



# Human-Computer Interaction IS 4300

---

Prof. Timothy Bickmore



## Overview for Today

---

- Brief review
- HCI Development Process
- Heuristic Evaluation
- Cognitive Walk-through Evaluation
- Homework I2
- Review of Projects



# Overview of Course

<http://www.ccs.neu.edu/course/is4300f13/>

## Course Website

### IS4300– Human-Computer Interaction

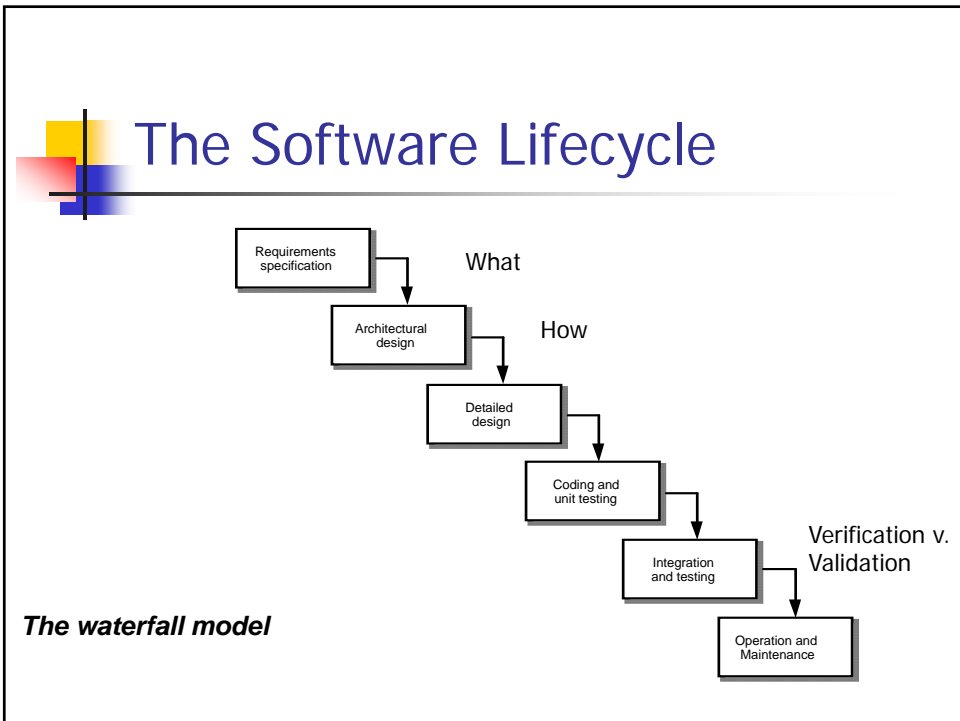
[\[Syllabus\]](#) [\[Schedule\]](#) [\[Homework\]](#) [\[Projects\]](#) [\[Resources\]](#) [\[Directory\]](#)

