Mensch-Maschine-Interaktion 1

Chapter 2 (April 26th, 2012, 9am-12pm): Basic HCI Principles 1

Overview

- Introduction
- Basic HCI Principles (1)
- Basic HCI Principles (2)
- User Research & Requirements
- Designing Interactive Systems
- Capabilities of Humans and Machines
- Implementing Interactive Systems
- User Study Design & Statistics
- Basic HCI Models
- User-Centered Development Process

Basic HCI Principles and Models

- Users and Developers
- 3 Usability Principles by Dix et al.
- 3 Usability Principles by Shneiderman
- Background: The Psychology of Everyday Action



What the User Sees

• Users see only what is openly visible!





What the Developer Knows

- Users have little idea about:
 - architecture,
 - state transitions,
 - dependencies
 - application context
 - system restrictions



• And users often do not want to know about it.





LMU München – Medieninformatik – Florian Echtler – Mensch-Maschine-Interaktion 1 – SS2012

A Computer Screen and its Interpretation

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



Answers from Skilled Computer Users

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



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



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



Metaphor Example 1 – Overlaying Windows

- What is the meaning of the fact that a window is behind another window?
- What is real? What is illusion?
- What does iconizing do?
- Models?
 Conceptual...
 Implementation...
 Represented...



Metaphor Example 2 – Scrollbar vs. Hand

- Moving up the hand moves up the document
- What happens in reality?
 What do we imagine?
 What is the metaphor?



Metaphor Example 2 – Scrollbar vs. Hand

- Moving up the scroll bar moves down the document
- What happens in reality?
 What do we imagine?
 What is the metaphor?



Metaphor Example 2 - Scrollbar vs. Hand

 Adequacy of interaction mechanism depends on content displayed



Types of Design Rules

- Principles
 - _abstract design rules
- Golden rules and heuristics _more concrete than principles
- Standards
 - -(very) detailed design rules
- Design pattern
 - _generic solution for a specific problem
- Style guides
 - –provided for devices, operating systems, widget libraries

increasing generality

principles

golden rules

standards

design pattern

style guides

increasing authority

- Authority: whether or not a rule must be followed or whether it is just suggested
- Generality: applied to many design situations or focused on specific application situation.

Usability 101 (by Jakob Nielsen)

- "Usability is a quality attribute that assesses how easy user interfaces are to use. The word 'usability' also refers to methods for improving ease-of-use during the design process."
- Usability has five quality components:
 - Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?
 - Efficiency: Once users have learned the design, how quickly can they perform tasks?
 - Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?
 - Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
 - Satisfaction: How pleasant is it to use the design?

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Principles to Support Usability

Learnability

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

- Flexibility
 - -the multiplicity of ways the user and system exchange information
- Robustness
 - -the level of support provided to the user in determining successful achievement and assessment of goal-directed behavior

Dix, A. J., Finlay, J., Abowd, G., Beale, R. Principles to support usability, Human-Computer Interaction, 260-273, Third Edition

Principles of Learnability (1 / 2)

- Predictability
 - determining effect of future actions based on past interaction history
 - operation visibility
- Synthesizability
 - ability of the user to assess the effect of past operations on the current state
 - the user should see the changes of an operation
 - immediate vs. eventual feedback



the ease with which new users can begin effective interaction and achieve maximal performance







C:\WINDOWS\system32\cmd.exe
C:∖>move test.txt test
C:\>dir *.txt Volume in drive C has no label. Volume Serial Number is FCB2-566A
Directory of C:\
25.05.2007 12:36 0 installDebug.txt 1 File(s) 0 bytes 0 Dir(s) 14,052,261,888 bytes free
C:\>cd test
C:∖test>dir *.txt Volume in drive C has no label. Volume Serial Number is FCB2-566A
Directory of C:\test
19.11.2007 16:56 0 test.txt 1 File(s) 0 bytes 0 Dir(s) 14,052,261,888 bytes free
C:\test>

Principles of Learnability (2 / 2)

