CS 147 Course Midterm Review
Design Thinking for User Experience Design, Prototyping & Evaluation

How to Design and Build Good UIs

- Iterative development process
- Usability goals
- User-centered design
- Design discovery
- Rapid prototyping
- Evaluation
- Programming

Design Process: Discovery

- Assess Needs
  - understand client’s expectations
  - determine scope of project
  - characteristics of customers & tasks
  - evaluate existing practices & products

Administrivia

- Heuristic Evaluation Grades
  - will be back to you by Friday night (still grading)
- Medium-Fi Prototype Grades (& Feedback)
  - will be back to you by Thursday night (still grading)
- OAE Accomodation for Midterm?
  - Contact me & Abdallah through email ASAP if we haven’t gotten your letter already (we need to coordinate)
- Course grades
  - In the past, ~67% of class has gotten A+, A, or A-
  - Most of the remainder B+ or B. Few B- and Cs, generally where student did not carry their share of project work

Iteration

At every stage!

Prototype
- Sketch
- Paper
- Video
- Tool
- Program

Evaluate
- Gut
- Crit
- Expert Eval
- Lo-fi Test
- User Study

Design Thinking Process

- Empathize
- Define
- Ideate
- Prototype
- Test
User-centered Design
“Know thy User”

- Cognitive abilities
  - perception (e.g., color)
  - physical manipulation
  - memory
  - Fitts’ Law, MHP: processors? cycle & decay times?
- Organizational / educational job abilities
- Keep users involved throughout
  - developers working with target customers
  - think of the world in users terms

Design Discovery
Needfinding & Task Analysis

- Observe existing practices for inspiration
- Make sure key questions answered
- Ethical questions in design w/ underserved communities

Reframing the Problem as a Point of View

WE MET . . .
(user you are inspired by)

WE WERE AMAZED TO REALIZE . . .
(what did you learn that’s new? Insight – verb reflecting user need)

IT WOULD BE GAME-CHANGING TO . . .
(Synthesized statement to leverage in designing solution. NOT just a reason for the need! NOT a solution)

Ideate: From POV to How Might We

POV: We met Janice, a harried mother of 3, rushing through the airport only to wait hours at the gate. We were surprised at the many games she makes up to entertain her children so they don’t irritate frustrated fellow passengers. It would be game changing to bring the other passengers and the airport facilities into helping families have a better travel experience.

How Might We Generators
Snap POV into pieces
Add up the good/Remove the bad
Explore the opposite
Question an assumption
Go after adjectives
Identify unexpected resources
Create an analogy from need or context
Change a status quo

Brainstorm: “How Might We’s” → Solutions

prototype: how?
Design Process: Exploration

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

From Sketch to Prototype

<table>
<thead>
<tr>
<th>Sketch</th>
<th>Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evocative</td>
<td>Didactic</td>
</tr>
<tr>
<td>Suggest</td>
<td>Describe</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>Prove</td>
<td>Test</td>
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<tr>
<td>Resolve</td>
<td>Tentative</td>
</tr>
<tr>
<td>Specific</td>
<td>Committed</td>
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</tbody>
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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 lets us quickly try many ideas & 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

Rapid Prototyping

- Build a mock-up of a 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
  - SketchFlow, Balsamiq, Axure, proto.io, Marvel, Invision, etc.
- UI builders
  - Expression Blend, Visual Studio, Xcode Interface Builder, etc.

Evaluation

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

Fantasy Basketball

Wanderlust
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
  - Exact heuristic less important than finding the problem
- 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 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 more participants to get statistically reliable results
- Difference between between & within groups?
  - Between groups: everyone participates in one condition
  - Within groups: everyone participates in multiple conditions

The Art of Balance

Promotion & demotion of important objects

1. 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.

Using Appropriate Color “Harmonies”

Human Abilities: Retina
Distribution & types of cones in the retina has major impact on our visual abilities

Experimental Results
• Task
Quickly tap each target 50 times accurately

Principles of Operation (cont.)
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:
$$T_{pos} = a + b \log_2 \left( \frac{D}{S} + 1 \right)$$
- summary
• time to move the hand depends only on the relative precision required
Conceptual Models

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