

EECS 4441 Human-Computer Interaction

Topic #3: Design

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Topics

- What is design?
- Designing for maximum usability
- Principles
- Standards
- Guidelines
- Design patterns

What is Design?

- Definition
 - **Achieving goals within constraints**
- Goals or purpose
 - Who is it for? Why do they want it?
- Constraints
 - Materials, platforms, costs, development time
- Trade-offs

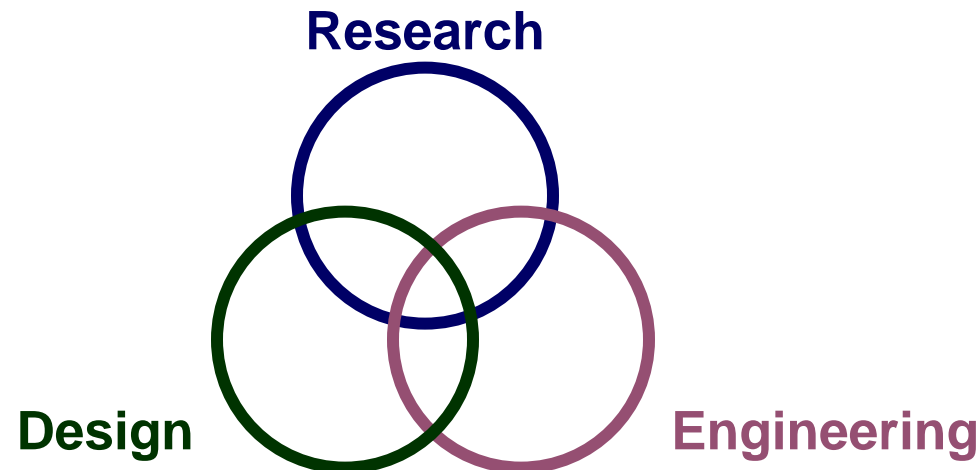
Golden Rule of Design

Understand Your Materials

- For HCI...
 - Understand computers
 - Limitations, capacities, tools, platforms
 - Understand people
 - Psychological, social aspects
 - Limits, capabilities, human error
 - Understand the interaction between computers and people

Research vs. Design vs. Engineering

- Design is not research
 - Design is the process of creating artifacts, considering...
 - Form \leftrightarrow Function
- Engineering is not research
 - Engineering is the process of creating artifacts, considering...
 - Form \leftrightarrow **Function**
- But...

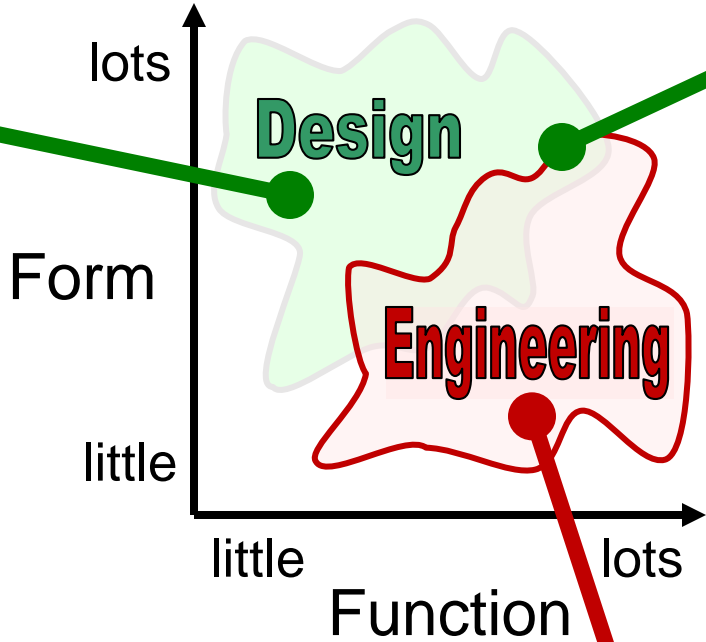


Form vs. Function



Aesthetically “cool” but...

- Expensive
- Awkward to use
- Difficult to wash
- Seeds mix with juice
- Hard to store



Aesthetically “bland” but...

