Expert Evaluations

November 30, 2016

Admin

- Final assignments
  - High quality expected
    - Slides
    - Presentation delivery
    - Interface (remember, focus is on a high-fidelity UI)
    - Reports
    - Responsive
  - Put your best foot forward: sharing your projects with the Mayor's Office
  - Explicitly demonstrate knowledge gained across semester
  - Practice, practice, practice your talks!
- Representatives from the Mayor's Office next week
- **ROOM CHANGE for next week: 425 Shillman Hall**

Admin

- T6
  - Publically-accessible link to your prototype (for sharing with Mayor's office)
- S-L Time sheet form
  - http://bit.ly/2g6pTLB
- S-L Survey: **Due Wednesday Dec 7 @ 6pm**
  - https://www.surveymonkey.com/r/Fall2016_S-LStudentEvaluation
- TRACE Course Evaluations
  - Please complete!

Expert Evaluations

- What
  - Experts use their knowledge of users & technology to review software usability
  - Critiques (crits) can be formal or informal reports.
- Types
  - Predictive Modelling
  - Cognitive Walkthrough
  - Heuristic Evaluation
- Used at what stage(s) of the UCD & software lifecycles?
  - Throughout the lifecycle
  - On prototypes of all levels of fidelity

Predictive Models in HCI

- What?
  - Abstractions of user behavior that allow experts to estimate how users will interact
    - Equations, formulas
- Advantages
  - Quicker & less expensive than a user study
  - Based on empirical data
- Disadvantages?
  - Usefulness limited to systems with predictable tasks
    - e.g., telephone answering systems, mobile text entry, etc.
  - Based on expert error-free behavior

Predictive Models

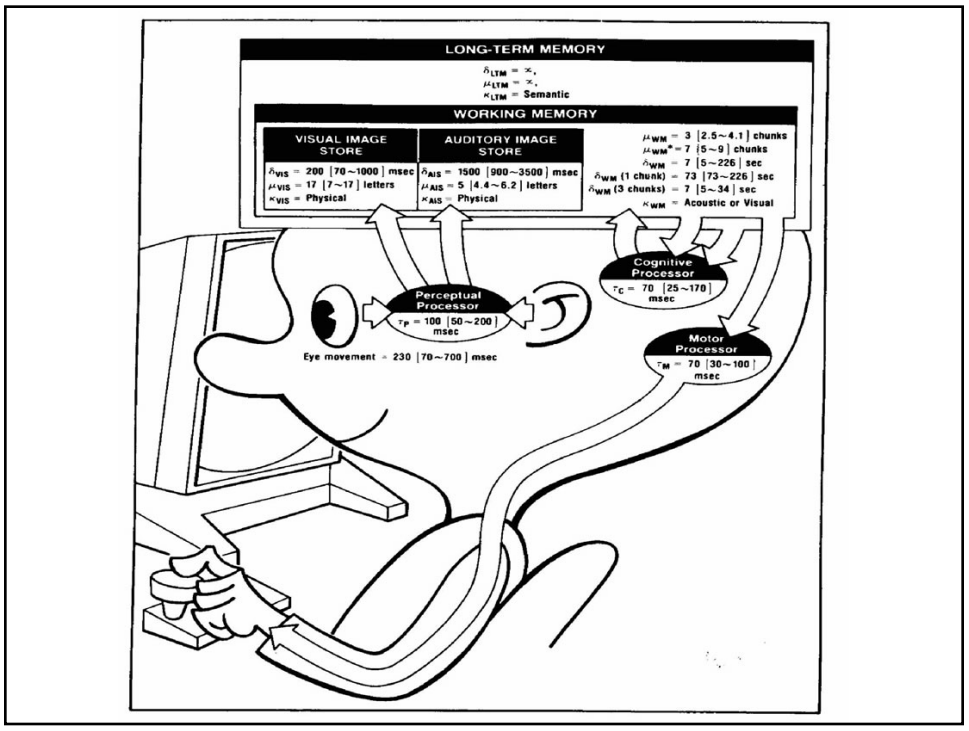
- GOMS Model
  - Card, Moran & Newell: 1980s
  - Family of modeling techniques to analyze complexity of interactive systems
  - Task decomposition: reduces user interaction into basic actions
    - Cognitive, physical, perceptual
  - Goals
    - State user wants to achieve (book a trip)
  - Operators
    - Elementary cognitive processes, physical actions, & perceptual acts performed to achieve goals (e.g., double click mouse, locate icon)
    - Empirically derived estimates
  - Methods
    - Sequence of steps to accomplish goal (eg. drag mouse over field, type in keywords, press the go button)
  - Selection Rules
    - How decide which method to select

