



Human-Computer Interaction IS 4300

Prof. Timothy Bickmore



Overview for Today

- Brief review.
- Affordances & Cognitive Models.
- Norman's Interaction Model
- Heuristic Evaluation.
- Cognitive Walk-through Evaluation
- Homework 12
- Review of Team Projects



Overview of Course

<http://www.ccs.neu.edu/course/is4300f12/>

Course Website

IS4300– Human-Computer Interaction

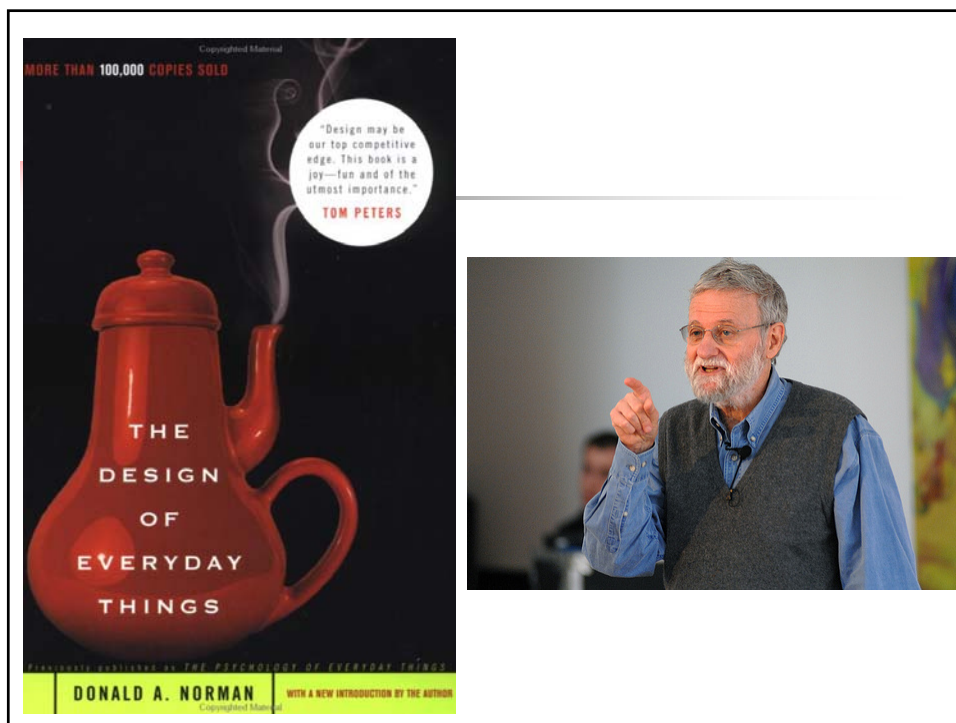
[\[Syllabus\]](#) [\[Schedule\]](#) [\[Homework\]](#) [\[Projects\]](#) [\[Resources\]](#) [\[Directory\]](#)

Schedule

Date	Topics & Readings	Assignments	
		Due	Start
9/6	Overview of HCI and course. Team Projects.		T1, T1
9/10	Motivation for design. Affordances & Cognitive Models. Heuristic Evaluation. Norman's Interaction Model & Cognitive Walk-through Evaluation. (Norman Ch 1-2).		T2
9/13	Further motivation. Designing for human memory. Design for obviousness. Team project brainstorming. (Norman Ch 3-4) (Guest lecture: Barbara Barry)	I1	
9/17	Doing observational studies (Stone Ch 2, Fetterman ; Example 1 ; Example 2).	I2	T3
9/20	Design for Errors. HCI development process (Norman Ch 5-6-7; Stone Ch 1).	T1a	
9/24	Users & Tasks (Stone Ch 3-4)	T1b	T2
9/27	Requirements Analysis (Stone Ch 5-7)		
10/1	Conceptual Design (Stone Ch 8). Interaction design (Stone Ch 10-11). Intro to Java Swing	T2, I3	T3, I4

Administrivia

- Tim
 - WVH448, is4300@ccs.neu.edu
 - Office hours: Weds 3-5, or by appt.
 - EXCEPTIONS: 9/12 (away), 9/19 12:30-2:30
 - In class prior to start
- TA – Lazlo Ring
 - WVH466, lring@ccs.neu.edu
 - Office hours: Tue 1-4, or by appt.
- Class: is4300-all@ccs.neu.edu



Norman Ch 1

- Affordances
- Visibility
- Conceptual models
- Constraints
- Mappings
- Feedback

Affordances

- The fundamental properties of a thing that determine just how it could possibly be used.
 - Examples?
 - A chair affords sitting
 - Knobs are for turning.
 - Slots are for inserting things into.



