CS 147 Course Midterm Review

Design Thinking for User Experience Design, Prototyping & Evaluation

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• Heuristic Evaluation Grades
  - will be back to you by Tuesday (so you know if you need to practice before the test)
• Medium-Fi Prototype Grades (& Feedback)
  - will be back to you by Sunday (still grading)
• OAE Accommodation for Midterm?
  - contact me & Nava 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
How to Design and Build Good UIs

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

At every stage!

Design

Prototype
Sketch
Paper
Video
Tool
Program

Evaluate
Gut
Crit
Expert Eval
Lo-fi Test
User Study
Design Process: Discovery

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

- Design Exploration

- Design Refinement

- Production
Design Thinking Process

1. Empathize
2. Define
3. Ideate
4. Prototype
5. 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

ChoreoLab observed/interviewed dancers in studios… and out in the streets …
Focus by Writing a “Point of View”

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

WE WERE SURPRISED TO NOTICE. . .
(tension, contradiction, or surprise)

WE WONDER IF THIS MEANS. . .
(what did you infer? need—verb reflecting user needs)

IT WOULD BE GAME-CHANGING TO. . .
(Frame up an inspired challenge for your team.
NOT a reason for the need! Not a solution, but a more informed problem)
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

- Break POV into pieces
- Amp 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

WE MET...
(extreme user you are inspired by)
A HOMELESS GUY ON A FISHING BOAT, WHO JUST A YEAR AGO WAS GIVEN A SECOND CHANCE AT LIFE
WE WERE AMAZED TO REALIZE...
(what did you learn that's new?)
THANKS TO THE BOAT OWNER'S MERCY, TRUST, AND DISCIPLINE OF THE FISHING LIFESTYLE AND CONNECTION TO NATURE, HE HAD TURNED HIS LIFE AROUND FROM DRUG ADDICT INTO A JOB TO SUPPORT OTHERS WITH SKILLS AND COMPASSION.
IT WOULD BE GAME-CHANGING TO...
(frame up an inspired challenge for yourself
all of us could take a risk to see a spark in others and
nurture it into a purposeful transformation.

HMW bring routine (and discipline)
prototype: how?
Design Process: Exploration

Expand Design Space
- brainstorming
- sketching
- storyboarding
- prototyping

Discovery

Design Exploration

Design Refinement

Production
From Sketch to Prototype

**SKETCH**
- EVOCATIVE
- SUGGEST
- QUESTION
- PROPOSE
- PROVOKE
- TENTATIVE
- NONCOMMITTAL

**PROTOTYPE**
- DIDACTIC
- DESCRIBE
- ANSWER
- TEST
- RESOLVE
- SPECIFIC
- DEPICTION

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
Augmenting Human Intellect – Engelbart (1968)

The NLS Hardware
Dynabook – Kay (1974)
Xerox Star – 1st Commercial GUI (1981)
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
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 ????? 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
How well does it work? How well does it communicate?
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
Visual Hierarchy and Reading Order

Weak visual hierarchies provide little or no guidance on what is important.

Strong visual hierarchies guide visual & logical progression by showing what is important.

Strong visual hierarchies create a sense of order and balance
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.
### Gestalt Principles of Perception

<table>
<thead>
<tr>
<th>Group Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity</td>
</tr>
<tr>
<td>Similarity</td>
</tr>
<tr>
<td>Continuation</td>
</tr>
<tr>
<td>Closure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Elements close together</td>
</tr>
<tr>
<td>Similarity of shape, size, or color</td>
</tr>
<tr>
<td>Aligned along a line or curve</td>
</tr>
<tr>
<td>Individual elements form a single object</td>
</tr>
</tbody>
</table>

- **Proximity**: Elements close together
- **Similarity**: Similarity of shape, size, or color
- **Continuation**: Aligned along a line or curve
- **Closure**: Individual elements form a single object
A higher plain

White Space = Value
Using Appropriate Color “Harmonies”

- Complementary
- Analogous
- Triad
- Split Complementary
- Rectangle (Tetradic)
- Square

Beginners should use these
Human Abilities: Retina

Distribution & types of cones in the retina has major impact on our visual abilities

http://webvision.med.utah.edu/imageswv/Ostergr.png
http://www.webexhibits.org/causesofcolor/1G.html
http://www.scratchapixel.com

Fig. 20. Graph to show rod and cone densities along the horizontal n

Wavelength λ (nm)
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 e.g., GOMS modeling
- Know the processors, memories, cycle times, & decay times 100ms is a good enough approx. for times
Experimental Results

• Task
  Quickly tap each target 50 times accurately
Online Experimental Results

Index of Difficulty: \[ ID = \log\left(\frac{D}{W}\right) + 1 \]

\( D \) = distance to target, \( W \) = width of target (or size)

fig. 1e: Time in ms over ID.
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 \textit{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
What Makes a Good Answer (H/W or Test)?

- Easy to understand
  - legible, well-annotated, good explanations, visual presentation instead of just listing bullets, clear structure (such as well designed visual hierarchy)
- Grounded in your prior work
  - e.g., needfinding, POV, HMW, EP results, usability results, data driven (if possible)
- Ideas/designs are novel
  - beyond what is heard/seen or already exists to push for something that feels new & exciting
- Backed by evidence
  - from your work or from principles of design, humans cognitive/perceptual/motor attributes
- Goes beyond just facts
  - based on some reasonable inference and integration, not straightforward and superficial
  - points made are insightful & point to a bigger picture as opposed to just stating the facts
- User-centered
  - findings and insights tie back to the user, keeping user experience in mind, ensuring a diverse set of participants and reasons why they were important
- Covers everything that was asked for
QUESTIONS?