Predictive Models

- GOMS Model: uses
  - Functionality coverage: make sure that methods exist to support each user goal
  - Predict execution time for each goal
  - Locate bottlenecks, compare application designs
  - Designing help systems: address issues of challenge identified
- Assumes expert use, with no mistakes
- Very predictable tasks

Predictive Models

- KLM: Keystroke Level Model
  - GOMS variant
  - Allows quantitative predictions about how long it takes a skilled user user to perform a task.
    - Eg, Search for a phrase in Word
    - Task decomposition
    - Empirically-derived response times for basic operations
      - Pressing a key, typing a character, pointing mouse
  - Allows analyst to compare systems in terms of predicted performance
  - Based on MHP - Model Human Processor



KSLM Accounts for

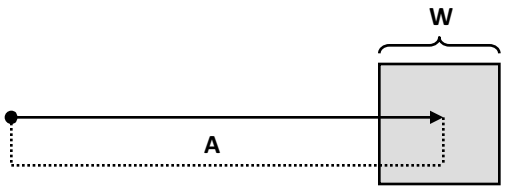
- **K**eystroking T_K
- **M**ouse button press T_B
- **P**ointing (typically with mouse) T_P
- **H**and movement between keyboard and mouse T_H
- **D**rawing straight line segments T_D
- "**M**ental preparation" T_M
- System **R**esponse time T_R

Predictive Models

- Fitts' Law
  - Original model development in 1954
  - Predicts the time to move to a target (movement time, MT)
    - E.G., time to move a mouse or other pointer to a target
    - function of the distance from the target object & the object's size
  - Movement assumed to be rapid, error-free, and targeted
  - useful for evaluating systems for which the time to locate an object is important, e.g., a cell phone
  - Adaptations for HCI

Task Environment

- Models movement of arm-hand to a target
  - Hand is A cm from the target (Amplitude)
  - Target is W cm wide (tolerance)
  - Assume movement follows straight horizontal path



Components

- ID - Index of difficulty

$$ID = \log_2 (a/w + 1.0)$$

a: distance to move

w: width (tolerance) of target

- ID is an *information theoretic* quantity
  - Formulation for HCI by Scott MacKenzie
  - Larger target = more information (less uncertainty)

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Interpretation of $\log_2(A/W + 1)$

- Arm-hand movement require more time when
  - Distance to target (A) increases
  - Error tolerance (W) decreases
  - Target is further away and of smaller size
- Arm-hand movement requires less time when
  - Distance to target (A) decreases
  - Error tolerance (W) increases
  - Target is closer and of larger size

Components

- MT - Movement time

$$MT = k_1 + k_2 * ID$$
$$MT = k_1 + k_2 * \log_2 (a/w + 1.0)$$

- MT is a linear function of ID
  k_1 and k_2 are experimental constants

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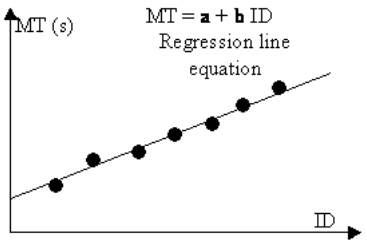
Equation

- Run empirical tests to determine k_1 and k_2 in $MT = k_1 + k_2 * ID$
  - Regression analysis on movement time data
- Constants vary by input devices & device uses
  - E.g., one-handed & two-handed text entry on mobile devices



$$MT_{\text{index finger}} = 165 + 52 \log_2(A/W + 1) \text{ ms} \quad (12)$$

and

$$MT_{\text{thumb}} = 176 + 64 \log_2(A/W + 1) \text{ ms} \quad (13)$$

https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/fitts-s-law

Silfverberg, M., MacKenzie, I. S., & Korhonen, P. (2000, April). Predicting text entry speed on mobile phones. In Proceedings of the SIGCHI conference on Human Factors in Computing Systems (pp. 9-16). ACM.