Visibility

- *aka "Obviousness"*
- The correct parts must be visible.
- They must convey the correct message.
- Impacts learnability.

- How different from affordance?
- Examples?



- How to get visitors to put their hand in the box?



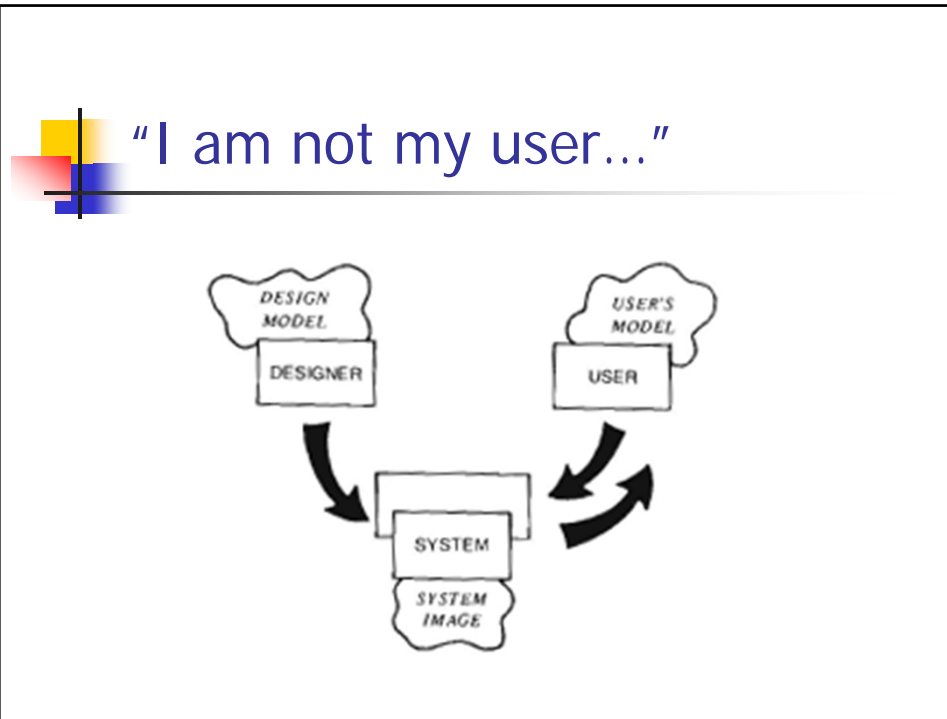
- touch what you want to say...


Conceptual models

- Mental representation of how a thing works
 - allows you to mentally simulate and predict its behavior.



- Daily
- Weekday
- Custom



 Constraints

- Limit the ways you can interact with an object.



A photograph of a red plastic component, possibly a button or switch, mounted on a black base with a metal contact point.

Mappings

- Relationship between controls and functions.
- Natural mapping – taking advantage of physical analogies and cultural standards – leads to immediate understanding.



Another important kind of mapping for UI users...

- External Consistency
- A kind of “cultural” knowledge.
- Also Internal Consistency

Feedback

- Providing user with information about the results of an action.

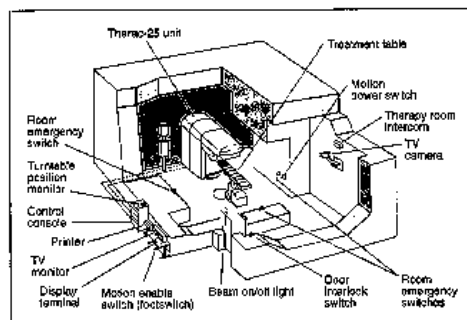


Figure 1. Typical Therac-25 facility.

