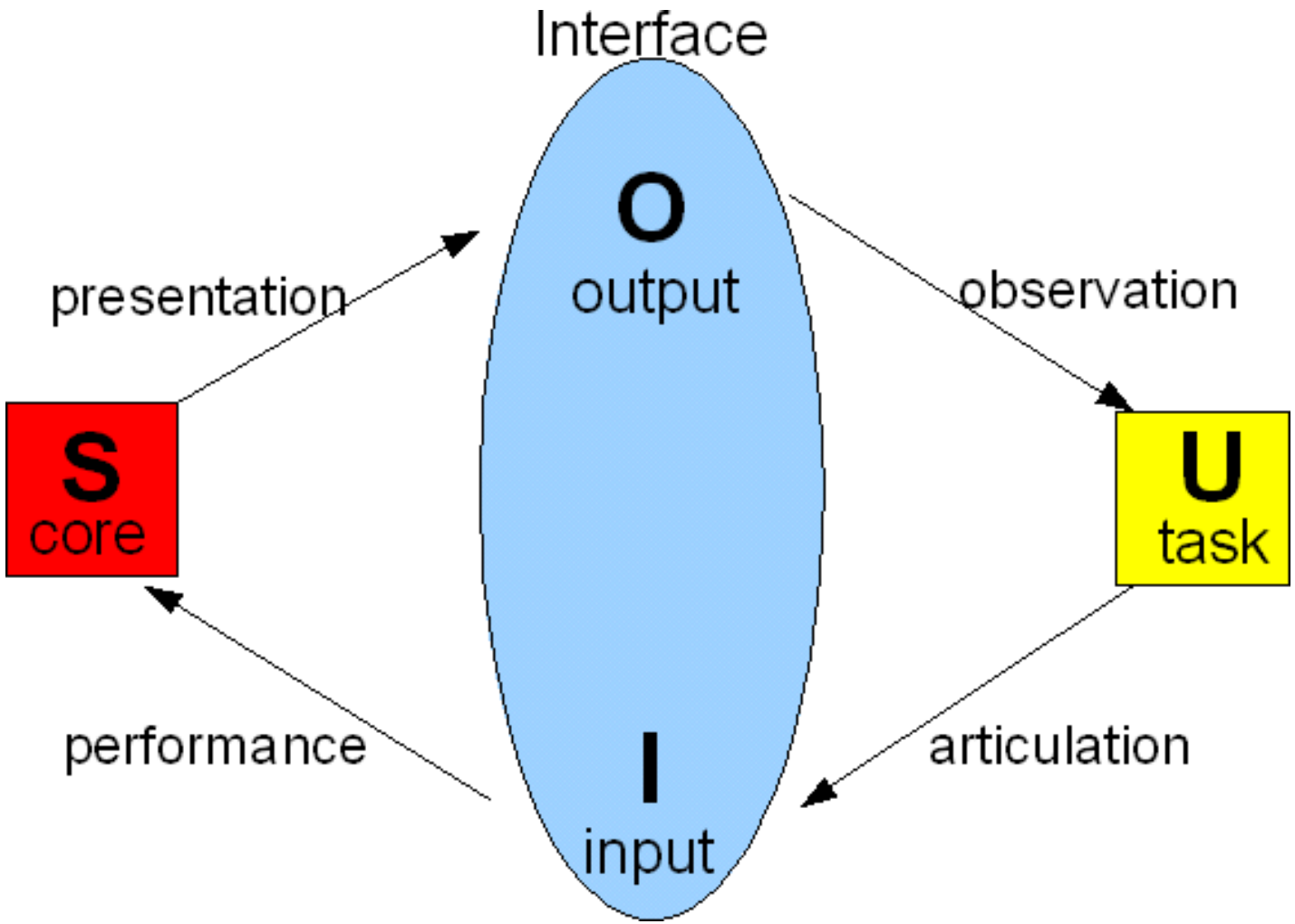
- Slip
  - Understand system and goal
  - Correct formulation of action
  - Incorrect execution
- Mistake
  - May not even have right goal!
- Fixing things?
  - Slip – better interface design
  - Mistake – better understanding of system

The Interaction Framework

- The interaction framework attempts a more realistic description of interaction by including the system explicitly, and breaks it into four main components.

