Chapter 3

The interaction
The interaction

Chapter outline

• Model of interaction.
  – The terms of interaction
  – The execution-evaluation cycle.
  – Donald Norman’s model of Interaction
  – Abowd and Beale interaction framework

• Ergonomics.

• Interaction styles.
Models of interaction
Model of interaction

- **Interactions involves two participants**

  communication

  user ← → system

- **Why develop a model for Interaction**
  - Identify and evaluate components of interaction.
  - Understand what is going in the interaction between user and system.
  - Address the translation between what the user wants and what the system does.
  - provide a framework to compare different interaction.
Some terms of interaction

• **Domain** – the area of work under study
  *Example*: graphic design

• **Goal** – what you want to achieve
  *Example*: create a solid red triangle

• **Task** – how you go about doing it ultimately in terms of operations or actions
  *Example*: select fill tool, click over triangle.

• **Intention** – specific action required to meet the goal.
The execution-evaluation cycle
Donald Norman’s model
Donald Norman’s model

- It is clear and intuitive.
- the most influential model in HCI
- Consist of seven stages:
  1. user establishes the goal
  2. formulates intention
  3. specifies actions at interface
  4. executes action
  5. perceives system state
  6. interprets system state
  7. evaluates system state with respect to goal and intention
- Concentrates on user’s view of the interface
## Norman example-Switching on light

<table>
<thead>
<tr>
<th>The Seven Stages of Action</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. user establishes the goal</td>
<td>You're sitting reading as evening falls, you decide you need more light.</td>
</tr>
<tr>
<td>2. Forming the intention</td>
<td>switch on the light, or ask someone else to switch on the light</td>
</tr>
<tr>
<td>3. Specifying the action</td>
<td>You specify the actions required to reach over and press the lamp switch.</td>
</tr>
<tr>
<td>4. Executing the action.</td>
<td>carrying out those steps</td>
</tr>
<tr>
<td>5. Perceiving the system state</td>
<td>The light is on.</td>
</tr>
<tr>
<td>6. Interpreting the system state</td>
<td>If the light does not come on you may interpret this as indicating the bulb has blown or the lamp is not plugged into the mains.</td>
</tr>
<tr>
<td>7. evaluates system state with respect to goal and intention</td>
<td>Is there now enough light? If so, the cycle complete. If not you may formulate a new intention</td>
</tr>
</tbody>
</table>
• User establishes the goal
• Formulates intention
• Specifies actions at interface
• Executes action
• Perceives system state
• Interprets system state
• Evaluates system state with respect to goal and intention
Execution/Evaluation loop

- User establishes the goal
- **Formulates intention**
- **Specifies actions at interface**
- **Executes action**
- Perceives system state
- Interprets system state
- Evaluates system state with respect to goal and intention
Execution/Evaluation loop

- User establishes the goal
- Formulates intention
- Specifies actions at interface
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- Evaluates system state with respect to goal and intention
Some systems are harder to use than others; **Norman’s** describe those problems in terms of:

<table>
<thead>
<tr>
<th>The gulf of execution</th>
<th>The gulf of evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The difference between the user’s formulation of the actions to reach the goal and the actions allowed by the system.</td>
<td>The distance between the physical presentation of the system state and the expectation of the user.</td>
</tr>
</tbody>
</table>
Gulf of execution - Example

Videocassette recorder

Several actions must be taken:

• Press the record button.

• Specify time of recording, usually involving several steps to change the hour and minute settings.

• Select channel to record on - either by entering the channel's number or selecting it with up/down buttons.

• Save the recording settings, perhaps by pressing an "OK" or "menu" or "enter" button.

The difference between the user's perceived execution actions and the required actions is called the gulf of execution.
Using Norman’s model
Human error - slips and mistakes

- **Slip**
  - Understand system and goal
  - Correct formulation of action
  - Incorrect action
    
    *Example:* mistype or press the mouse button at the wrong time

- **Mistake**
  - You don't know the system well you may not even have right goal!
    
    *Example:* you Think is ‘find’ function, but in fact it is to magnify the text.

To Fix errors?

- **Slip** – make a better interface design.. e.g. Putting more space between buttons.
- **Mistake** – Good understanding of the system
Abowd and Beale Interaction framework
Abowd and Beale Interaction framework

- extension of Norman…
- Their interaction framework has 4 parts
  - user
  - input
  - system
  - output

Each has its own unique language

*Interaction* ⇒ translation between languages

*problems in interaction* = problems in translation
Abowd and Beale Interaction framework

Four types of Translation between components:

1. **Articulating a goal** *(User --> Input)*
   - How easy is it to translate a goal requirement into the input language?
   - **Example:**
     - **Difficult:** Consider a bank of light switches, stovetop
     - **Easy:** Virtual reality system

2. **Performance** *(Input --> System)*
   - Can all system stimuli be articulated by user language?
   - **Example:** Consider remote control (or front panel) with limited functions.
**Abowd and Beale Interaction framework**

3. **Presentation** *(System --> Output)*
   - Can system output device provide a complete view of system state?
     
