Usability & User Centered Design

SWE 432, Fall 2018

Design and Implementation of Software for the Web



Review: Mental models

- Only single temperature sensor.
- Controls not independent, need to adjust both.
- (also delayed feedback)



Review: Norman's 7 stages of action

- 1. Goal (form the goal)
- 2. Plan (the action)
- 3. Specify (action sequence)
- 4. Perform (action sequence)
- 5. Perceive (the state of the world)
- 6. Interpret (the perception)
- Compare (outcome w/ goal)



Review: Example - burners



Today

- What is user centered design?
- What does it mean to be usable?
- How can one evaluate usability?
 - Heuristic evaluations

For further reading: https://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/ https://www.nngroup.com/articles/ten-usability-heuristics/ http://designingwebinterfaces.com/6-tips-for-a-great-flex-ux-part-5

Characteristics of usability

- ease of use
- productivity
- efficiency
- effectiveness
- learnability
- retainability
- user satisfaction

Ground rules - terminology

- Affordances allow a user to interact with an object in **specific** ways (e.g. the sort buttons on wikipedia tables)
- Constraints restrict interactions and are often physical (e.g. can't move cursor outside of the screen)
- Conventions are usually cultural constraints (e.g. reading left-to-right), or the meaning Keynote File_Edit of the "apple" menu

Ú.	Keynote	File	Edit	Insert	
Ał	About This Mac				
S) Lo Ap	/stem Prefer ocation op Store	rences.		۲	
Re	ecent Items			•	
Fo	orce Quit Key	ynote	7	0 # O	
SI Re Sh	eep estart nut Down				
Lo Lo	ock Screen og Out Jonat	than Be	ell	^ 米Q 企業Q	1

Affordances, Constraints, Conventions









From Don Norman, Emotional Design

A teapot



A word processor

Usability

- A property of the relationship between
 - humans with goal-driven tasks
 - an artifact
- The speed and success with which the goals can be accomplished (task **performance**)

User-centered design

 Given humans with goals and tasks, design an artifact that helps to accomplish these tasks

Iterative User-centered design

 Given humans with goals and tasks, redesign an existing artifact that helps to accomplish these tasks faster and more successfully



Usability evaluation

 Given humans with goals and tasks and a new artifact, identify usability **issues** that decrease task performance

Empirical: Usability evaluation study

- Given humans with goals and tasks and an artifact,
 observe humans to identify usability issues that decrease task performance
- Offers ground truth (subject to measurement error and sampling bias)



Analytical: Usability principles

- Given humans with goals and tasks and an artifact, assess for conformance to UI principles to identify usability issues that decrease task performance
- Enables ground truth to be roughly approximated using lightweight evaluation method

Why study usability?



Adapted from Maneesh Agrawala & Bjoern Hartmann

GMU SWE 432 Fall 2018

Life-Threatening Errors

- 1995 American Airlines jet crashed into canyon wall, killing all aboard
- On approach to Rozo airport in Colombia
- Pilot skipped some of the approach procedures
- Pilot typed in "R" and system completed full name of airport to Romeo
- Guidance system executed turn at low altitude to head for Romeo airport
- 9 seconds later plane struck canyon wall
- Is the pilot to blame?
- <u>http://en.wikipedia.org/wiki/</u>
 <u>American_Airlines_Flight_965</u>



What usability is not

- Not "dummy proofing"
- Not being "user-friendly"
- Not just "usability testing"
- Not just making software pretty

21

The user is NOT like me

• Understanding user needs, tasks, goals

Human-Computer Interaction

"a discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them." ACM SIGCHI Curriculum Development Group Report, 1992



Heuristic evaluation

- "Discount usability engineering methods"
 - Pioneered by Jakob Nielsen in the 1990s
- Involves a small team of evaluators to evaluate an interface based on recognized usability principles
- Heuristics-"rules of thumb"

Adapted from slides by Bonnie John and Jennifer Mankoff

Heuristics

- 1. Visibility of system status
- 2. Match between system and the real world
- 3. User control and freedom
- 4. Consistency and standards
- 5. Error prevention
- 6. Recognition vs. recall
- 7. Flexibility and efficiency of use
- 8. Aesthetic and minimalist design
- 9. Help users recognize, diagnose, and recover from errors
- 10.Help and documentation

H1: Visibility of System Status



H1: Visibility of System Status

Time Left: 00:00:19 searching database for matches			
			46%

- What input has been received--Does the interface above say what the search input was?
- What processing it is currently doing--Does it say what it is currently doing?
- What the results of processing are--Does it give the results of processing?
- Feedback allows user to monitor progress towards solution of their task, allows the closure of tasks and reduces user anxiety (Lavery et al)

H2: Match between system and the real world



- Speak the users' language
- Follow real world conventions









H3: User Control and Freedom

eZip Wizard - Evaluation Copy			
	What would you like to do?		
	Unzip an existing ZIP file		
	C Create a new ZIP file		
	C Update an existing ZIP file		
eLup N			
<u>About</u> <u>R</u> egis	ster < <u>B</u> ack <u>N</u> ext > <u>C</u> ancel		