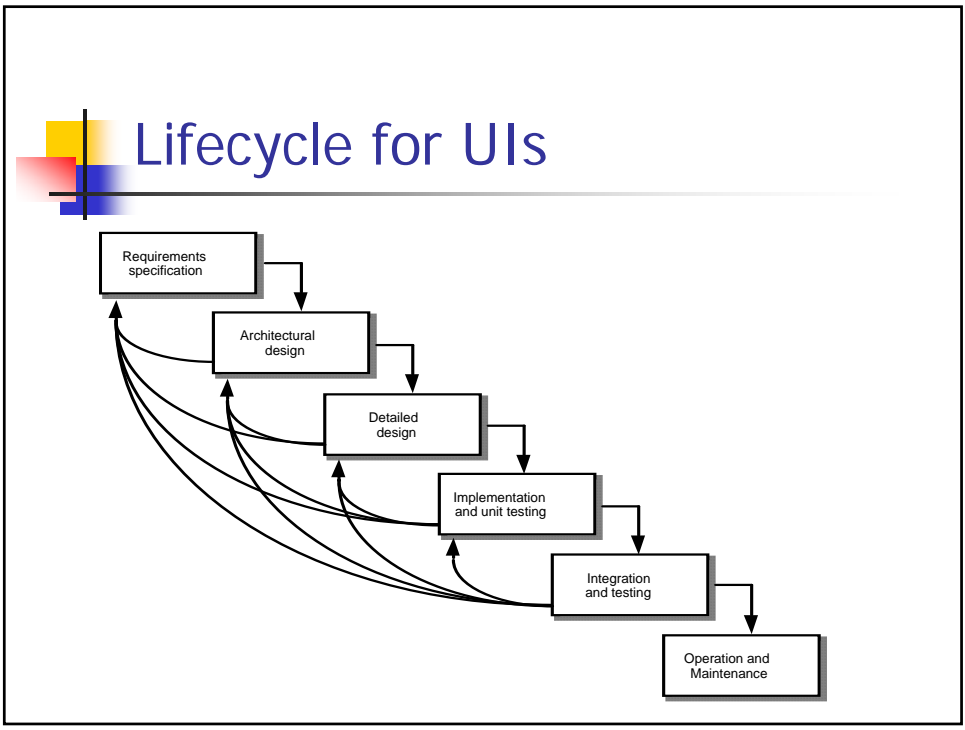
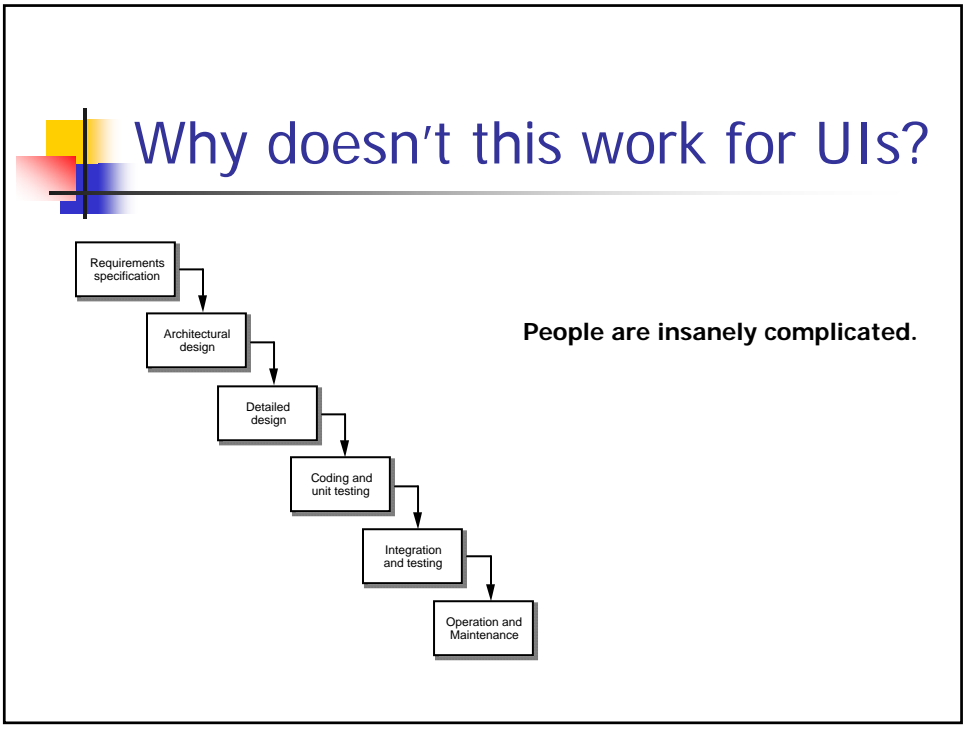
#### Schedule

Date	Topics & Readings	Assignments	
		Due	Start
9/5	Overview of HCI and course. Getting started on projects.		<a href="#">I1, P1</a>
9/9	HCI development process (Dix Ch 6). Critical Analysis of UIs (Dix Ch 7)		<a href="#">I2</a>
9/12	Humans (Dix Ch 1). Team project brainstorming.	I1	
9/16	Computers (skim Dix Ch 2). Doing observational studies, <a href="#">Fetterman</a> ; <a href="#">Example 1</a> ; <a href="#">Example 2</a> .	I2	<a href="#">I3</a>
9/19	Interaction (Dix Ch 3-4).	P1a	
9/23	Requirements analysis: Users & Tasks (Dix Ch 13 & 15), Scenarios (Rosson part of Ch 2), Intro to Usability.	P1b	<a href="#">P2</a>
9/26	GUI Software Architecture (Dix Ch 8). <a href="#">[Intro to Java Swing (1st three)]</a>	I3	<a href="#">I4</a>

