

Lecture 6: Usability I: Principles and Guidelines

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Introduction

- Usability principles and guidelines are an important complement to modelling and empirical evaluation
- Usability principles are generic rules for user interface design
 - An interface should be easy to learn
- Usability guidelines are more specific advice for how a usability principle might be achieved in practice
 - Use of colour, menu design
- Guidelines often require careful interpretation with respect to context and may conflict
- Standardisation
 - ISO 9241 guidelines
 - Manufacturers' guidelines
 - De facto standards

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Learnability

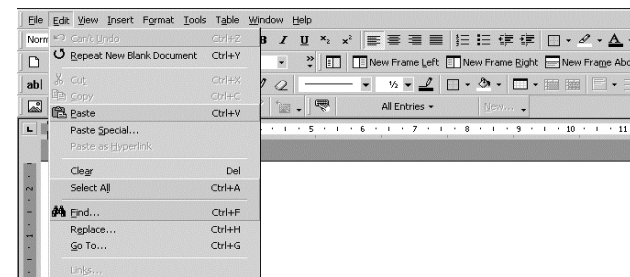
- **Predictability:** system behaviour is observably deterministic
 - Every user action should be matched by a system response
 - A system may appear non-deterministic if there are variable delays in updating state after each user action. The effect may become more difficult to associate with the action
 - This may be unavoidable in a distributed system environment

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Learnability

- A related principle for predictability is *operation visibility*, or *affordance*:



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Learnability

- **Synthesizability:** the user can assess effect of past actions
 - Users like Direct Manipulation (DM) interfaces because of their promise of *immediate honesty*, but sometimes have to be satisfied with *eventual honesty*
 - Command Line (CL) interfaces are never honest:

```
Window Edit Options
dewar> ls
AdobeFnt.lst      lib          public_html
Mail              mail         research
Network Trash Folder mbox        software
bin              ns_imap     teaching
documents         nsmail
guitar           papers
dewar> cd papers/
dewar>
```

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Learnability

- **Familiarity:** match the interface to users' expectations:
 - Compatibility with prior knowledge
 - Guideline:
 - use metaphor;
 - use Natural Language syntax
 - Consistency, knowing part of the interface is relevant to the use of other parts
 - Guideline:
 - use same placement for recurrent menu options such as Quit

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Flexibility

- **Dialogue initiative:** give user control of the dialogue flow
 - User pre-emption
 - Guideline:
 - permit user to abandon, suspend and resume tasks at any stage
- **Multi-threading:** provide support for simultaneous tasks
 - Guideline:
 - provide multiple task contexts

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Flexibility

- **Task migratability:** negotiability of function allocation between user and system
 - People get bored doing routine tasks and stop concentrating (Yerkes-Dodson Law)
 - Guideline:
 - automate routine tasks, but don't fix function allocation

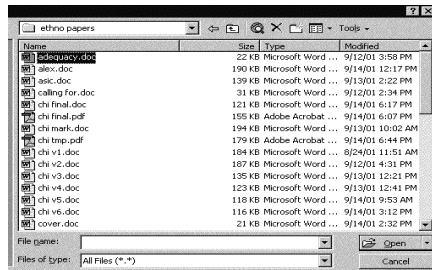
People are better at	Machines are better at
Detecting small sensory inputs	Responding quickly to signals
Improvising and using flexible procedures	Following procedures repeatedly, precisely
Reasoning inductively	Reasoning deductively
Selective information recall	Total information recall
Exercising judgement	Following orders

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Flexibility

- **Substitutability:** equivalence for different forms of input expression
 - Guideline:
 - don't force users to refer to objects by name if they can point to them

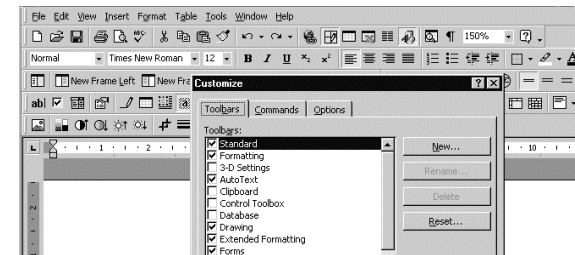


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Flexibility

- **Customisability:** interface is capable of being adapted to suit different needs
 - Guideline:
 - provide choice of methods; allow short cuts; permit users to change system features -- 'deferred design'