- System
- User
- Input
- Output

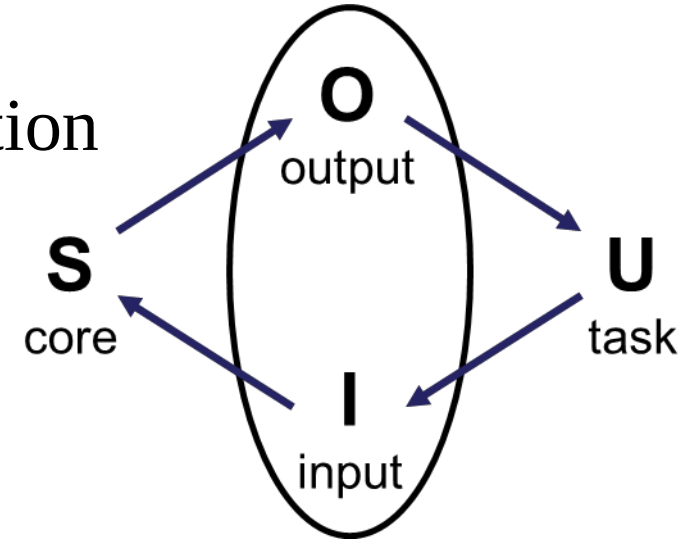
The Interaction Framework



The Interaction Framework cont.

- Each part (component) has its own unique language
  - Input + Output = Interface
  - Interaction → translation between languages