# User-Centered Design

Dix Ch 6

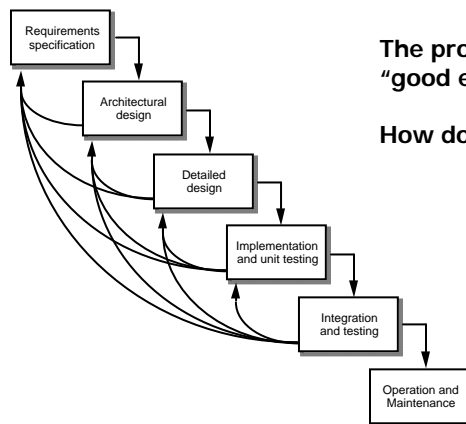




## User-Centered Design

- Try lots of stuff. See how it plays with the users.
  - Involve representative users in all stages of the development process.
  - Minimize the cost of and commitment to prototypes.
  - Users often can't tell you which alternative is "better" – have to test and measure.

## Usability Engineering



The process by which we achieve "good enough" usability.

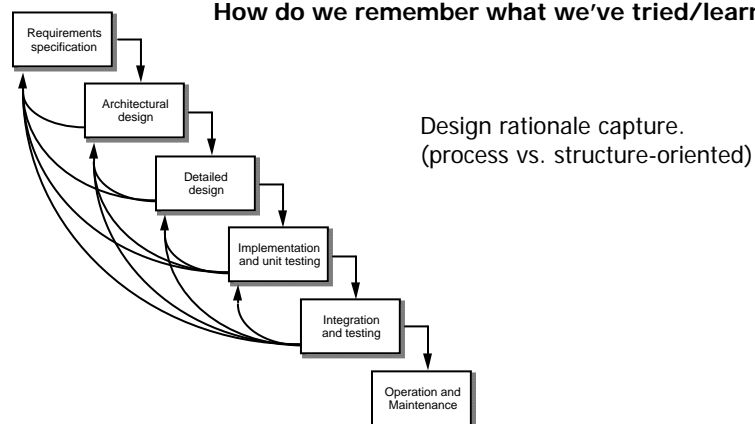
How do we know when we're there?

## Usability Engineering

- Must define usability attributes (multi-dimensional)
- Must define specific measures for each
- Must define “good enough” (goal) levels for each
  - If appropriate, current & ideal levels for each
- Example attributes (measures?)
  - Learnability
  - Efficiency
  - Memorability
  - Low error rate
  - Subjectively pleasing

## Usability Engineering

How do we remember what we've tried/learned before?





## First Step: Requirements & Specifications

---

- Know your user
  
- Knowledge about people in general
- Very, very specific knowledge about users and work environment
  
- Ethnography in 1 week



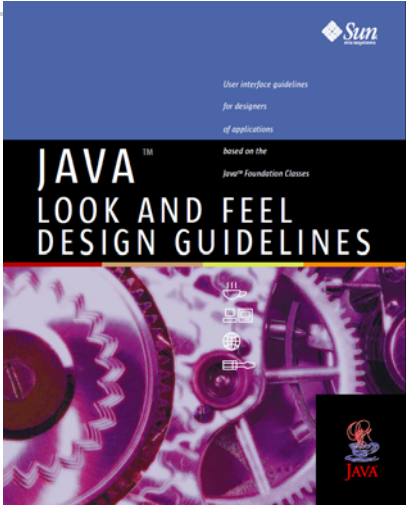
## Design Rules

---

Dix Ch 7

## Design Rules

- Principles
  - Learnability
  - Flexibility
  - Robustness
- Standards
- Guidelines