     **Example:** Consider document editing with limited view of data

4. **Observation** *(Output --> User)* (interpretation by user)
   - Is the information presented to a user in a way that is easy to interpret.
   - **Examples:**
     - Difficult to read unmarked analog clock.
     - Difficult to observe result of hierarchical system file copying using command line interface.
     - Developing a website using a HTML would be virtually impossible without being able to preview the output through a browser.
Abowd and Beale Interaction framework

Example:- a VCR remote control

The user is not sure if the recording is set properly.

• User presses the wrong button or the wrong sequence of buttons is an **Articulation Error**

• The VCR can record on any channel but the remote can not access the channel (lacks the ability to select channels) is a coverage or **Performance Error**

• The VCR does not indicate the channel or the recording is a **Presentation Error**

• The user misinterprets the VCR symbols is an **Observation Error**
Ergonomics

- **Ergonomics (human factors)** the study of the physical characteristics of the interaction.

- **Arrangement of controls and displays.**
  - so important when we turn to safety-critical application such as plant control, aviation and air traffic control.

- **Physical environment**

- **Health issues**
  - Example:- physical position, environmental conditions (temperature, humidity), lighting, noise.

- **Use of colour**
Ergonomics

• The organization of the controls and displays.

  – **Functional**
    • controls and displays are organized so that those that are functionally related are placed together

  – **Sequential**
    • controls and displays are organized to reflect the order of their use in a typical interaction

  – **Frequency**
    • controls and displays are organized according to how frequently they are used, with the most commonly used controls being the most easily accessible

  – *Example:*- the poor design for electronic newsreader
Ergonomics

- **The use of color**

- Blue should not be used to display critical information

- The color used should correspond to common conventions and user expectations
  - Red, green, yellow -> stop, go, standby
  - Use of red for warning
Indirect manipulation

- **Office** – direct manipulation
  - user interacts with artificial world inside the computer.

- **Industrial** – indirect manipulation
  - user interacts with real world through interface.
Interaction styles
**Interaction styles**

*Dialogue* refers to the exchange of instructions and information that takes place between a user and a computer.

*There are a number of common styles including*

- command line interface
- menus
- natural language
- question/answer and query dialogue
- form-fills and spreadsheets
- (direct manipulation) WIMP
- point and click
- three–dimensional interfaces
Interaction styles

Command line interface

```
C:\Program Files\Brooks Internet Software\INTELLIscribe>isendfile --help
Usage: isendfile [ options ] port file
Options include:
    --help       Display this help text
    -v or --verbose   Print messages about ISendfile actions
    -s           Silent, opposite of verbose
    -h           No banner for this job
    -F=format    Format is one of the following:
                  f - formatted, l - leave control characters, o - Postscript
                  p - use 'pr' format, r - FORTRAN, c - CIF, d - dvi, g - plot
                  n - ditroff, t - troff, v - raster
    -C=class     Class is used on banner page; up to 31 characters
    -T=title     Job title
    -J=jobname   Job name
    -K=copies or -#=copies   Number of copies of each file to be printed
    -P=port      Equivalent to the 'port' argument
    -U=username  Specify a username; otherwise use the logged-in username
    -i=columns   Indent input by columns (LPD only)
    -w=width     Specify the page width (LPD only)
    -H=host      Hostname that jobs comes from, defaults to local computer name
    -Z=option    Pass the specified options
```
**Interaction styles**

**Menu-** Set of options available to the user are displayed on the screen, and selected using the mouse, or numeric or alphabetic keys.

```
PAYMENT DETAILS

please select payment method:

1. cash
2. cheque
3. credit card
4. invoice
9. abort transaction
```
Interaction styles

• **Natural language**
  - the most attractive means of communicating with computers.
  - speech recognition or typed natural language.

• **Question/answer interfaces**
  - the user is asked a series of questions and so is led through the interaction step by step.
  - *Example:* - web questionnaires, ATM.

• **Query languages** (*Example:* - SQL)
  - be used to construct queries to retrieve information from a database
Interaction styles

Form-fill - Primarily for data entry
Spreadsheets
- sophisticated variation of form-filling.
- grid of cells contain a value or a formula
- user can enter and alter data spreadsheet maintains consistency
Interaction styles

- **The WIMP interface**
  - Windows, Icons, Menus, Pointer
  - OR Windows, Icons, Mice, Pull-down menus
  - default style for majority of interactive computer systems, especially PCs and desktop machines

- **Point-and-click interfaces**
  - in most multimedia and in web browsers
  - be popularized by World Wide Web pages
Interaction styles

Three-dimensional interfaces

A 3D appearance using shading

Interfaces with 3D workspaces
References

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