Problems in Interaction = Problems in Translation

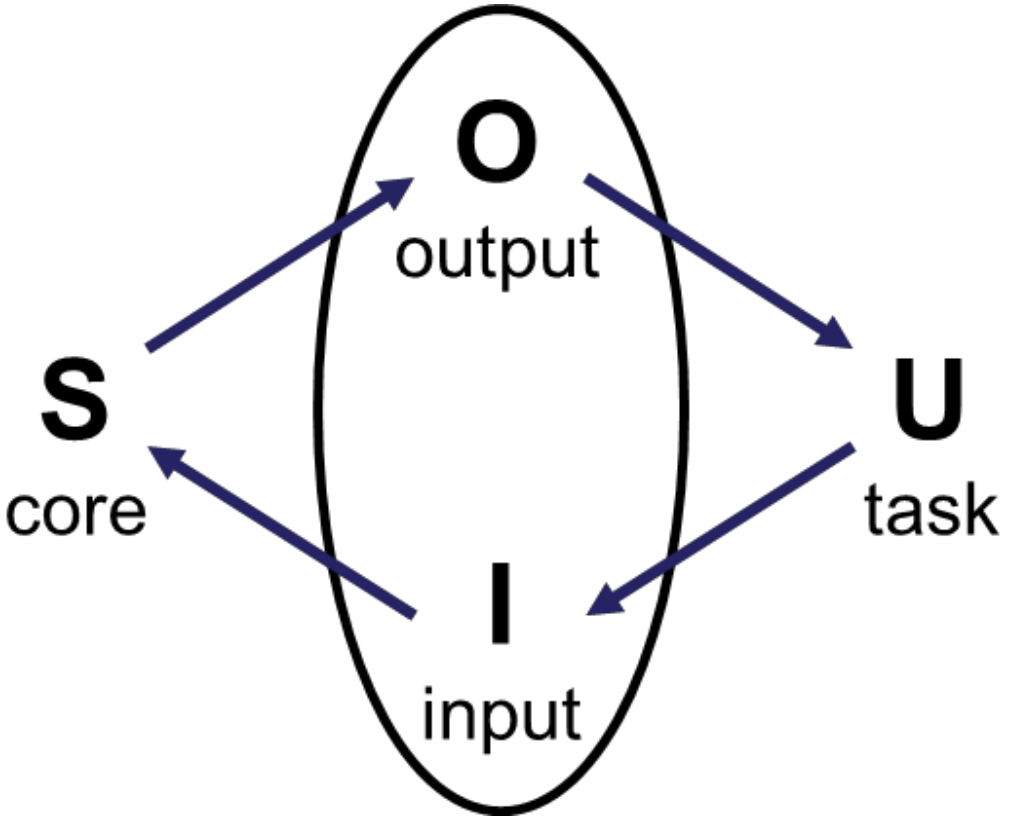


Translation between Languages

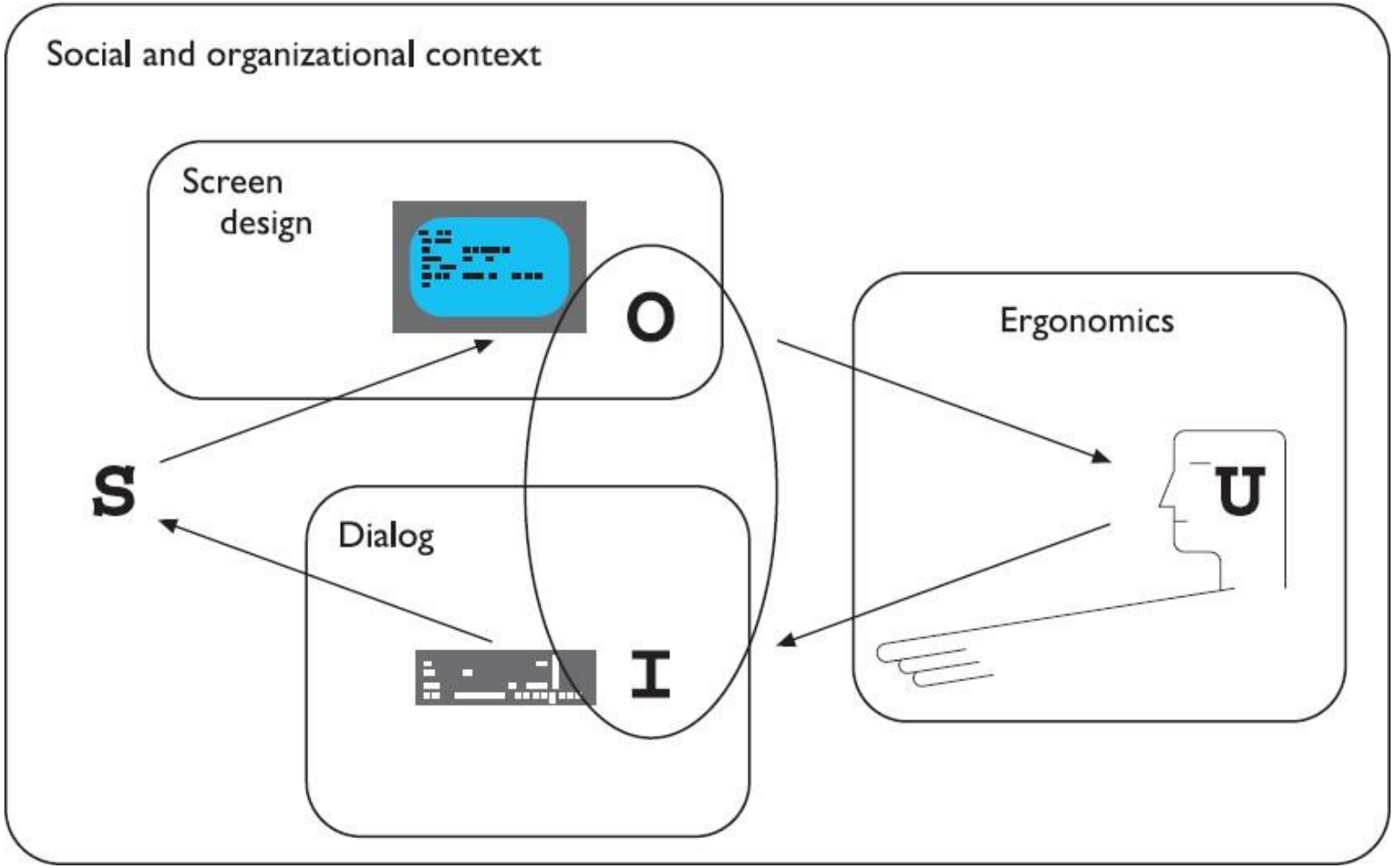
- Interface sits between the User and the System
- Four steps in the interactive cycle
  - Presentation
  - Performance
  - Observation
  - Articulation
- Each corresponding to a translation from one component to another