## Design Heuristics

- “Rules of Thumb” for improving usability





## Heuristics

---

- There are many other “checklists” available
  - Nielsen's 10 design heuristics (Dix 9)
  - 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



Google™

[Web](#) [Images](#) [Groups](#) [Directory](#) [News](#)

[Advanced Search](#)  
  [Preferences](#)  
[Language Tools](#)

[Advertise with Us](#) - [Business Solutions](#) - [Services & Tools](#) - [Jobs, Press, & Help](#)

©2003 Google - Searching 2,307,998,701 web pages

## 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

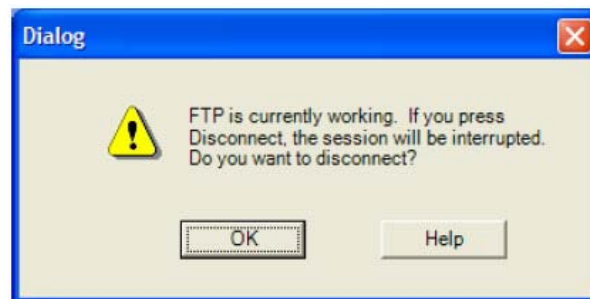
---

- 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



## Critical Analysis of UIs


---



## Evaluation Methodologies

---

- Expert
  - inspection methods
    - Heuristic evaluation
    - Cognitive walk through
  - models
- User testing
  - qualitative methods (observation, interviews, questionnaires, think aloud)
  - quantitative usability evaluation




## Some examples...

---

What's wrong with these?

## Example 1



Select an award style using the scroll bar. When you've found a style that suits you, press OKAY to create that award and open the editor.

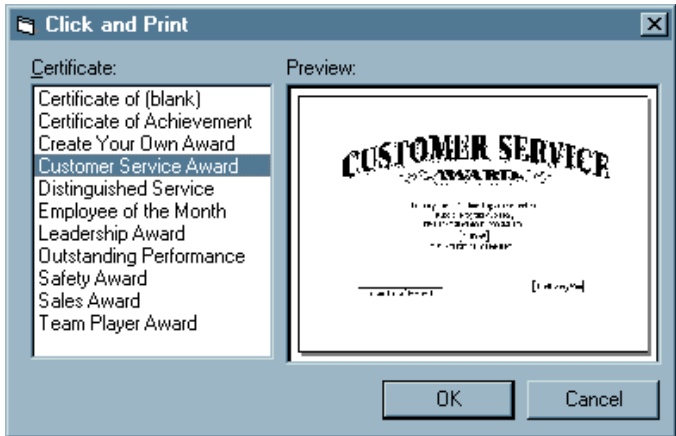
**Certificate of Achievement**

\_\_\_\_\_  
[Print this, too]

CERTIFICATE OF ACHIEVEMENT

Cancel OK

## Example 1 - redesign



**Click and Print**

Certificate:

- Certificate of (blank)
- Certificate of Achievement
- Create Your Own Award
- Customer Service Award**
- Distinguished Service
- Employee of the Month
- Leadership Award
- Outstanding Performance
- Safety Award
- Sales Award
- Team Player Award

Preview:

**CUSTOMER SERVICE**

\_\_\_\_\_  
[Print this, too]

OK Cancel



## Example 2

First Launch Date: 09/09/97 Set Date

First Launch Time: 19:17 Set Time

7:17 pm

am 11 12 1 pm

10 2

9 3

8 4

7 5

6

Left Mouse Button: Change Minute  
Right Mouse Button: Change Hour

OK Cancel

## Example 3

Pick Newsgroups on news.zwolle.nl.net

Type name or Select from List:

