dt +UX DESIGN THINKING FOR USER EXPERIENCE DESIGN + PROTOTYPING + EVALUATION

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

Prof. James A. Landay
Computer Science Department
Stanford University

Autumn 2018
November 12, 2018

Administrivia

- Heuristic Evaluation Grades
  - see Piazza tonight or tomorrow (still grading)

- React Native Workshop
  - Tonight at 7 pm @ Gates 219

Balance

DESIGN   TECHNOLOGY

HCI Approach to UX Design

Organisational and Social Issues

Tasks + Activities

Technology

DESIGN

Humans

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

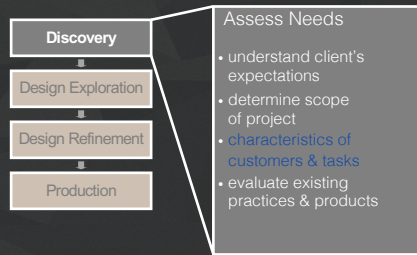**Prototype**
Sketch
Paper
Video
Tool
Program

Evaluate
Gut
Crit
Expert Eval
Lo-fi Test
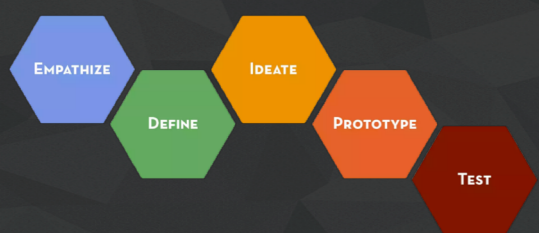User Study

Usability/User Experience Goals

- Set goals early & later use to measure progress
- Goals often have tradeoffs, so prioritize
- Example goals(?)
  - Learnable
    - faster the 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
    - learn new features over time
  - Pleasing
    - high user satisfaction
  - Fun

GOAL

Design Process: Discovery

Discovery

Design Exploration

Design Refinement

Production

Assess Needs

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

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

ChoreoLab observed/interviewed dancers in studios … and out in the streets …

Reframing the Problem as a Point of View

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

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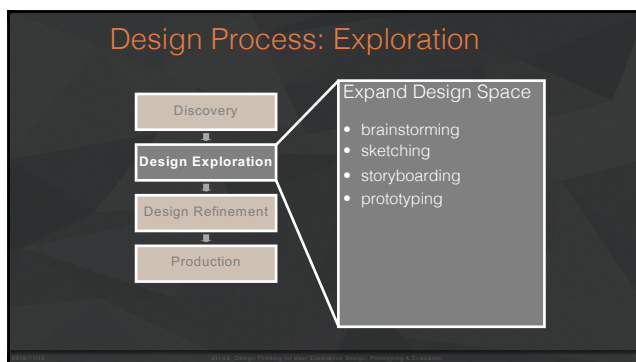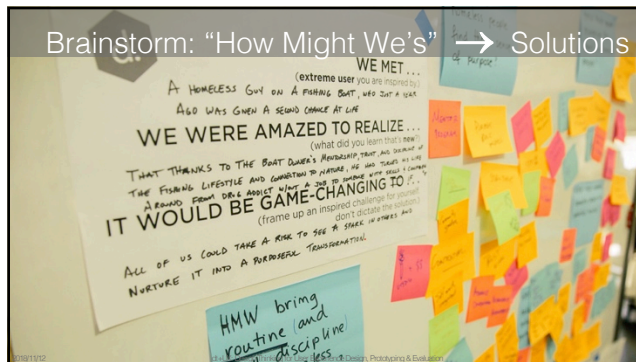(what did you learn that's *new? Insight* – verb reflecting user need)

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 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

http://dschool.stanford.edu/wp-content/uploads/2012/02/HMWMETHODCARD.pdf

Break POV into pieces

Amp up the good/Remove the bad

Explore the opposite

Question an assumption

Go after adjectives

Identify unexpected resources

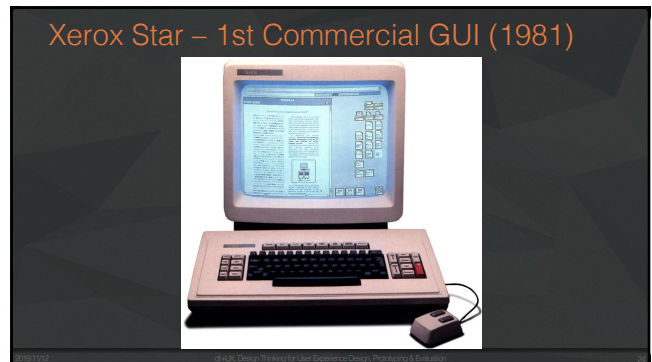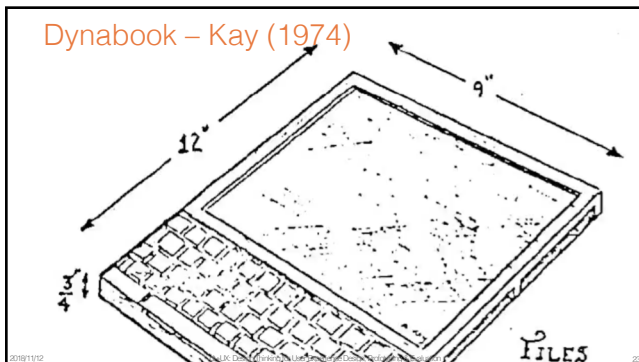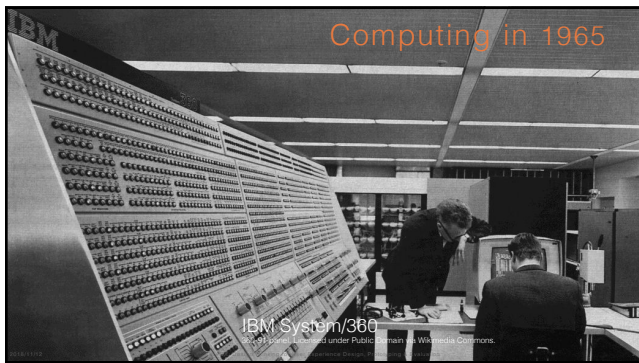*Create an analogy from need or context*