Translation between Languages cont.

- S-O: Presentation
- I-S: Performance
- O-U: Observation
- U-I: Articulation



Frameworks and HCI



Ergonomics

- Study of the physical characteristics of interaction
- Also known as human factors
- Ergonomics good at defining standards and guidelines for constraining the way we design certain aspects of systems

Interaction Styles

- Interaction can be seen as a dialog between the computer and the user.
- There are a number of common interface styles
  - Command line interface
  - Menus
  - Natural language
  - Question/answer and query dialog
  - Form-fills and spreadsheets
  - WIMP
  - Point and click
  - Three-dimensional interfaces

Command Line Interface

- Way of expressing instructions to the computer directly
  - function keys, single characters, short abbreviations, whole words, or a combination
- Suitable for repetitive tasks
- Better for expert users than novices
- Offers direct access to system functionality
- Command names/abbreviations should be meaningful!

Menus

- Set of options displayed on the screen
- Options visible
  - Less recall - easier to use
  - Rely on recognition so names should be meaningful
- Selection by:
  - Numbers, letters, arrow keys, mouse
  - Combination (e.g. mouse plus accelerators)
- Often options hierarchically grouped
  - Sensible grouping is needed

Natural Language

- Familiar to user – most attractive means of communicating with computers
- Speech recognition or typed natural language
- Problems
  - Vague
  - Ambiguous (“the boy hits his friend with the stick”)
- Solutions
  - Try to understand a subset
  - Pick on keywords

Query Interfaces

- Question/answer interfaces
  - User led through interaction via series of questions
  - Suitable for novice users but restricted functionality
  - Often used in information systems
- Query languages (E.g. SQL)
  - Used to retrieve information from database
  - Requires understanding of database structure and language syntax, hence requires some expertise

Form-Fills

- Primarily for data entry or data retrieval
- Screen like paper form
- Data put in relevant place
- Requires
  - Good design
  - Obvious correction facilities

Spreadsheets

- First spreadsheet VISICALC, followed by
  - Lotus 1-2-3
  - MS Excel most common today
- Sophisticated variation of form-filling
- Grid of cells contain a value or a formula
- Formula can involve values of other cells
  - E.g. sum of all cells in this column
- User can enter and alter data spreadsheet maintains consistency

WIMP Interface

- WIMP
  - Windows
  - Icons
  - Menus
  - Pointers
- Default style for majority of interactive computer systems, especially PCs and desktop machines.