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PATIENT NAME : TEST      BEAM TYPE: X ENERGY (keV): 25      A      1
TREATMENT MODE: FIX
UNIT RATE/MINUTE          0          ACTUAL      200      PRESCRIBED
MONITOR UNITS             50 50          200
TIME (MIN)                 0.27          1.00

GANTRY ROTATION (DEG)     0.0          0          VERIFIED
COLLIMATOR ROTATION (DEG) 359.2        359        VERIFIED
COLLIMATOR X (CM)         14.2          14.3       VERIFIED
COLLIMATOR Y (CM)         27.2          27.3       VERIFIED
WEDGE NUMBER              1            1          VERIFIED
ACCESSORY NUMBER          0            0          VERIFIED

DATE : 84-OCT-26  SYSTEM: BEAM READY  OP.MODE: TREAT  AUTO
TIME : 12:55.8   TREAT : TREAT PAUSE  X-PAY      173777
OPR ID: T25V02-803 REASON: OPERATOR  COMMAND:
  
```

Some Kinds of Feedback

- Immediate control manipulation feedback
- "Action in progress" feedback
- Updated system state feedback

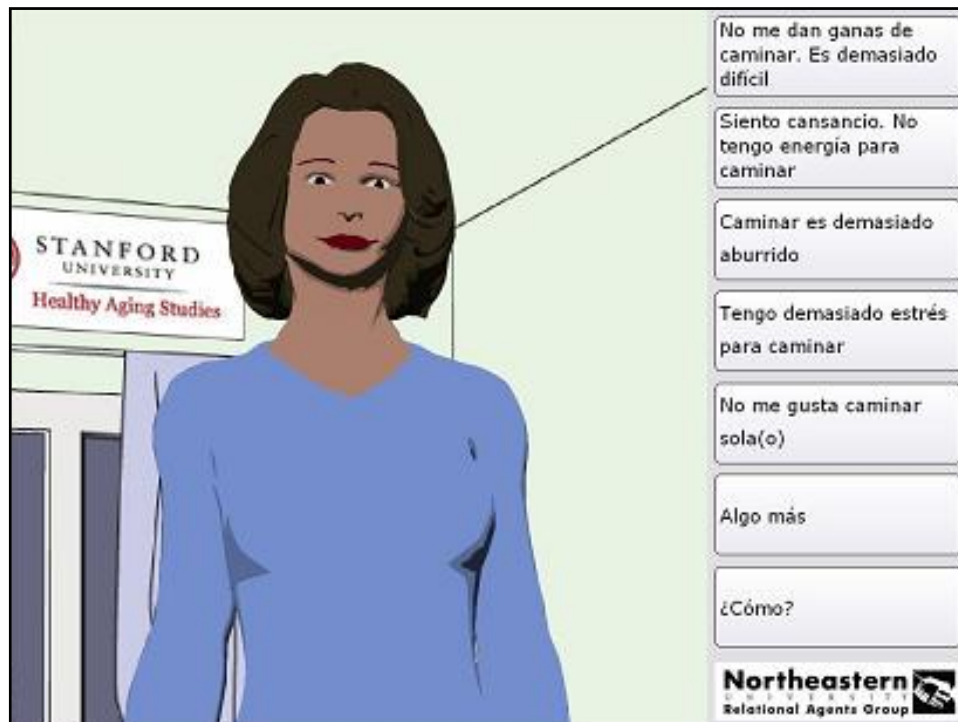
Feedback



Feedback



- Air France Flight 447, 1 June 2009, Airbus A330-200
- Stalled, crashed, killed 216 passengers and 12 aircrew
- Final report:
 - Initial cause: icing of airspeed sensors
 - Many feedback problems:
 - Inconsistency between the airspeed measurements
 - Incomprehension of the situation when the autopilot disconnection occurred,
 - The lack of a clear display in the cockpit of the airspeed inconsistencies identified by the computers
 - A failure to identify the aural stall warning
 - The appearance at the beginning of the event of transient warnings that could be considered as spurious
 - The absence of any visual information to confirm the approach-to-stall after the loss of the limit speeds



Who should users blame if they can't use your interface?

- Who do they blame?
- Ramifications for empirical testing?



Norman's Interaction Framework

1. user establishes the goal
2. formulates intention
3. specifies actions at interface
4. executes action
5. perceives system state
6. interprets system state
7. evaluates system state with respect to goal

Gulf of execution

user's formulation of actions
≠ actions allowed by the system

Gulf of evaluation

user's expectations about system state
≠ presentation of state by system



Slip vs. Mistake

- Slip
 - Error in executing action
- Mistake
 - Error in formulating intention & action



Individual Homework #12

UI Critique

- Find 2 good & 2 bad examples of UI design
- Criteria from today
 - Conceptual Model
 - Mappings
 - Affordances
 - Feedback
 - Consistency
 - etc
- Include visuals if possible
- Informal “heuristic evaluation”



Evaluation methods

- Expert/Inspection methods