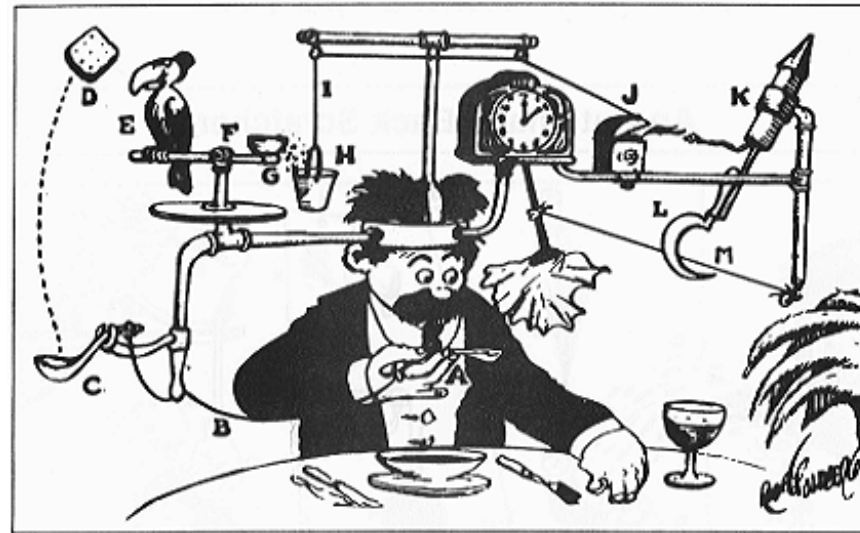
- Inexpensive
- Simple to use
- Easy to wash
- Seeds separated from juice
- Easy to store



Designers Unleashed



Engineers Unleashed

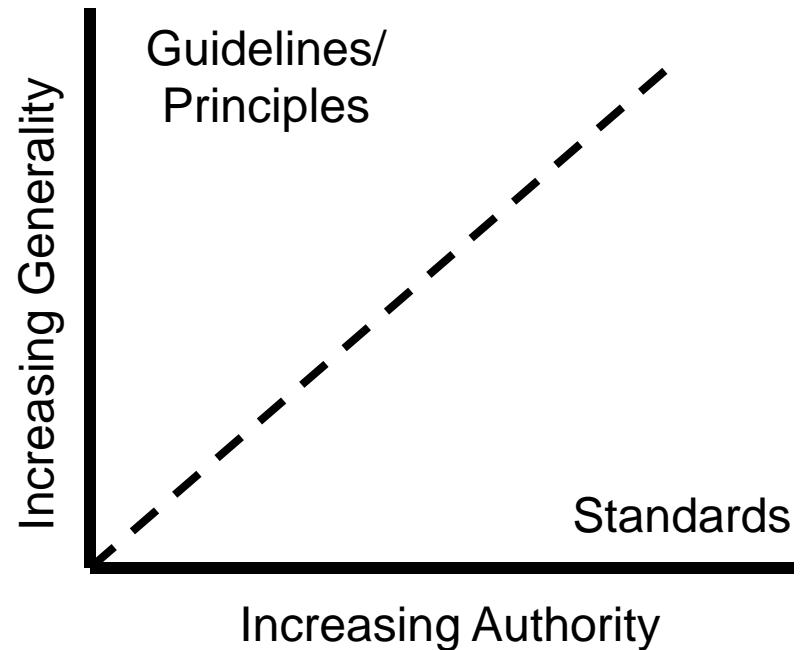


Self-Operating Napkin

HCI Example?

Types of Design Rules

- Principles
 - Abstract design rules
 - Low authority
 - High generality
- Standards
 - Specific design rules
 - High authority
 - Limited generalizability
- Guidelines
 - Lower authority
 - More general application



Restricting the Design Space

- Design rules are mechanisms to...
 - Restrict the space of design options
 - E.g., DR: If there is a “File” menu on the menu bar, put it on the left
 - Prevent a designer from pursuing bad design options
 - E.g., DR: Use a maximum of three colours in designing a window
- Chances for success are best if design rules are applied early

Principles to Support Usability

1. Learnability

- The ease with which users can begin effective interaction and achieve maximal performance

2. Flexibility

- The multiplicity of ways the user and system exchange information and do things