Uses for Fitts' Law

- Menu item size
- Icon size
- Scroll bar target size and placement
  - Up / down scroll arrows together or at top and bottom of scroll bar

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Cognitive Walkthrough

- How compare to Fitts' Law?
  - Still predicting interaction
  - Analyst actually uses system him/herself to identify issues: Inspection Method
- Detailed review of likely user interactions with system
- Focus of evaluation?
  - ease of learning
  - new users accomplishing tasks
- Start with
  1. Prototype or detailed system specification
  2. (representative) task descriptions & scenarios
  3. Actions needed to complete tasks
  4. Description of users (the knowledge, experience etc. that evaluators can assume)

Cognitive Walkthrough

- Steps
  1. Designer presents an aspect of the design & usage scenarios.
  2. Expert is briefed
     - assumptions about user population, context of use, task details
  3. 1+ experts walk through the design with the scenarios, tasks, & action lists
     - Guided by set of questions

Cognitive Walkthrough

- For each action, step through and "try to tell a believable story" about:
  - Will users **see** action is available?
  - Will users **know** the action is one they need?
  - If action taken, will user **associate and interpret** the response from the action correctly?
  - *Do effects of actions match goals?*
- Note any problems that arise

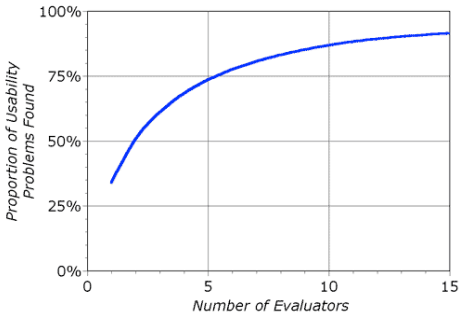
Usability Heuristics

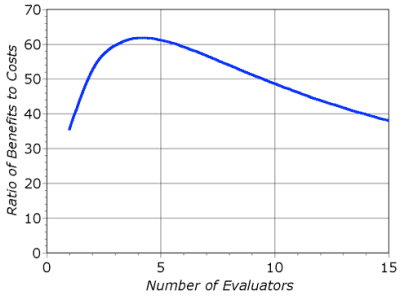
- General principles, rules of thumb
  - Many to choose from
    - Neilsen's 10 principles
    - Shneiderman's 8 golden rules
    - Norman's rules from Design of Everyday Things
    - Mac, Windows, Android, Java, etc. guidelines
- Help designers choose design alternatives
- Help evaluators find problems in interfaces ("heuristic evaluation")

Heuristic Evaluation

- More holistic than cognitive walkthrough, which is task-specific
- Jacob Nielsen: early 1990s.
  - Heuristics distilled from an empirical analysis of 249 usability problems
  - "Systematic inspection of a user interface for usability" Nielsen'93
    - By experts
- Discount technique
  - Cheap (done w/HCI team)
  - Can use early
  - Flexible (throughout design process)
- ? evaluators find 75% of problems
  - 5
  - A single evaluator misses most problems!

Nielsen Experiments





Heuristic Evaluation

- Often uses Neilson's ten heuristics
  - New heuristics developed
    - mobile devices, wearables, virtual worlds, etc.
- Heuristic evaluator explicitly documents usability issues
  - Notes violations
    - Written
    - Vocalize + Observer

Heuristic Evaluation

- Distinct from traditional user testing
  - Observer can answer evaluators' questions about
    - Domain
      - Helps them better assess usability
    - how interface works
      - But after they have tried to understand it themselves & commented on usability issue
  - Evaluator explicitly documents usability problems
    - Vs. observer inferring problems from user experiments
  - Goal: expert opinion of how users might receive the system

Heuristic Evaluation: 3 Stages

- Briefing session to tell experts what to do
- Evaluation period of 1-2 hours in which:
  - Each expert works separately;
  - Take one pass to get a feel for the product;
  - Take a second pass to focus on specific features.
- Debriefing session in which experts work together to prioritize problems.

Heuristic Evaluation

- Advantages
  - Few ethical & practical issues to consider because users not involved.
  - Can be quicker than a user study
  - Actionable results
- Challenges?
  - Can be difficult & expensive to find experts, especially "double experts" (HCI + domain)
  - Important problems may get missed
  - Many trivial problems are often identified
  - Experts have biases

Heuristic Evaluation

- Identify & use heuristics
  - Assess severity of problems
    - 1: Cosmetic problem (only fix if extra time)
    - 2: Minor problem (low-priority fix)
    - 3: Major problem (important to fix, high-priority)
    - 4: Catastrophe (must fix)