 - Heuristic evaluation
 - Cognitive walk-through
 - Modeling
- User Testing
 - qualitative methods (interviews, questionnaires)
 - observation in the field
 - controlled experiments (same environment & task with 2 or more alternative designs)

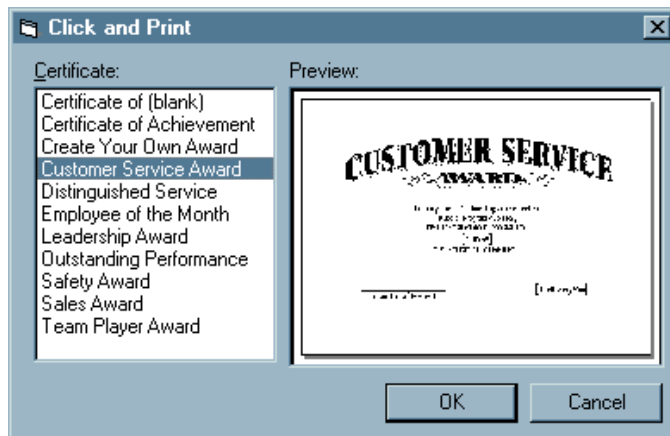
Inspection methods

- Heuristic evaluation
 - Checklist approach
 - Usually...
 - Independent evaluators (3-5)
 - Severity rating for problems
 0. No problem
 1. Cosmetic problem
 2. Minor – low priority
 3. Major problem – high priority
 4. Catastrophe – must fix

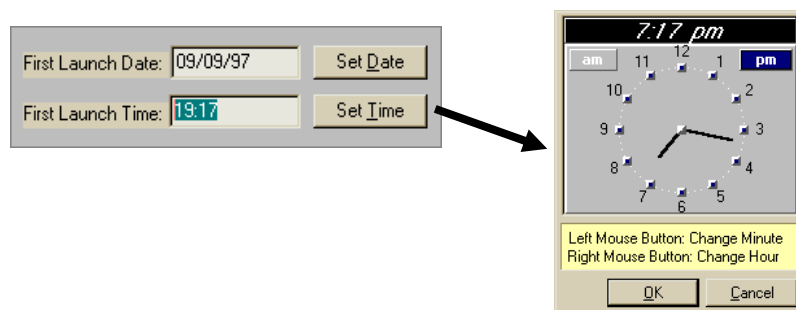
Example 1



Example 1 - redesign



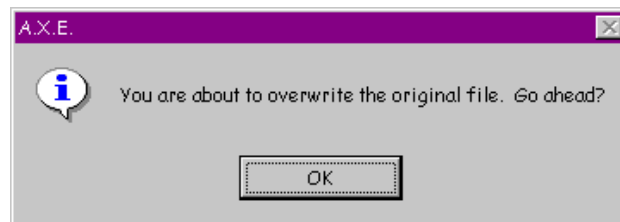
Example 2



Example 3



Example 4



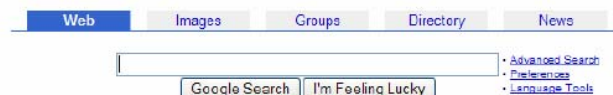
Heuristic Evaluation

- There are many “checklists” available
- Nielsen’s 10 design heuristics
- Tognazzi’s First Principles of Interaction Design
- Gerhardt-Powals’ cognitive engineering principles
- etc

Nielsen’s Heuristics

1. Simple and Natural Dialogue

- “Less is More” / KISS
 - Omit extraneous info, graphics, features



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Nielsen's Heuristics

2. Speak the User's Language

- Use common words, not techie jargon
 - But use domain-specific terms where appropriate
- Don't put limits on user defined names
- Allow aliases/synonyms in command languages
- Metaphors are useful but may mislead

Nielsen's Heuristics

3. Minimize User Memory Load

- Use menus, not command languages
- Use combo boxes, not textboxes
- Use generic commands where possible (Open, Save, Copy Paste)
- All needed information should be visible



Nielsen's Heuristics

4. Consistency

- Principle of Least Surprise
 - Similar things should look and act similar
 - Different things should look different
- Other properties
 - Size, location, color, wording, ordering, ...
- Command/argument order
 - Prefix vs. postfix
- Follow platform standards
- Kinds of Consistency
 - Internal
 - External
 - Metaphorical



Nielsen's Heuristics

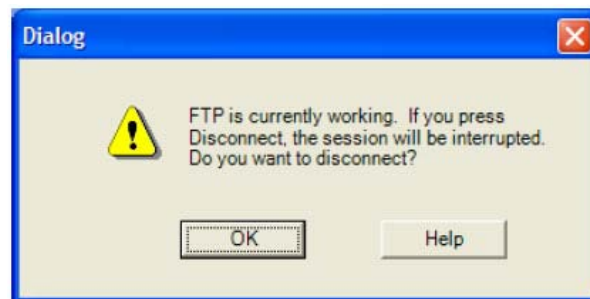
5. Feedback

- Keep user informed of system state
 - Cursor change
 - Selection highlight
 - Status bar
- Response time
 - < 0.1 s: seems instantaneous
 - 0.1-1 s: user notices, but no feedback needed
 - 1-10 s: display busy cursor or other feedback
 - > 10 s: display progress bar

Nielsen's Heuristics

6. Clearly Marked Exits


- Provide undo
- Long operations should be cancelable
- All dialogs should have a cancel button



Nielsen's Heuristics

7. Shortcuts

- Provide easily-learned shortcuts for frequent operations
 - Keyboard accelerators
 - Command abbreviations
 - Styles
 - Bookmarks
 - History



Nielsen's Heuristics