3. Robustness

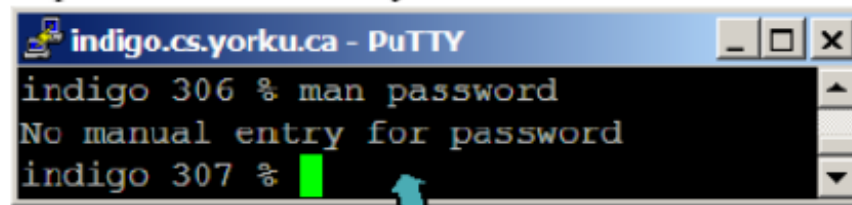
- The level of support provided to the user for successful achievement and assessment of goal-directed behaviour

Details and examples

1. Learnability (1)

- Predictability
 - Determining effect of future actions based on past interaction history
 - Must be predictable to the user (i.e., not the same as a system's behaviour being deterministic)
 - Operation visibility

Operation visibility – NOT!



```
indigo.cs.yorku.ca - PuTTY
indigo 306 % man password
No manual entry for password
indigo 307 %
```

Gee... What's the command to change my password?



Next slide

Account Information - Netscape

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://edit.yahoo.com/config/eval_profile?

Home Google Calendar H1 CNN BBC Star IAAF 3461


YAHOO! ACCOUNT INFORMATION [Yahoo! Canada - Help](#)

Review My Account Information

Review the member information listed below, click the **Edit** button above each item to change the information. Be sure to click **Finished** when you're done.

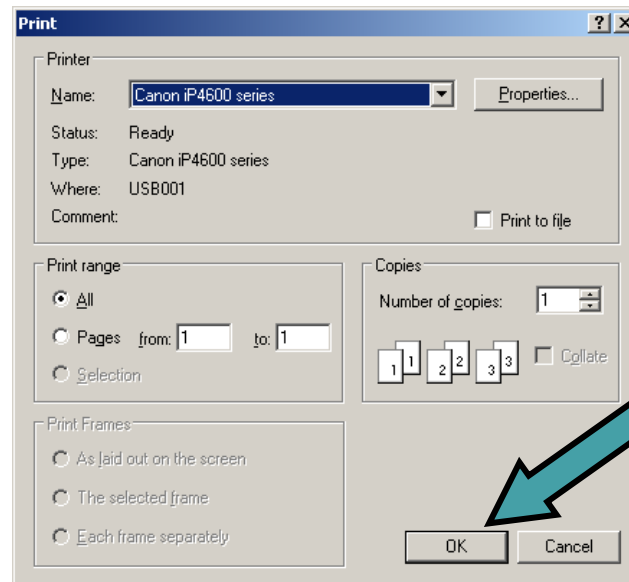
Yahoo! ID Card

Name:	Mr COSC 3461 TA	Public Information Public profile ta3461
Yahoo! ID:	ta3461	
Yahoo! Mail Address:	ta3461@yahoo.ca	
Password:	Change Password	



1. Learnability (2)

- Synthesizability
 - User must be able to assess the effect of past actions
 - Immediate vs. eventual honesty



Did my document print?

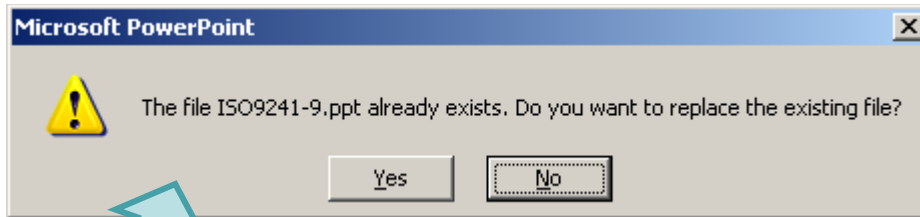
1. Learnability (3)

- Familiarity
 - How prior knowledge applies to new system (aka metaphor)
 - Guessability (Where is the progress bar?)
- Generalizability
 - Extending specific interaction knowledge to new situations (Using a new e-mail client?)
- Consistency
 - Likeness in input/output behaviour arising from similar situations or task objectives (mouse right-click, touchscreen touch-and-hold)