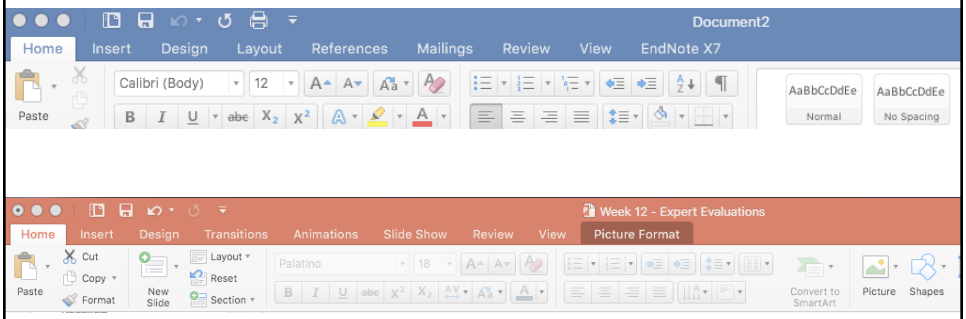
Heuristic Evaluation

- How assess the severity?
  - Answer the following questions:
    - How common is problem
      - Does this issue happen in multiple aspects of the design?
    - Will problem persist
      - Will users keep running into this issue?
    - How easy for user to overcome
      - Is it a barrier to them doing what they need to do?
    - How seriously will problem be perceived?
      - A small annoyance or major disturbance?

Schneiderman's 8 Golden Rules
1. Strive for Consistency

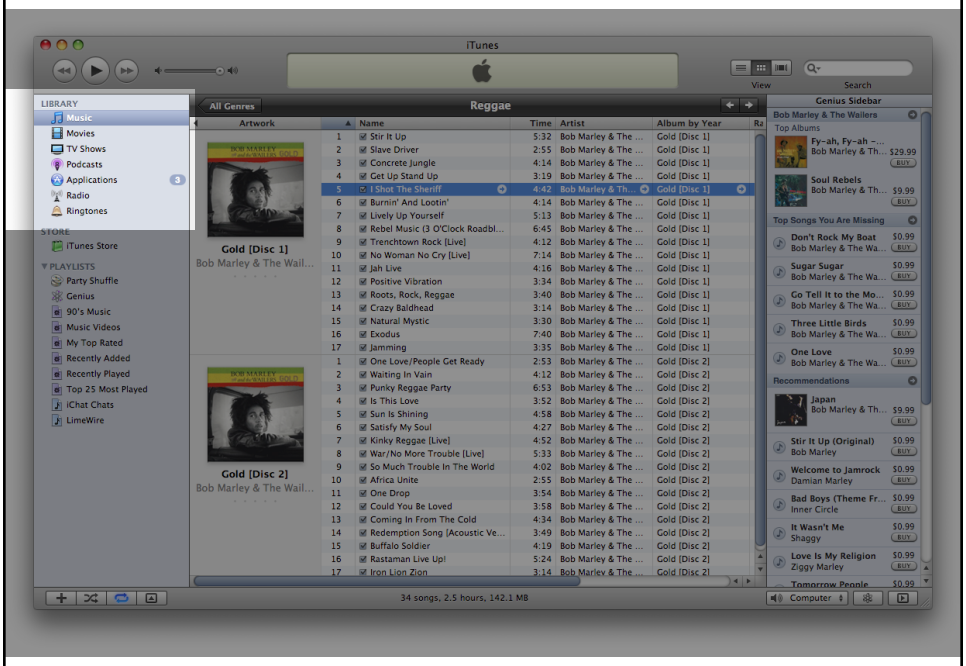
- Principle of Least Surprise
  - Similar things should look and act similar
  - Different things should look different
- Size, location, color, terminology, prompts, ordering, …
- Kinds of Consistency
  - Internal
  - External
  - Metaphorical

https://www.cs.umd.edu/users/ben/goldenrules.html



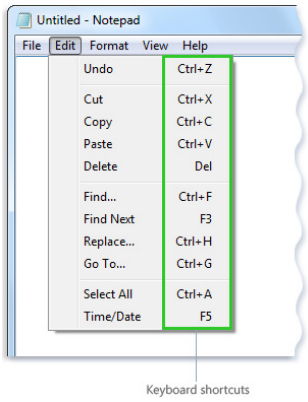
Consistency
internal (drop down arrow to reveal more options)
& external (similar text formatting functionality in PPT and Word)

