Chapter 2
Basics of HCI and History

2.1 Motivation
2.2 Principles for UI-Design
  - Principle 1: Recognize User Diversity
  - Principle 2: Follow the Eight Golden Rules
  - Principle 3: Prevent Errors
2.3 Understanding Errors
2.4 Consistency
2.5 Basic Models
2.6 A Brief History of HCI

Outline of the course

1 Introduction
2 Basics of HCI and History
3 Designing Systems for Humans
4 Analysis
5 Designing Interactive Systems
6 Implementing Interactive Systems
7 Evaluation

What the User Sees

Users see only what is visible!
What the Developer Knows

- Users see only what is visible!
- Users have little idea about:
  - architecture,
  - state transitions,
  - dependencies
  - application context
  - system restrictions
- ... And users often do not want to know about it.

Basic (Naive) Technical Answers

- 2-D surface
- Controllable pixels
- Image with a resolution of 1400x1050 pixels
- For each pixel the colour can be set
- The change of colour can be controlled rapidly

Practical Motivation

- What do we see?
- What is shown?
- What is the meaning?

Perfect User’s Answers

- My work environment
- Meeting notes
- Budget for next year
- Request to write a technical article
- Background information on a psychological phenomenon

Skilled Computer Users Answers

- Win2000 desktop
- Text and figures
- Icons and toolbars
- Overlapping windows
- Scroll bars and menus
- Task bar and status information
- Handles and a pointer
- Representations of documents

Example I – Overlaying Windows

- What is the meaning that a window is behind another window?
- What is real? What is illusion?
- What does iconizing do?
- Models? Conceptual... Implementation... Represented...
Example II – Scrolling vs. Hand
- Moving up the scroll bar
  Moves down the document
- What happens in reality?
  What do we imagine?
  What is the metaphor?

Principles for UI design
- Implementation and technology independent
- Shneiderman’s principles:
  (see http://media.pearsoncmg.com/aw/aw_shneiderma_dtui_4/chapter2.pdf)
  - Principle 1: Recognize User Diversity
  - Principle 2: Follow the Eight Golden Rules
  - Principle 3: Prevent Errors
- Restated in different variants – basically telling the same story

Example II – Scrolling vs. Hand
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  Moves up the document
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Usage Profiles “Know Thy User”
- What is the background of the user?
- Different people have different requirements for their interaction with computers.
- Issues to take into account:
  - goals, motivation, personality
  - education, cultural background, training
  - age, gender, physical abilities, …
- Experience:
  - Novice users
  - Knowledgeable intermittent users
  - Expert frequent users
User-Needs and Task Profiles

- Find out what the user is trying to do! The Goal!
- Needs of users, goals and resulting tasks
- Supported tasks should be determined before the design starts
- Functionality should only be added if identified to help solving tasks
  - Temptation: If additional functionality is cheap to include it is often done – this can seriously compromise the user interface concept!
- Frequency of tasks related to user profiles

Task Frequency - Examples

- Bold is available in the toolbar
- Subscript requires menu and dialog
- Assumption for the standard UI is that user needs more often bold than subscript
- For users with different needs the customization is available

Hypothetical Frequency of Tasks
(Example of a booking system for travel)

<table>
<thead>
<tr>
<th>Task Position</th>
<th>Group reservation</th>
<th>Change of itinerary</th>
<th>Booking child care</th>
<th>Comparing sales agent performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales agent</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Manager</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.3</td>
</tr>
<tr>
<td>Family</td>
<td>0.05</td>
<td>0.05</td>
<td>0.3</td>
<td>0</td>
</tr>
<tr>
<td>Business traveler</td>
<td>0.01</td>
<td>0.2</td>
<td>0.01</td>
<td>0</td>
</tr>
</tbody>
</table>

Task Frequency - Examples

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Task Frequency: Trade-off between quick access and over-crowed interface

- Example toolbar
  - More tasks directly available in the toolbar make it quicker to do these tasks
  - Increasing the number of options in the toolbar increase the time needed to locate them
  - Screen area that is used

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Principle 2: 
Follow the 8 Golden Rules

- Strive for consistency
- Enable frequent users to use shortcuts
- Offer informative feedback
- Design dialogues to yield closure
- Error prevention/handling
- Permit easy reversal of actions
- Support internal locus of control
- Reduce short-term memory load

Shneiderman, chapter 2

8 Golden Rules - Feedback

- For any action performed the user should have appropriate and informative feedback
- For frequent actions it should be modest, peripheral
- For infrequent action is should be more substantial

8 Golden Rules - Consistency

- Within an application it is the developer’s job (see earlier slides…but that is the easy part)
- In a specific environment it is defined by guidelines (e.g. for GNOME, for KDE, for Mac OSX, for Win XP, for JAVA Swing)
- In the WWW it gets pretty hard!
  - No real guidelines and no authority
  - How are links represented?
  - Where is the navigation?
  - Styles and "fashion" change quickly…

8 Golden Rules - Shortcuts

Improves speed for experienced users

Shortcuts on different levels
- Access to single commands, e.g. keyboard shortcuts (CTRL+S) or toolbar
- Customizing of commands and environments, e.g. printer preset (duplex, A4, …)
- Reusing actions performed, e.g. history in command lines, macro functionality

Shortcuts to single commands are related to consistency
- CTRL+X, CTRL+C, CTRL+V in Microsoft applications for cut, copy and paste
- However CTRL+S (saving a document) is only implemented in some applications…

8 Golden Rules - Closure

Sequences of actions should have a beginning, middle, and end.
- For non-instantaneous actions
  - On different levels –
    - E.g. in the large: Web shop - it should be clear when I am in the shop, and when I have successfully checkout
    - E.g. in the small: a progress bar