2. Flexibility (1)

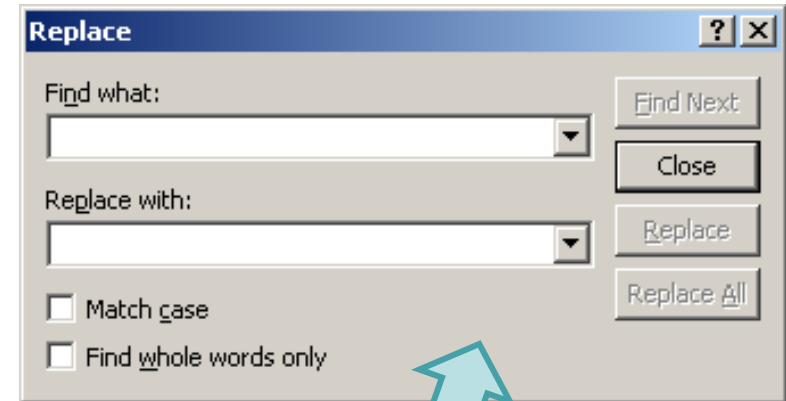
- Dialogue initiative
 - Freedom from system-imposed constraints
 - Input dialogues: system vs. user

System initiated dialog



Popped up by system

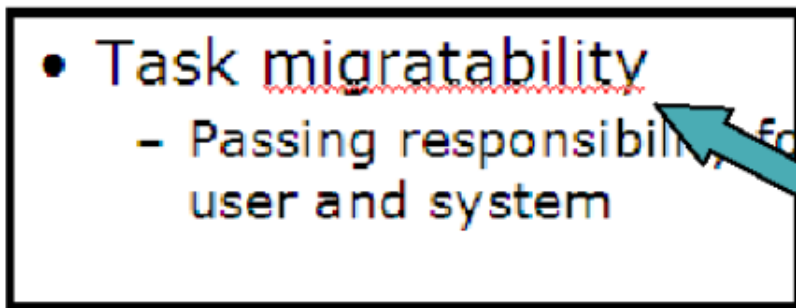
User initiated dialog



Popped up by user

2. Flexibility (2)

- Multi-threading
 - Ability of system to support user interaction for more than one task at a time
 - Concurrent vs. interleaving; multimodality
- Task migratability
 - Passing responsibility for task execution between user and system
 - E.g., spell checking (see below)

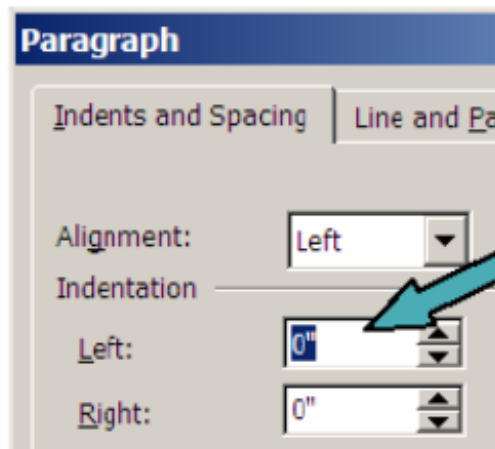


Spell checking initiated by system with responsibility for corrections passed to user.

2. Flexibility (3)

- Substitutivity
 - Allowing equivalent values of input and output to be substituted for each other
 - Representation multiplicity; equal opportunity
 - E.g., specifying a unit of distance as cm, inches, points (see below), or even as an equation

Example: MS Word (Format | Paragraph)



Can specify left margin as

- 5 in
- 5 cm
- 5 pt

2. Flexibility (4)

- Customizability
 - Modifiability of the user interface by the user (adaptability) or system (adaptivity)

3. Robustness (1)

- Observability
 - Ability of the user to evaluate the internal state of the system from its perceivable representation
 - Browsability; defaults; reachability; persistence; operation visibility

3. Robustness (2)

- Recoverability
 - Ability of user to take corrective action once an error has been recognized
 - Reachability; forward/backward recover; commensurate effort (next slide)

Reachability (Netscape)