Windows

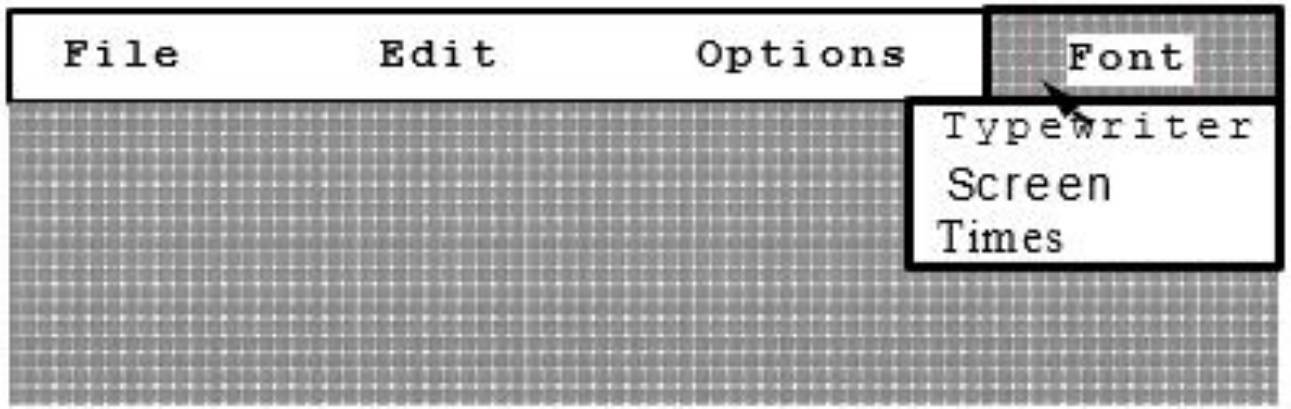
- Areas of the screen that behave as if they were independent
  - can contain text or graphics
  - can be moved or resized
  - can overlap and obscure each other, or can be laid out next to one another (tiled)
- Scrollbars
  - allow the user to move the contents of the window up and down or from side to side
- Title bars
  - describe the name of the window

Icons

- Small picture or image
- Represents some object in the interface
  - Often a window or action
- Windows can be closed down (iconized)
  - Small representation many accessible windows
- Icons can be many and various
  - Highly stylized
  - Realistic representations

Menus

- Choice of operations or services offered on the screen
- Required option selected with pointer



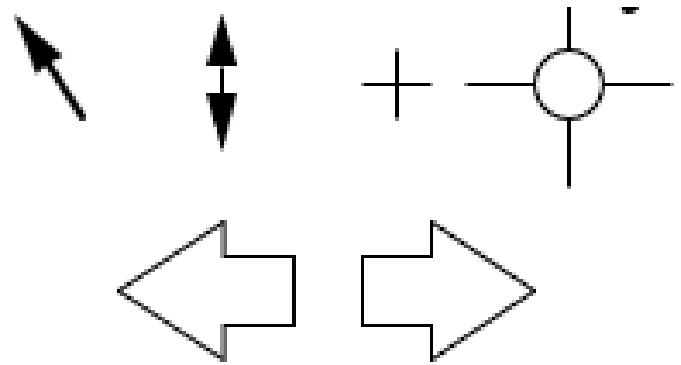
- problem – take a lot of screen space
- solution – pop-up menu appears when needed

Types of Menus

- Menu Bar at top of screen (normally), menu drags down
  - pull-down menu - mouse hold and drag down menu
  - drop-down menu - mouse click reveals menu
- Contextual menu appears where you are
  - pop-up menus - actions for selected object
  - pie menus - arranged in a circle

Pointers

- Important component
  - WIMP style relies on pointing and selecting things
- Uses mouse, trackpad, joystick, trackball, cursor keys or keyboard shortcuts
- Wide variety of graphical images for pointer cursors to tell the user about the system activity



Point and Click Interfaces

- Used in,
  - Multimedia
  - Web browsers
  - Hypertext
- Just click something!
  - Icons, text links or location on map
- Minimal typing

Interactivity

- What is interactivity?
  - The way system reacts to a user's actions
  - Less obvious than visual components
- Examples:
  - Information Visualization System
  - Speech-driven interfaces (yes/no)

Have a nice day!