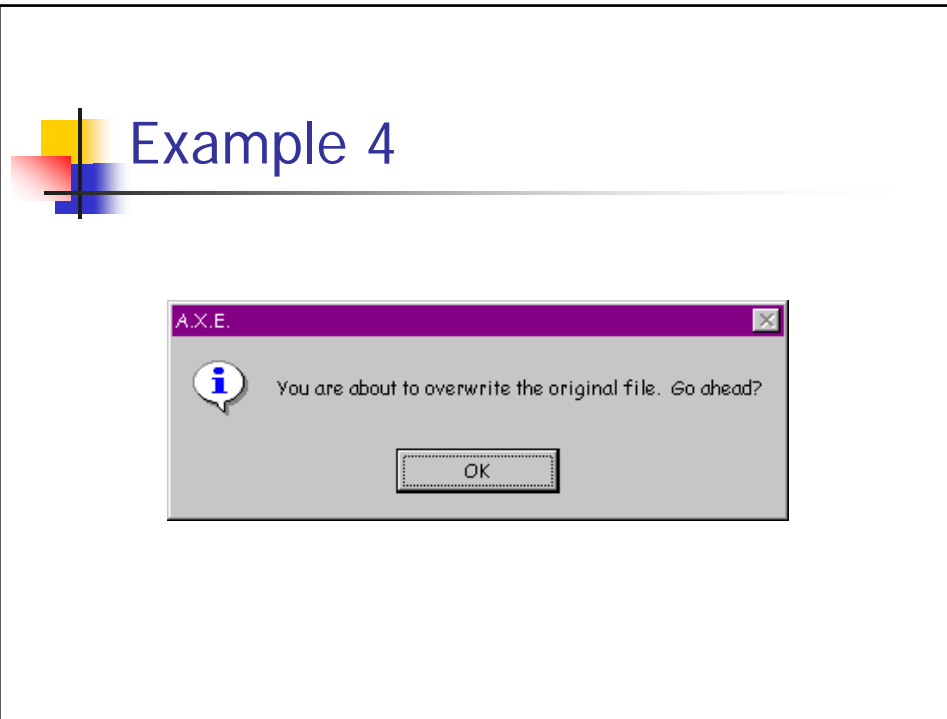
inetexplorer.ie5

microsoft.public.inetexplorer.ie5beta.a...  
microsoft.public.inetexplorer.ie5beta.b...  
microsoft.public.inetexplorer.ie5beta.icw  
microsoft.public.inetexplorer.ie5beta.i...  
microsoft.public.inetexplorer.ie5beta...

Add Remove

Newsgroups to post to:

microsoft.public.inetexplorer.ie5beta.s...



## Exercise 1

- "Heuristic evaluation"
- Critique a UI using Nielsen's Heuristics
  1. Simple and Natural Dialogue
  2. Speak the User's Language
  3. Minimize User Memory Load
  4. Consistency
  5. Feedback
  6. Clearly Marked Exits
  7. Shortcuts
  8. Good Error Messages
  9. Prevent Errors
  10. Help and Documentation
- 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?



## 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 #2

### UI Critique

---

- Find 2 good & 2 bad examples of UI design
- Use Nielsen's Heuristics
  - Make explicit reference to them
- Include visuals
- Make suggestions for improvement