Go	Bookmarks	Tools	Window	Help
<u>B</u> ack				Alt+Left Arrow
<u>F</u> orward				Alt+Right Arrow
<u>H</u> ome				Alt+Home
<u>H</u> istory				Ctrl+H
• Overview (Java 2 Platform SE v1.4.2)				
Overview (Java 2 Platform SE v1.4.2)				
JComboBox (Java 2 Platform SE v1.4.2)				
NIST Internet Time Service				
Google Search: internet time server				
Google				
http://time.windows.com/				
Merriam-Webster Online				
Merriam-Webster Online				
Google Search: websters dictionary				
Google				
TheStar.com - News/News				
CNN.com				
CNN.com - Frist knocks Edwards over stem cell comment - Oct 12, 2004				
CNN.com				

Forward/backward recovery



3. Robustness (3)

- Responsiveness
 - How the user perceives the rate of communication with the system
 - Stability
- Task conformance
 - Degree to which system services support all the user's tasks
 - Task completeness
 - Task adequacy

Standards (1)

- Set by national or international bodies to ensure compliance by a large community of designers
- Standards require sound underlying theory and slowly changing technology
- Hardware standards
 - More common than software
 - High-authority, details at a very low level

Standards (2)

- ISO 9241: “Ergonomic design of visual display terminals (VDTs) used for office work”, defines...
- Usability
 - The effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in particular environments
- Effectiveness
 - The accuracy and completeness with which specified users can achieve specified goals in particular environments
- Efficiency
 - The resources expected in relation to the accuracy and completeness of goals achieved
- Satisfaction
 - The comfort and acceptability of the work system to its users and other people affected by its use

ISO9241-9 Questionnaire

1. Force required for actuation:	1	2	3	4	5	6	7
	Very uncomfortable				Very comfortable		
2. Smoothness during operation:	1	2	3	4	5	6	7
	Very rough				Very smooth		
3. Effort required for operation:	1	2	3	4	5	6	7
	Very high				Very low		
4. Accuracy:	1	2	3	4	5	6	7
	Very inaccurate				Very accurate		
5. Operation speed:	1	2	3	4	5	6	7
	Unacceptable				Acceptable		
6. General comfort:	1	2	3	4	5	6	7
	Very uncomfortable				Very comfortable		
7. Overall operation of input device:	1	2	3	4	5	6	7
	Very difficult				Very easy		
8. Finger fatigue:	1	2	3	4	5	6	7
	Very high				Very low		
9. Wrist fatigue:	1	2	3	4	5	6	7
	Very high				Very low		
10. Arm fatigue:	1	2	3	4	5	6	7
	Very high				Very low		
11. Shoulder fatigue:	1	2	3	4	5	6	7
	Very high				Very low		
12. Neck fatigue:	1	2	3	4	5	6	7
	Very high				Very low		

Guidelines

- More suggestive and general
- Many textbooks and reports full of guidelines
- Abstract guidelines (principles) applicable during early life cycle activities
- Detailed guidelines (style guides) applicable during later life cycle activities
- Understanding justification for guidelines aids in resolving conflicts

Golden Rules and Heuristics

- “Broad brush” design rules
- Useful check list for good design
- Better designs using these than using nothing!
- Different collections, e.g.,
 - Shneiderman’s 8 Golden Rules
 - Norman’s 7 Principles

Shneiderman's 8 Golden Rules

1. Strive for consistency
2. Enable frequent users to use shortcuts
3. Offer informative feedback
4. Design dialogs to yield closure
5. Offer error prevention and simple error handling
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short-term memory load



Ben Shneiderman

Norman's 7 Principles

1. Use both knowledge in the world and knowledge in the head
2. Simplify the structure of tasks
3. Make things visible: bridge the gulfs of execution and evaluation
4. Get the mappings right
5. Exploit the power of constraints, both natural and artificial
6. Design for errors
7. When all else fails, standardize



Don Norman

Shneiderman's 8 Golden Rules

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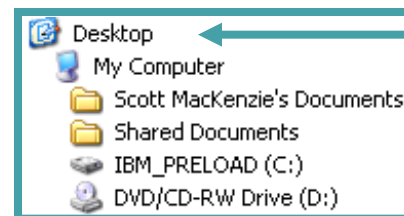
————— Same or similar
(in class activity)

HCI Design Patterns

- An approach to reusing knowledge about successful design solutions
- Originated in architecture
- A pattern is
 - An invariant solution to a recurrent problem within a specific context
- Examples
 - Light on two sides of every room (architecture)
 - Go back to a safe place (HCI)



“home”



Root directory

Thank You