- "Exits" for mistaken choices, undo, redo
- Don't force down fixed paths

H4: Consistency and Standards

Microsoft Visual Basic	🔀 Microsoft Visual Ba	ısic
OK Cancel Help		OK Cancel Help
🚯 Microsoft Visual Basic	🔀 Microsoft Visual Ba	isic 🔀
Microsoft Visual Basic	🔀 Microsoft Visual Ba	nsic X
Microsoft Visual Basic	🔀 Microsoft Visual Ba	nsic X
Microsoft Visual Basic	K	nsic X OK Cancel Help
Microsoft Visual Basic	DK	Isic X

- Same words, situations, actions, should mean the same thing in **similar** situations; same things look the same, be located in the same place.
- Different things should be different



H5: Error prevention

🐃, Form1 📃 🗆 🗙	Appointment
Date: Month Day Year May 22 1997 Month Day Year	General Attendees Notes Planner Start 8 : 30 AM ⊕ Wed 5 /14 /97 ● At dag End 4 : 30 PM ⊕ Wed 5 /14 /97 ● At dag Itescription S M T W T F S 27 38 29 30 1 2 3 Smart Technology Sen 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 12 3 4 5 6 7 27 38 29 30 31 1 2 3 4 5 6 7

 Careful design which prevents a problem from occurring in the first place

H6: Recognition rather than recall

Connect Comp	uServe		? ×
User name:	(
Password:			
	🗖 Save Passi	vord	
Dial	Cancel	Properties	Help

Make objects, actions and options visible or easily retrievable

H7: Flexibility and Efficiency of Use



- Accelerators for experts (e.g., gestures, kb shortcuts)
- Allow users to tailor frequent actions (e.g., macros)

H8: Aesthetic and Minimalist design

Form Title (appears above URL in mos	Backgound Color.		
Q&D Software Development Order Desk	FFFBFO		
Form Heading (appears at t	op of Web page in bold type)	Text Color:	
Q&D Software Development Order Desk	000080		
E-Mail respones to (will not appear on	Alternate (for mailto forms only)	Background Graphic	
dversch@q-d.com			
Text to appear in Submit button	Text to appear in Reset button	O Mailto	
Send Order	Clear Form	i CGI	
Scrolling Status Bar Message (max length = 200 characters)			
WebMania 1.5b with Image Map Wizard is here!!			
KK Prev Tab		Next Tab >>	

 Interfaces should not contain irrelevant or rarely needed information

H9: Help users recognize, diagnose, and recover from errors



- Error messages in language user will understand
- Precisely indicate the problem
- Constructively suggest a solution

H10: Help and documentation



- Easy to search
- Focused on the user's task
- List concrete steps to carry out
- Always available

Example

- I. Visibility of system status
- 2. Match between system and the real world
- 3. User control and freedom
- 4. Consistency and standards
- 5. Error prevention
- 6. Recognition vs. recall
- 7. Flexibility and efficiency of use
- 8. Aesthetic and minimalist design
- 9. Help users recognize, diagnose, and recover from errors
- 10. Help and documentation

wGetGUI v1.0 You ar	e using GNU Wget 1.9-beta	ı - 1.7 is minimum.	_ 🗆 🗵
URL: Hosts Span All Allow List ->		- Clear	 Retrieval Options No clobber Timestamping Continue file download
C Reject List -> Accept/Reject C Accept: ⓒ Reject: C htm(I) ☑ gif	Special Retries: 10 Additional Parameters:	Running Options Go 2 background	Quota (kB): Spider (check for files) No directories Force directories Save to custom dir.
☐ ipg ☐ txt ☐ zip ☑ exe ☐ doc ☐ All Custom list: *thm*	 Act like a browser Convert links Ignore robots.txt Configure Proxy 	All info Some info Append to logfile Overwrite Logfile	Clear Server Cache ✓ Recursive Retrieval Depth: 0
Start wGetStart.bat	Save Load settings settings Add to wGetStart.bat Emp	About <u>Exit</u>	 Download "as-is" Mirror site add HTML suffix Only go deeper

Example

- I. Visibility of system status
- 2. Match between system and the real world
- 3. User control and freedom
- 4. Consistency and standards
- 5. Error prevention
- 6. Recognition vs. recall
- 7. Flexibility and efficiency of use
- 8. Aesthetic and minimalist design
- 9. Help users recognize, diagnose, and recover from errors
- 10. Help and documentation



Using heuristic evaluation

- Can be used informally to identify issues in a website
- Can be used as a more formal usability inspection method
- Evaluators each first separately identify issues
- Issues then combined from each evaluator

Heuristic evaluation in groups



Bell

Advantages of HE

- "Discount usability engineering" Intimidation low
- Don't need to identify tasks, activities
- Can identify some fairly obvious fixes
- Can expose problems user testing doesn't expose
- Provides a language for justifying usability recommendations

Disadvantages of HE

- Un-validated
- Do not employ real users
- Can be error prone
- Better to use usability experts
- Problems unconnected with tasks
- Heuristics may be hard to apply to new technology

Ways to use HE

- Early in design process to catch major issues
- When time or resources are not available for empirical usability evaluation

In class activity

- Form groups of 3 or 4
- Together select an application or website (e.g., Word, Twitter)
- Work individually identify at least 1 usability issue
- For each issue, identify the heuristic, identify the functionality in the application, and summarize how the heuristic is violated in a few sentences