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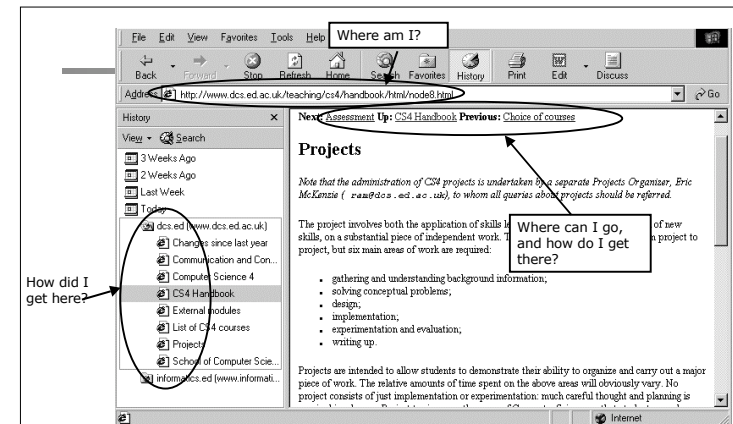
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Robustness

- **Observability:** relationship between system state and its presentation
 - Where am I? -- immediate honesty
 - System state
 - How did I get here? -- synthesizability
 - Trails, history
 - What can I do here? -- operation visibility
 - Where can I go from here? -- predictability
 - How did I get there? -- operation visibility

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Robustness

- **Recoverability:** support for undoing errors
 - Reduce scope for making errors
 - Guideline: avoid free-form input where possible
 - User input should be validated as soon as possible
 - Guideline: validate immediately; allow user to correct input
 - Users should be able to change their minds
 - Guideline: command set should include undo; permit premature termination of any action

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Robustness

- Help users understand nature of error
 - Guideline: error messages should be concise, informative, specific, positive in tone, constructive

Poor error message

Error 404: document not found

Better error message

The requested URL <http://www.xyz.com/blah.html> is not valid.
This may be because the URL is incorrect or because the information pointed to no longer exists.

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Robustness

- **Task conformance:** interface functionality should match common user tasks
 - Few general purpose commands, long methods, simple
 - Many highly tuned commands, short methods, complex
 - Guideline: identify core tasks and provide a command for each one
 - But core task set tends to grow over time, language becomes baroque as command lexicon expands
 - UNIX CL, once based upon a small set of composable commands, now has over 700; 10% account for 90% of all usage
 - Word command lexicon now includes text formatting, drawing, annotating, WWW related commands, etc.
 - How is this complexity to be tackled at the interface?

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Robustness

- **Responsiveness:** feedback should be commensurate with action
 - Echoing input < 0.1 secs
 - Page turning < 0.5 secs
 - String search < 4 secs
 - Provide time *affordances* where delays are unpredictable

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Time Affordances

- Where delays are inevitable and unpredictable, users need reassurance that an operation will complete
- User sensitivity to delay depends on context
- User interface should provide time affordances such that delays become part of the accountable behaviour of the system

Time Affordances

- A. Acceptance
- B. Initiation and Heartbeat
- C. Scope
- D. Remainder
- E. Progress
- F. Completion

Processing From: J:\NEWAPP\macrob02.azm
To: D:\MYPROD\macrob02.azm

Status

Current File: 24 [F] Total Files: 36 [C]
Bytes processed: 824466 [E] Files Remaining: 12 [D]
Installation time: 00:09:45

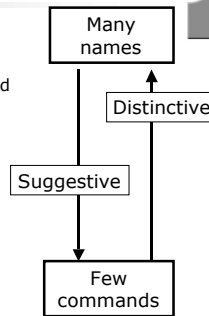
FILE	BYTES
21. macroa14.azm	7413
22. macroa15.azm	8692
23. macrob01.azm	1465
▶ 24. macrob02.azm [E]	12442 ▶
25. macroc01.azm	
26. libsamp01.azl	
27. libsamp02.azl	