## Project Review

---

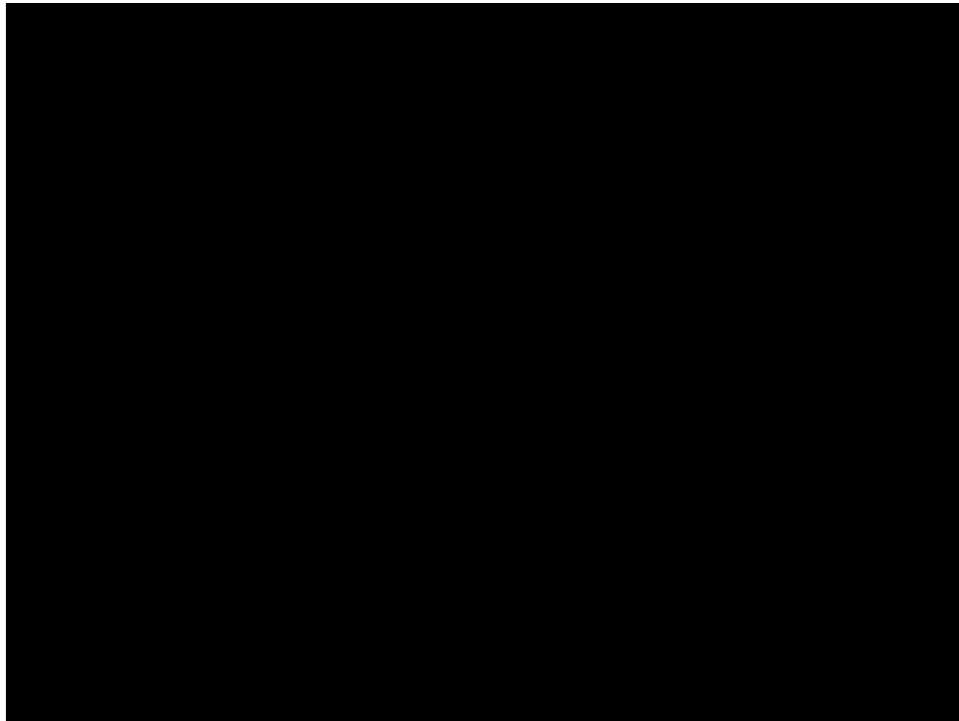
- Must have a substantial UI
- UI must be interactive
- Creative, original, non-obvious is better
- Ideas: research papers & past CHI, UIST, IUI
- Each project should have 1-2 members
- Ideally complementary skills



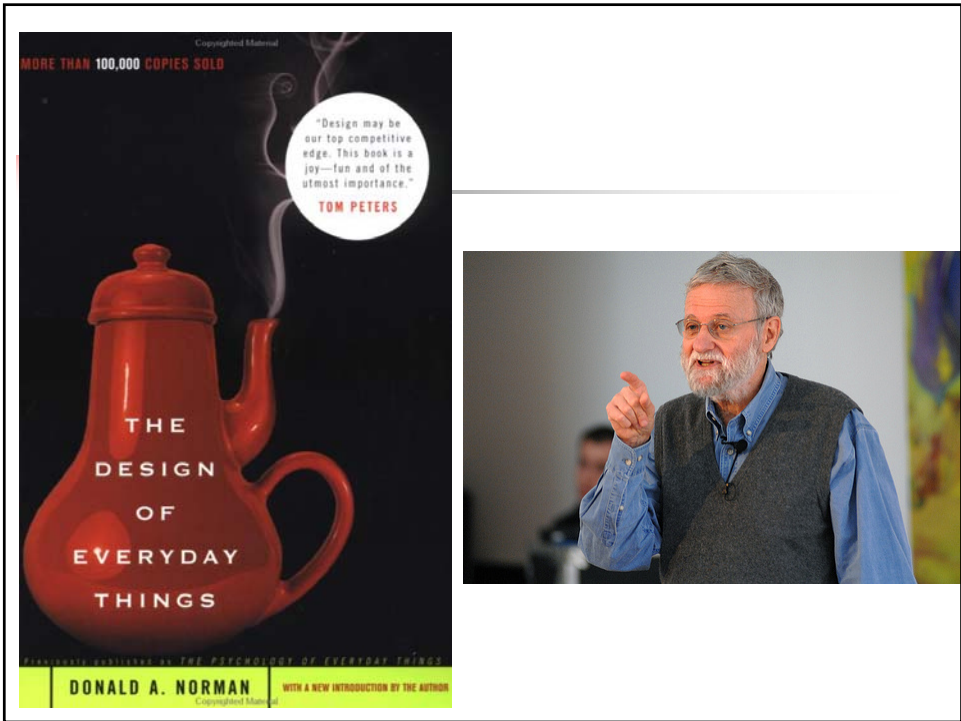
## To Do for Next Class

---

1. I1
  - Set up individual course web page
  - Project brainstorming
    - Pick three different project ideas that you would be interested in working on, make a rough sketch of a user interface and write a few sentences
    - Be prepared to present your ideas in class. Make sure they are posted to the web for presentation.
2. Read Dix Ch 1 (Humans)
3. I2 - Start UI critique (1 week)