- Familiarity
 - –how prior knowledge applies to new system
 - -affordance (guessability)
- Generalizability
 - extending specific interaction knowledge to new situations
- Consistency
 - likeness in input/output
 behavior arising from
 similar situations or
 task objectives









Principles of Flexibility (1 / 6)

- the multiplicity of ways the user and system exchange information
- Ways in which the user and the system exchange information
- Dialogue initiative
 - freedom from system imposed constraints on input dialogue
 - user preemptiveness: user initiates dialog
 - system preemptiveness: system initiates dialog



user preemptiveness



system preemptiveness

Principles of Flexibility (2 / 6)

- Multithreading
 - ability of system to support user interaction for several tasks at a time
 - concurrent multimodality: simultaneous communication of information pertaining to separate tasks
 - multi-modal dialog
 - editing text and beep (incoming mail) at the same time
 - interleaving multimodality: permits temporal overlap between separate tasks, dialog is restricted to a single task
 - window system, window = task
 - modal dialogs
 - interaction with just one window at a given time



Principles of Flexibility (3 / 6)

- Task migratability
 - passing responsibility for task execution between user and system
 - -example: spell checking

Task	migratab	ility	
Spelling			
Not in Dictionary <u>:</u>	migratability		
Change <u>t</u> o:	irritability	Ignore	Ignore All
Suggestions:	irritability	⊆hange	Change All
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Add <u>w</u> ords to:	CUSTOM.DIC	AutoCorrect	Close

Principles of Flexibility (4 / 6)

- Substitutivity
 - allowing equivalent values
 of input and output to be
 substituted for each other
 representation multiplicity



Width	35.556	
-		
Height 1	14.222	Inches Inches
Resolution 7	72	

-equal opportunity: blurs the distinction between input and output



	A	В	С	D	
1					
2	Summand 1	1	2	1	
3	Summand 2	2	2	2	
4	Summand 3	3	3	3	
5	Total sum	6	7	6	
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Principles of Flexibility (5 / 6)

- Customizability
 - modifiability of the user interface by the user (adaptability) or system (adaptivity)
 - adaptability: users ability to adjust the form of input and output
 - adaptivity: automatic customization of the user interface by the system

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				Navigation Help Window	cm_ShowQuickSearch cm_SwitchLongNames cm_RereadSource	2915 Show name search window 2010 Turn long names on and off 540 Reread source	
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Principles of Flexibility (6 / 6)

- Customizability
 - modifiability of the user interface by the user (adaptability) or system (adaptivity)
 - adaptability: users ability to adjust the form of input and output
 - adaptivity: automatic customization of the user interface by the system

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Principles of Robustness (1 / 2)

 → Level of support provided to the user in determining successful achievement and assessment of goal-directed behavior



- Observability
 - ability of the user to evaluate the internal state of the system from its perceivable representation
- Recoverability



- ability of the user to correct a recognized error
- reachability (states): forward (redo) / backward (undo) recovery
- commensurate effort (more effort / steps for deleting a file than for moving it)

Total Co	ommander 🔀
2	Do you really want to delete the selected file AUTOEXEC.BAT?
	Yes <u>N</u> o Cancel

Principles of Robustness (2 / 2)

- Task conformance
 - -degree to which system services support all of the user's tasks
 - -task completeness; task adequacy
- Responsiveness
 - -how the user perceives the rate of communication with the system
 - -preferred: short durations and instantaneous responses (< 100ms)
 - -stability and indication of response time



Letterboxing	1
Please wait. This may take a while.	
	C

Letterboxing: Please wait. This may take a while.

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3 Usability Principles by Dix

- Learnability
 - -Predictability
 - -Synthesizability
 - -Familiarity
 - -Generalizability
 - -Consistency
- Flexibility
 - -Dialogue initiative
 - -Multithreading
 - -Task migratability
 - -Substitutivity
 - -Customizability

- Robustness
- Observability
- Recoverability
- Responsiveness
- Task conformance

[Section 7.2 in Dix. "Human Computer Interaction"]