Change a status quo

Brainstorm: "How Might We's" → Solutions

EXPERIENCE PROTOTYPE / INTERACTION PROTOTYPE

Design Process: Exploration

Discovery

Design Exploration

Design Refinement

Production

Expand Design Space

- brainstorming
- sketching
- storyboarding
- prototyping

From Sketch to Prototype

SKETCH		PROTOTYPE
EVOCATIVE	→	DIDACTIC
SUGGEST	→	DESCRIBE

Difference in **intent** rather than in **form**

QUESTION	→	ANSWER
PROPOSE	→	TEST
PROVOKE	→	RESOLVE
TENTATIVE	→	SPECIFIC
NONCOMMITTAL	→	DEPICTION

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*)
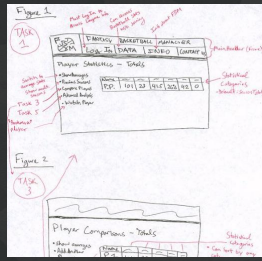
Concept Videos

- 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

Computing in 1945

Harvard Mark I: 55 feet long, 8 feet high, 5 tons
http://sites.harvard.edu/~chsi/markone/images/Mark1HousingSmall.jpg

Computing in 1965

IBM System/360

Augmenting Human Intellect – Engelbart (1968)
The NLS Hardware

Dynabook – Kay (1974)

Xerox Star – 1st Commercial GUI (1981)
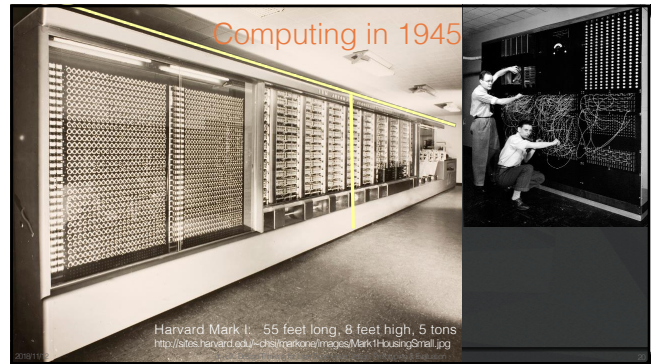
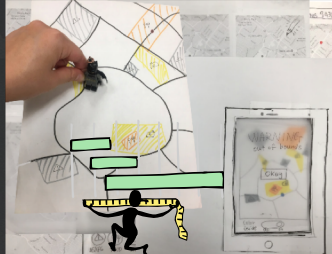## Rapid Prototyping

Fantasy Basketball

- 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.
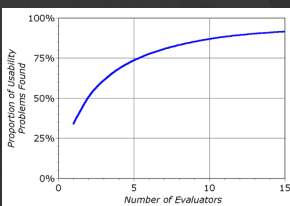
Evaluation

Wanderlust

- Test with real customers (participants)
  - w/ interactive prototype
  - low-fi with paper "computer"

- Low-cost techniques
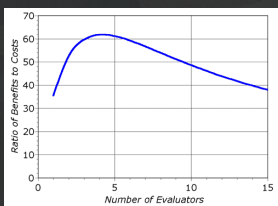 - expert evaluation
  - walkthroughs
  - online testing

Heuristic Evaluation Decreasing Returns
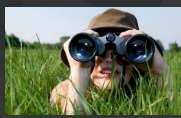
problems found

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*

http://elisaollers.com/content/uploads/2012/10/analyzing-data.jpg

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
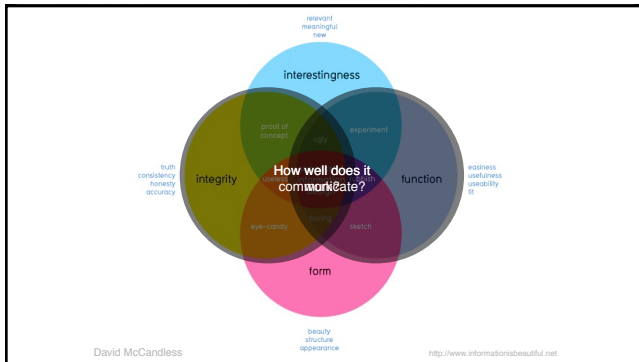
The Art of Balance

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.

Using Appropriate Color "Harmonies"

Human Abilities: Retina

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

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

Principles of Operation (cont.)

Fitts' Law
- moving hand is a series of microcorrections
  - correction takes Tp + Tc + Tm = 240 msec
- time Tpos to move the hand to target size S, which is distance D away is given by:

  Tpos = a + b log2 (D/S + 1)

- 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

QUESTIONS?