Consistency violated
"Shapes" in different places



Schneiderman's 8 Golden Rules
2. Cater to Universal Usability

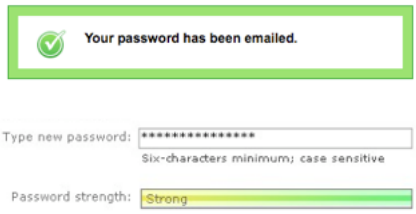
- Support diverse users
  - Novice – Expert
  - Age, Disabilities, etc.
- Help & Documentation for novices
- Provide easily-learned shortcuts for frequent operations
  - Speed interactions
  - Keyboard accelerators
  - Command abbreviations
  - Shortcuts



windows.microsoft.com/en-us/windows7/using-your-keyboard

Schneiderman's 8 Golden Rules
3. Offer Informative Feedback

- Feedback for all actions
- 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
  - 1-5 s: display busy cursor
  - > 1-5 s: display progress bar



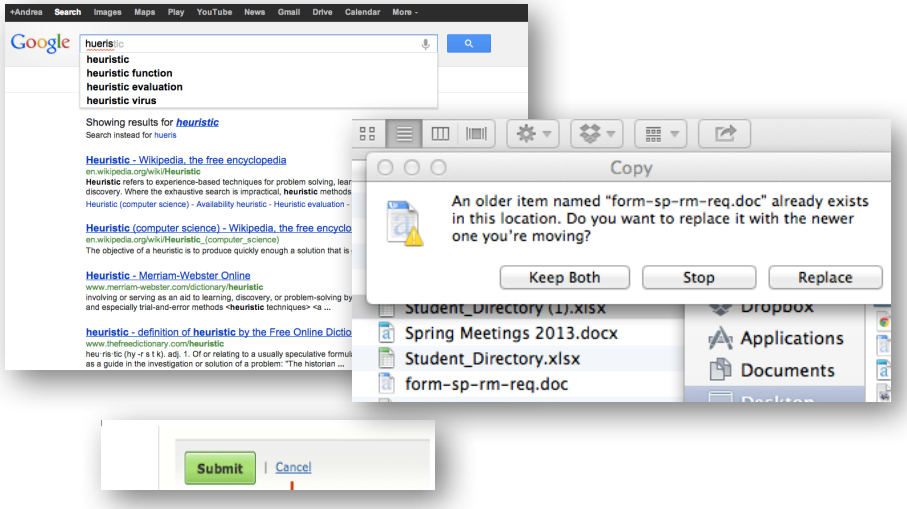
designingwebinterfaces.com/6-tips-for-a-great-flex-ux-part-5

Schneiderman's 8 Golden Rules
4. Design Dialogs to Yield Closure

- Action sequences
  - Beginning
  - Middle
  - End
  - E.g., e-commerce
    - Shopping, checkout, confirmation
- Informative feedback upon completion of a set of actions
- Provides
  - a feeling of relief
  - indication that user can prepare for the next group of actions


File Edit View Controls Store Advanced Help
iTunes
Syncing "Abhay's iPhone" (Step 1 of 6)
Waiting for sync to start
LIBRARY
Music
Movies
TV Shows
Podcasts
Books
Apps
Tones
Radio
STORE
iTunes Store
Purchased
DEVICES
Abhay's iPho...
SHARED
Home Sharing
GENIUS
Genius
PLAYLISTS
iTunes DJ
90's Music
Classical Music
Music Videos
My Top Rated
Recently Added
Summary
Info
Tones
Music
Movies
TV Shows
Podcasts
Books
Photos
iPhone
Name: Abhay's iPhone
Capacity: 13.75 GB
Software Version: 5.1.1
Serial Number:
Phone Number:
Version
Update
A newer version of the iPhone software is available (version 6.0).
iPhone with the latest software, click Update.
Restore
If you are experiencing problems with your iPhone, you can resto
settings by clicking Restore.
Audio 1.03 GB
Video 0.01 GB
Photos 1.31 GB
Apps 5.2 GB
Books 0.02 GB
Other 2.6 GB
Sync

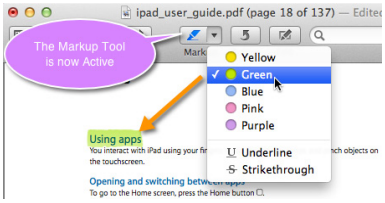
Schneiderman's 8 Golden Rules
5. Prevent Errors