60% [B] Cancel

Current File: Percent Complete

Detailed Guidelines: CLs

- Choose command names that are:
 - Compatibility with users' knowledge
 - Suggestive and distinctive within the command name set, and easily memorable
- Permit abbreviation of command form with consistent rule. E.g.: execute
 - Simple truncation to fixed length -- exec
 - Vowel drop with truncation -- exct
- Choose consistent syntax:
 - Semantic-syntactic alignment
 - Use flags where arguments are numerous and/or optional



Detailed Guidelines: Forms

- 'Plan' of action
- Deviation should be permitted
- Follow paper form if it exists
- Use defaults and lists if appropriate
- Allow editing

Degree: [] Director of Studies: []

Email address: []

Term-time address: [] Permanent address: []

Telephone number: [] Telephone number: []

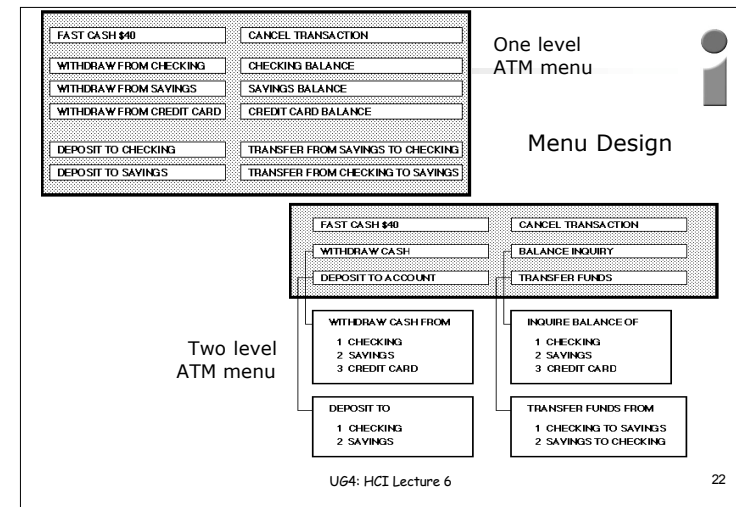
Module selection

Please indicate the modules you intend to take each term.

Term 1	Term 2
<input type="checkbox"/> Communication and Concurrence (coc)	<input type="checkbox"/> Cognitive Modelling (cm)
<input type="checkbox"/> Computer Graphics (cg)	<input type="checkbox"/> Cognitive Neuroscience of Language (cnl)
<input type="checkbox"/> Computer Networking (cn)	<input type="checkbox"/> Computational Complexity (cmc)
<input type="checkbox"/> Embedded Systems (es)	<input type="checkbox"/> Computational Vision (cv)
<input type="checkbox"/> Empirical and Analytical Research Methods (earn)	<input type="checkbox"/> Computer Algebra (ca)

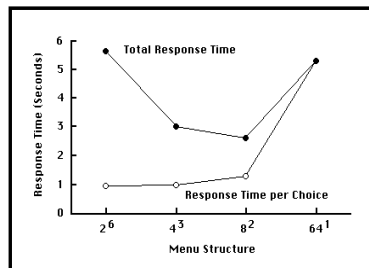
Detailed Guidelines: Menus

- Ordering
 - Alphabetical, semantic, random
 - Frequency of use
 - Order of use
 - Importance
 - Positional consistency for re-occurring entries
 - Allow customisation



Hierarchical Menu Design

- According to earlier analysis, breadth should always be maximised and depth minimised
- Empirical studies suggest that optimum number of entries per level is 8, which coincides with WM memory capacity (7+/-2)
- Explanation is that WM capacity is the limiting factor when making a visual search
- Guideline is minimise depth, because depth increases likelihood of getting 'lost', but don't exceed 8 entries per level
- This may be difficult to implement it means ignoring *natural categories* to which entries belong



Selection errors follow a similar pattern

Further Reading

- Dix et al., 2nd ed: chapter 4, p. 162-177; 3rd ed: chapter 7
- Newman and Lamming, chapter 15, p. 373-85