Heuristic Evaluation Grades

- See Piazza tonight or tomorrow (still grading)

Why is HCI Important?

- Major part of work for “real” programs
  - approximately 50%
- Bad user interfaces cost
  - money
    - 5% satisfaction → up to 85% profits
    - finding problems early makes them easier to fix
  - reputation of organization (e.g., brand loyalty)
  - lives (Therac-25)
- User interfaces hard to get right
  - people are unpredictable
  - intuition of designers often wrong

How to Design and Build Good UIs

- Iterative development process
- Usability goals
- User-centered design
- Design discovery
- Rapid prototyping
- Evaluation
- Programming
**User Interface Development Process**

- **Discovery**
  - Understand client's expectations
  - Determine scope of project
  - Characterize customers & tasks
  - Evaluate existing practices & products

- **Design Exploration**
  - Robust
    - Minimal error rates
    - Good feedback so user can recover
  - Discoverable
    - Learn new features over time
  - Pleasing
    - High user satisfaction
  - Fun

- **Specification**
  - High-fidelity, refined design
  - Based on customer feedback
  - Foundation in product reality

- **Evaluation**
  - Expert eval
  - User study

- **Prototype**
  - Sketch
  - Paper
  - Video
  - Tool

- **Design**
  - Design is driven by requirements
    - What the artifact is for
    - Not how it is to be implemented
    - E.g., phone not as important as mobile app

- **Usability/User Experience Goals**
  - Learnable
    - Faster 2nd time & so on
  - Memorable
    - From session to session
  - Flexible
    - Multiple ways to do tasks
  - Efficient
    - Perform tasks quickly
  - Robust
    - Minimal error rates
    - Good feedback so user can recover
  - Discoverable
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**Design Process: Discovery**

- Assess Needs
- Design Exploration
- Design Refinement
- Production
Design Thinking Process

User-centered Design
“Know thy User”

- Cognitive abilities
  - perception
  - physical manipulation
  - memory
  - Fitts’ Law, MHP: processors? Cycle times?

- Organizational / educational job abilities

- Keep users involved throughout
  - developers working with target customers
  - think of the world in users terms

Design Discovery
Needfinding, Contextual Inquiry & Task Analysis
Observe existing practices for inspiration
Make sure key questions answered

Reframing the Problem as a Point of View
WE MET . . .
(user – possibly extreme – you are inspired by)

WE WERE AMAZED TO REALIZE . . .
(what did you learn that’s new?)

IT WOULD BE GAME-CHANGING TO . . .
(frame up an inspired challenge for your team.)
(don’t dictate the solution.)

Design Discovery Summary

- Know thy user & involve them in design

- Needfinding
  - build empathy with customers
  - listen to them to discover interesting insights

Ideate: From POV to How Might We
POV: Harried mother of 3, rushing through the airport only to wait hours at the gate, needs to entertain her playful children because “annoying little brats” only irritate already frustrated fellow passengers.

Break POV into pieces
Amp up the good/Remove the bad
Explore the opposite
Question an assumption
Go after adjectives
ID unexpected resources
Create an analogy from need or context
Change a status quo

Brainstorm “How Might We”s \rightarrow Solutions

Design Process: Exploration

- Discovery
- Design Exploration
- Design Refinement
- Production
- Expand Design Space
  - brainstorming
  - sketching
  - storyboarding
  - prototyping

From Sketch to Prototype

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<tr>
<th>Sketch</th>
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<td>Evocative</td>
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Difference in intent rather than in form

Courtesy Bill Buxton

Design Exploration Summary

- Sketching allows exploration of many concepts in the very early stages of design
- As investment goes up, need to use more and more formal criteria for evaluation
- Experience prototyping allows us to try many ideas quickly & learn more about the problem & solution space (prototype to learn)

Concept Videos

- Illustrate context of use rather than specific UI
- Quick to build
- Inexpensive
- Forces designers to consider details of how users will react to the design
- More important when context is not traditional work scenario
Context – Computing in 1945

Computing in 1965

Augmenting Human Intellect

Dynabook – Kay (1974)

Xerox Star – 1st Commercial GUI (1981)

Rapid Prototyping

- Build a mock-up of design so you can test it
- Low fidelity techniques
  - paper sketches
  - cut, copy, paste
  - low-fi testing allows us to quickly iterate
  - get feedback from users & change right away
- Interactive prototyping tools
  - HTML, SketchFlow, Balsamiq, Axure, proto.io, etc.
- UI builders
  - Expression Blend + Visual Studio, etc.
**Evaluation**

- Test with real customers (participants)
  - w/ interactive prototype
  - low-fi with paper “computer”
- Build models
  - GOMS
- Low-cost techniques
  - expert evaluation
  - walkthroughs
  - online testing

**Heuristic Evaluation Decreasing Returns**

- problems found
- benefits / cost

* Caveat: graphs for a specific example

**Heuristic Evaluation Summary**

- Have evaluators go through the UI twice
- Ask them to see if it complies with heuristics
  - note where it doesn’t & say why
- Combine the findings from 3 to 5 evaluators
- Have evaluators independently rate severity
- Alternate with user testing

**User Testing Data**

- Process data
  - observations of what users are doing & thinking
  - qualitative
- Bottom-line data
  - summary of what happened
    - time, errors, success
    - i.e., the dependent variables
    - quantitative

**User Testing Summary**

- User testing is important, but takes time/effort
- Use ????? tasks & ????? participants
  - real tasks & representative participants
- Be ethical & treat your participants well
- Want to know what people are doing & why? collect
  - process data
- Bottom line data requires ???? to get statistically reliable results
  - more participants
- Difference between between & within groups?
  - between groups: everyone participates in one condition
  - within groups: everyone participates in multiple conditions

David McCandless

[http://www.informationisbeautiful.net](http://www.informationisbeautiful.net)
The Art of Balance
Promotion & demotion of important objects

First Question for any design
➢ What are the most important things?

Information should be prioritized based on its importance to the user

Using Proximity to Indicate Relationships

“The whole is greater than the sum of the parts.”
– David Hothersall

Gestalt Psychology in information design

Information blocks should be **grouped together if related**, but unrelated elements should be located at some distance from each other.

Grid Systems

• A key pattern for implementing rationality, modernism, asymmetry
• Note that no elements are “centered”

Using Appropriate Color “Harmonies”

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Complementary
Analogous
Triad
Split Complementary
Rectangle (Tetradic)
Square

Human Abilities: Retina

Distribution of rods & types of cones has major impact on our visual abilities

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The Model Human Processor

- Developed by Card, Moran & Newell ('83)
  - based on empirical data
- Basic model underlies other HCI techniques
- Allows us to make predictions w/o users
- Know the processors, memories, cycle times, and decay times – 100ms!

Fitts’ Law

- Moving hand is a series of microcorrections
  - correction takes $T_p + T_c + T_m = 240$ msec
- Time $T_{pos}$ to move the hand to target size $S$ which is distance $D$ away is given by:
  - $T_{pos} = a + b \log_2 (D/S + 1)$
- Summary
  - time to move the hand depends only on the relative precision required

Fitts’ Law Experimental Results

- Task: Quickly tap each target 50 times accurately
  - 30 sec
  - 48 sec
  - 31 sec
  - 21 sec (lots of spread)

Conceptual Models Summary

- Conceptual models:
  - mental representation of how the object works & how interface controls effect it
- Design model should equal customer’s model:
  - mismatches lead to errors
  - use customer’s likely conceptual model to design
- Design guides:
  - make things visible
  - map interface controls to customer’s model
  - provide feedback