8 Golden Rules – Prevent Errors

Create UI that make it hard to make errors (e.g. menus instead of commands)
Detect errors or possible errors
- Is related to “easy reversal of actions”

Examples
- Leaving a editor without saving
- Writing to a file that already exists

Different options how to handle it:
- Involve the user (current practice)
- Prevent the error or its consequences on system level (e.g. create backups/versions when a file is overwritten, keep all files that have been created by the user)
8 Golden Rules – Permit Easy Reversal of Actions

- As a basic rule – all actions should be reversible
- Providing UNDO functions (possibly with infinite depth)
- Allow undo of groups of actions
- Undo is not trivial if user is not going sequential
  - E.g. write a text, copy it into the clipboard, undo the writing
    - the text is still in the clipboard!
- Reversal of action becomes a usage concept
  - Browser back-button is used for navigation (for the user a conceptual reversal of action)
  - Formatting of documents – e.g. “let’s see how this look, … don’t like it, … go back to the old state”

8 Golden Rules – Feeling in Control

- Users should feel to be in control of the system
- User should initiate actions (initiator instead of responder)
- Avoid non-causality
- The system should be predictable
- Some current developments are in contrast:
  - Proactive computing
  - Intelligent agents
- Have to be aware when designing these!

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8 Golden Rules – Reduce Short-term Memory Load

- 7 +/- 2 chunks of information
- The system should remember, not the user
- Examples that create problems
  - Multi-page forms where the user has to know at form N what she filled in in form N-1
  - Abbreviations introduced in one step and used in the following (e.g. user selects a destination as the name of a city – and the...)

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Principle 3: Prevent Errors - Examples

- Correct matching pairs
  - Examples:
    - Making some text `<b>bold</b>` will make too much bold if the `<b>` is omitted or mistyped
  - IDE often provide {} match checking
- Complete sequences
  - Assistance for the user to complete a sequence of actions to perform a task
  - Example: Wizards
- Command correction
  - Aim: Trying to prevent users entering incorrect commands
  - Examples:
    - File completion on Unix
    - Helpful error messages
Human Error

Human Error

About (Human) Errors…

• “If an error is possible, someone will make it” (Norman)

• Human Error may also be a starting point to look for design problems.

• Design implications
  - Assume all possible errors will be made
  - Minimize the chance to make errors (constraints)
  - Minimize the effect that errors have (is difficult!)
  - Include mechanism to detect errors
  - Attempt to make actions reversible

Understanding Errors

• Errors are routinely made
  - Communication and language is used between people to clarify – more often than one imagines
  - Common understanding of goals and intentions between people helps to overcome errors

• Two fundamental categories
  - Mistakes
    - overgeneralization
    - wrong conclusions
    - wrong goal
  - Slips
    - Result of “automatic” behaviour
    - Appropriate goal but performance/action is wrong

more (Human) Errors…

In an attempt to prevent similar accidents in future, the air force has asked the AIDC to help teach pilots how to use the fighter’s emergency function.

...In an attempt to prevent similar accidents in future, the air force has asked the AIDC to help teach pilots how to use the fighter’s emergency function.

Human Error

Main Subway Accidents On Human Error

Most of the tragic events involved workers and supervisors not following procedures.

• http://1010wins.com/topstories/local_story_278071424.html

Understanding Errors

Human Error

Error management (misperception)
- Can be prevented by better curve design
- Often ignored due to lack of funding
- Important for safety

• http://pittsburghlive.com/x/tribune-review/business/s_385507.html

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MMI 2005/2006
Understanding the types of Slips Users Make

- Capture errors
  - Two actions with common start point, the more familiar one captures the unusual (driving to work on Saturday instead of the supermarket)
- Description errors
  - Performing an action that is close to the action that one wanted to perform (putting the cutlery in the bin instead of the sink)
- Data driven errors
  - Using data that is visible in a particular moment instead of the data that is well-known (calling the room number you see instead of the phone number you know by heart)
- Associate action errors
  - You think of something and that influences your action. (e.g. saying come in after picking up the phone)
- Loss-of-Activation error – forgetting
  - In a given environment you decided to do something but when leaving then you forgot what you wanted to do. Going back to the start place you remember.
- Mode error
  - You forget that you are in a mode that does not allow a certain action or where a action has a different effect

Norman, Chapter 5

Preventing Mode Errors

- Why use modes in the first place?
  - User interface trade-off (e.g. number of buttons needed can be reduced, actions within a mode can be speeded up)
- Design recommendations
  - Minimize number of modes
  - Make modes always visible
- Example alarm clock
  - Mode vs. mode free
  - Visualization of mode
- What is your solution?
  - Draw the control elements
  - Provide labels

Making things reversible

- Is a great solution – but where is the problem with it?
- What is the cost?

Preventing Description Errors

- Related to Gestalt theory
- Example Car
  - Different openings for fluids, e.g. oil, water, brake, ...
  - Openings differ in
    - Size
    - Position
    - Mechanism to open
    - Color
- Design recommendations
  - Make controls for different actions look different

Confirmation is unlikely to prevent Errors

- Example
  - User: “remove the file most-important-work.txt”
  - Computer: “are you sure that you want to remove the file most-important-work.txt?”
  - User: “yes”
  - Computer: “are you certain?”
  - User: “yes of course”
  - Computer: “the file most-important-work.txt has been removed”
  - User: “Oops, damn”

The user is not reconsidering the overall action – it only prompts to think about the immediate action (clicking)

A solution is to make the action reversible

Norman, Chapter 5

References

Meet the Authors
5. November 2005
16.00 Uhr
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Es sprechen
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