8. Good Error Messages

- Be precise; restate user's input
 - Not "Cannot open file", but "Cannot open file named paper.doc"
- Give constructive help
 - why error occurred and how to fix it
- Be polite and non-blaming
 - Not "fatal error", not "illegal"
- Hide technical details (stack trace) until requested



Nielsen's Heuristics

9. Prevent Errors

- Selection is less error-prone than typing
- Disable illegal commands
- Description Error
 - different things/commands should look and act different
- Mode Error
 - Eliminate modes
 - Visibility of mode
 - Spring-loaded or temporary modes



Nielsen's Heuristics

10. Help and Documentation

- Model
 1. Searching
 2. Understanding
 3. Applying
- Important features
 - Index
 - Overview map
 - Help visible while user is applying
 - Describe confirmatory feedback



Exercise 1

- "Heuristic evaluation"
- Critique a UI using criteria from today
 - Conceptual Model
 - Mappings
 - Affordances
 - Feedback
 - Consistency
 - etc
- Teams of 2-3
- Pick one random web site...



Inspection methods

- Cognitive walkthrough
 - Walk through each step in the task and evaluate:
 1. Is the effect of the action the same as the user's goal at that point?
 2. Will users see that the action is available?
 3. Once users have found the action, will they know it is the one they need?
 4. After the action is taken, will users understand the feedback they get?



Examples (need 10)

- Discuss what was found
- Discuss methodology – was it very systematic???

- Your cell phone
- myNeu home page
- Facebook
- AngryBirds



Exercise 2

- Cognitive walk-through
 - A more methodical approach to heuristic evaluation

- 1. Define a task (as end goal, not how-to)
- 2. For each step (UI action)
 - Is the next action obvious?
 - Is the effect of the action taken obvious?



Individual Homework #12

UI Critique

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 - etc
- Include visuals if possible
- Some examples...



Team Project Review

- Must have a substantial UI
- UI must be interactive
- Creative, original, non-obvious is better
- Ideas: research papers & past CHI, UIST, IUI
- Each team should have 2-4 members
- Ideally complementary skills



To Do for Next Week

1. Set up individual course web page
 - *Note: All assignments must be posted 1 hour before class on due date.*
 2. Read Norman Ch 3-4
 3. Finish Homework I1 (project brainstorming) – be prepared to present your ideas in class. Make sure they are posted to the web for presentation.
 4. Start Homework I2
 5. Continue Project T1 (thinking about team projects)
 - Review CHI Proceedings for inspiration.
- Guest lecture next week: Dr. Barbara Barry
 - Tim & Lazlo away