# More UI Concepts / Heuristics





## 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.



## Mappings

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



## Feedback

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

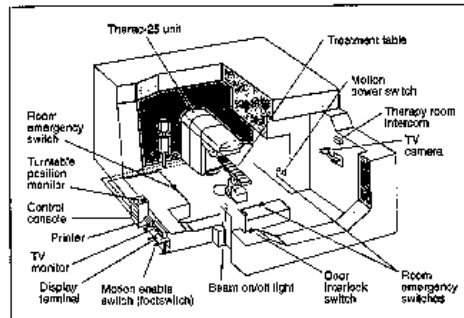


Figure 1. Typical Therac-25 facility.

```

PATIENT NAME : TEST      BEAM TYPE: X ENERGY (keV): 25      A      1
TREATMENT MODE: FIX
UNIT RATE/MINUTE          0          200      ACTUAL      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
OPR ID: T25V02-803  REASON: OPERATOR  COMMAND:
  
```

## Some Kinds of Feedback

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

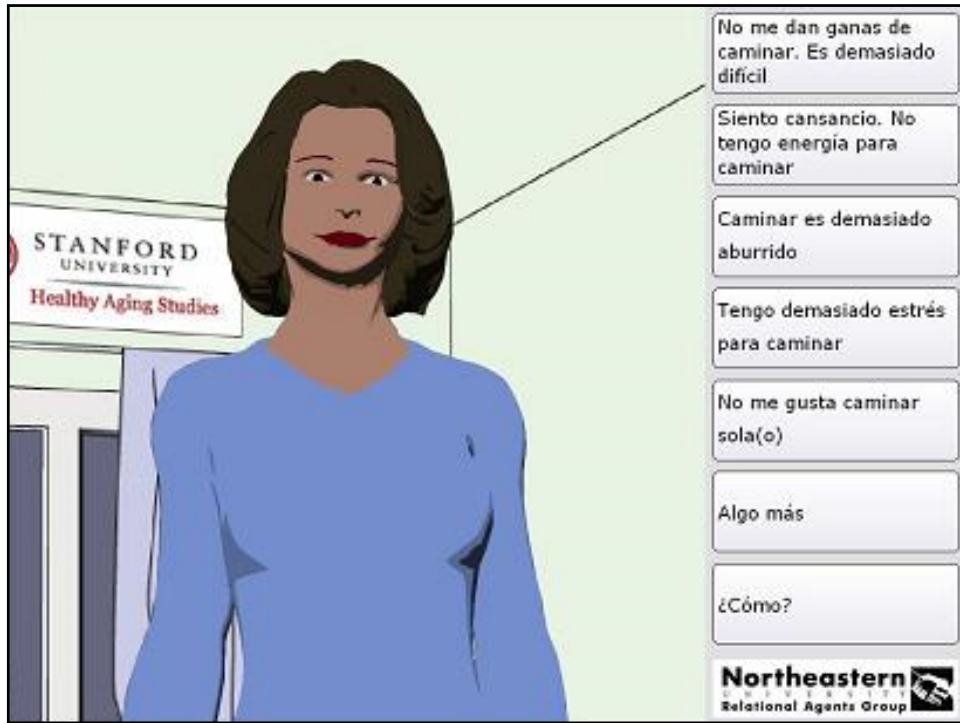
## Feedback



## 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



The image shows a woman with dark hair and a blue top standing in front of a sign that reads "STANFORD UNIVERSITY Healthy Aging Studies". A speech bubble originates from her, containing a list of reasons for not wanting to walk. The list includes: "No me dan ganas de caminar. Es demasiado difícil", "Siento cansancio. No tengo energía para caminar", "Caminar es demasiado aburrido", "Tengo demasiado estrés para caminar", "No me gusta caminar sola(o)", "Algo más", and "¿Cómo?". At the bottom right of the image is the logo for "Northeastern Relational Agents Group".

STANFORD UNIVERSITY  
Healthy Aging Studies

No me dan ganas de caminar. Es demasiado difícil

Siento cansancio. No tengo energía para caminar

Caminar es demasiado aburrido

Tengo demasiado estrés para caminar

No me gusta caminar sola(o)

Algo más

¿Cómo?

Northeastern  
Relational Agents Group