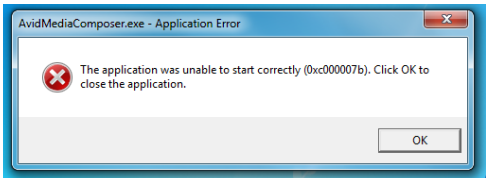
designingwebinterfaces.com/6-tips-for-a-great-flex-ux-part-5

Schneiderman's 8 Golden Rules
5. Prevent Errors

- Selection is less error-prone than typing
- Disable illegal commands
- Description Error
  - when two actions are too similar
  - e.g., similar looking buttons
  - different things should look and act different
- Mode Error
  - Limit use of modes
  - Visibility of mode
  - Spring-loaded or temporary modes



Schneiderman's 8 Golden Rules
6. Permit Easy Reversal of Actions



Schneiderman's 8 Golden Rules
6. Permit Easy Reversal of Actions

- 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

Schneiderman's 8 Golden Rules
7. Support Internal Locus of Control

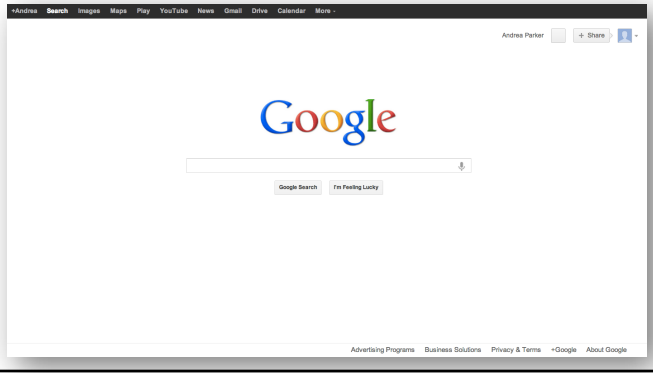
- Users often choose system functions by mistake
  - need a clearly marked "emergency exit"
  - Support quick exits without extended dialogue
- Provide undo
- Long operations should be cancelable
- All dialogs should have a cancel button
- User preemptive
- Easy access to info, shortcuts, etc.

Schneiderman's 8 Golden Rules
8. Reduce short-term memory load

- Minimize what user is required to remember between
  - Screens
  - Use sessions
- Include task-relevant information and features in a single screen, where possible
- Make objects, actions, and options visible or easily retrievable

And, one of Nielsen's Heuristics
* Aesthetics and Minimalist Design

- Less is More
- Visibility, reduce noise
- Omit extraneous info, graphics, features



Lab: Heuristic Evaluation

Due at conclusion of class today

Heuristic Evaluation

- Evaluate 1 prototype (assigned)
- Not anonymous, may ask for clarification
  - But attempt to figure out system for yourself
- As a team
  - Introduce your system to your evaluators
  - Persona (especially goals & attributes)
  - Design Requirements
  - Features
- Take notes

Heuristic Evaluation

- Use Schneiderman's 8 Golden Rules
- Make a numbered list of usability problems and successes you find

- For each problem and success:
  - describe the problem or positive feature
  - identify the relevant usability heuristics
    - Discuss violation or conformance
  - Estimate severity
    - Cosmetic, Minor, Major, Catastrophe

Heuristic Evaluation

- You may use your notes and any course readings to assist you in your evaluation.
- Recommend solutions for the problems
- Be thorough
  - At least 10 useful comments (positive or negative) about the interface that you evaluate

Heuristic Evaluation

- Must be readable & easy to understand
  - Don't bury the problems you found in reams of free-flowing prose: **be concise, neat, organized**
  - Where possible, include screenshots to illustrate your points

Heuristic Evaluation

- At the end of class, email a PDF copy of your report to
  - the appropriate team members and
  - CC' Prof. Parker & Farnaz

Team	URL	Evaluated By
1	http://homepro.com.s3-website-us-east-1.amazonaws.com/index.html	Team 2
2	https://cs5340team2-millayryan.rhcloud.com/	Team 1
3	Native app (provided in class)	Team 7
4	http://ishashah112.com/HCI-Project/www/index.html#/login	Team 5
5	http://projecthci.s3-website-us-east-1.amazonaws.com/index.html	Team 6
6	https://github.ccs.neu.edu/pages/nitins51/housing-hub/	Team 4
7	https://hci-findhome.herokuapp.com/project/#/	Team 3

Debriefs

- Problems identified
- Potential solutions