Building better systems

- There has been much work in HCI on principles for interface design
- We shall look at a few of these and see how they can be applied to common systems
- Remember these principles are based on a lot of serious psychology research

Using Design Rules

- Attempt to provide designers with information about impact of their designs
- Always a trade-off - the more general the rule, the more chance it conflicts with another rule
- We can make a vague distinction between:
  - Guidelines: vague, need to know theoretical underpinning
  - Standards: can be very specific, e.g., 3-button mice used
Standards

> Usually set by international committee
  > Hardware standards more specific than software
  > Hardware less likely to change

> Strength lies in forcing a large community to follow standard

> Currently not much for promoting usability; tend towards "de facto" standards

Guidelines

> Style guides published by Apple, Sun etc.
> Tend to be generalisations - the more general, the earlier they should be in the design process
> Can range from:
  > Users must initiate all dialog (Apple)
  > to
  > Use white space between long groups of menu controls (Open Look)

Summary

<table>
<thead>
<tr>
<th>Standards</th>
<th>Guidelines</th>
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<tbody>
<tr>
<td>High authority</td>
<td>Lower Authority</td>
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<tr>
<td>Little overlap</td>
<td>Conflicts / overlap / trade-off</td>
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<tr>
<td>Limited application</td>
<td>Less focused</td>
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<tr>
<td>Minimal interpretation</td>
<td>Interpretation required -</td>
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<td></td>
<td>HCI background</td>
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Specific Guides - Web (Jakob again)

- As there are so many styles of site, make sure you find one which suits the site you are interested in
- I will give you a list of style guides, but here are some good design rules from Jakob Nielsen [Web guru]
  - http://www.useit.com

To 10 points of bad design

- Breaking the back button
- Opening browser windows
- Non-standard use of widgets
- Lack of biography
- No archives
- Moving URI’s
- “Smart” headlines
- Buzzwording
- Slow sites
- Any advertising, or similar graphic

Writing for the Web

- Simplicity and informality
- Credibility
- Outbound links for credibility
- Low humour
- Speed
- Scanable text (bullet points)
- Concise (half word count of other media)
- Summaries / inverted pyramid
- Graphics and text integrated
- Check Strunk and White
General Design

- What follows are high level design principles derived from psychology and computer science.
- These can be applied to pretty much any interface.

Affordance (Don Norman)

- Affordances of an object are those properties of the object which give users clues as to how the device is used.
  - Good examples include push buttons and levers.
  - Bad examples:
    - Pet hate is Web site design where links are not underlined and give no indication of how they should be used.

Affordance examples (UCT)
Visual affordance

- needs familiar idiom and metaphor to work

**Visual affordance problems**

- Handles are for lifting, but these are for scrolling!

**Mapping** [Don Norman]

- Mapping is concerned with ensuring that there is a natural correlation between objects and the interface controlling them

This crops up with oven controls, light switches and, our old friend, the car radio

Beware of cultural mappings as opposed to ‘real’ mappings
Constraints (Don Norman)

- Constraining a design so that it can only be used the correct way
  - Lego
  - 3.5" disks
  - Greyed menu options
More ATM

Visible constraints: Entering a Date

Visualising (Don Norman / Ben Shneiderman)

Features should be made visible - we talked about this earlier
- Bad (usually impoverished interface)
  - Command lines
  - Cellular phone menus
- Good
  - Direct Manipulation
  - Menu systems
Memory (Don Norman & many others)

- Essentially memory comes in two flavours
  - Short term
  - Long term
- Short term memory is like RAM and can hold 7±2 items at a time. This impacts issues like menu design
- Long term is like hard disk. Too complicated to go into here
- Also linked to cognitive models

Knowledge & Chunking (Don Norman etc.)

- To improve on memory, we tend to chunk actions
  - Chunking works by grouping actions into a lump
  - Seek for meaningful relationships. Here is my UK cellphone number written two ways:
    - 0376 609766
    - 09766 09766
- To help, we need to differentiate “knowledge in head” and “knowledge in world”
  - Display based action
  - Recognition vs. recall

Role Integrity (Harold Thimbleby)

- Interfaces should not mislead users about what the computer is capable of
- This usually applies to hidden limits such as
  - Midi sequencers coping with only eight tracks
  - Generally limits should be zero, one or infinity
- If the interface is capable of specifying a task, the computer should be able to complete it
Simpler is not always better  
[H. Thimbleby]

- Einstein's "Everything should be made as simple as possible, but not simpler"
- Fewer buttons often seen as simpler, but not always the case
  - Overloading buttons with modes
    - Typewriters are easy to use
    - My Fours-key Nokia is not

Complex looking buttons can be hid under a lid

Principle of least astonishment  
[H. Thimbleby]

- Consistency is obviously a key goal in interface design.
- This has been stated as
  - "The principle of least astonishment"

- Consistency applies to functionality and form
  - The car radio displays both types of inconsistency
    - Button layout on face / button layout on remote control
    - Functionality of RDS modes

Modes  
[H. Thimbleby etc.]

- Modes allows different behaviours from the same interface features
- Not necessarily bad, but linked to poor feedback, can be awful
  - Buttons 7-12 on the radio
- For users who are not aware that the mode has changed, this makes the device appear non-deterministic
  - Polya's principle of "Non-sufficient reason" - if there is no reason to believe things are different, they aren't
Equal opportunity  
(Harold Thimbleby & Andy Monk)

- Equal opportunity states that there should be no difference between input and output values (or known / unknown) - one can be substituted for the other.

- Good examples include:
  - Spreadsheets - cells are neither input or output exclusively
  - Camera aperture / shutter speed
  - Zicof Query by Example

Principle of least effort  
(Harold Thimbleby)

- Zipf's principle of least effort can be rewritten as:
  - "Make frequent things easy, unlikely things harder"

- Similar to the simplicity idea, this manifests in the following ways
  - Morse code 'E' is only one dot, apostrophe is 6 dots and dashes
  - Menus organised to common things at top
  - "Dangerous" operations could be heavily nested or require many clicks or presses

Feedback  
(Harold Thimbleby & Isaac Newton)

- Newton taught us that every action in nature is met with a reaction - this is not always the case in interfaces

- Every user action needs the interface to react so that the user knows the action is complete
  - this can be tricky in multi-tasking systems

- Especially important for displaying modal information
Fitts’ Law

- “The time taken to acquire a target is a function of the distance to and size of the target”
- For a target of size $S$, a distance $D$ from the pointer, time is
  - $a + b \cdot \log_2(D/S + 1) \text{ [a and b depend on device characteristics]}$

- This has big implications for items such as menu design