Autumn 2017
Prof. James A. Landay
Stanford University

CS 147 Course Midterm Review

Design Thinking for User Experience Design, Prototyping & Evaluation

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Autumn 2017

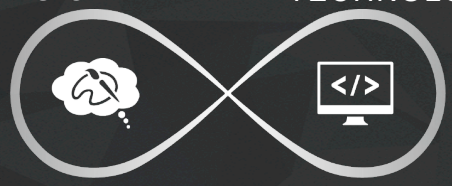
November 13, 2017

Heuristic Evaluation Grades

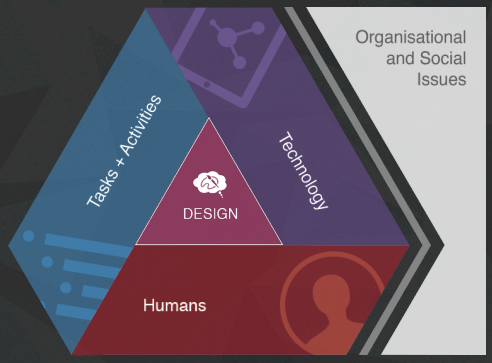
- See Piazza tonight or tomorrow (still grading)

B A L A N C E

DESIGN TECHNOLOGY

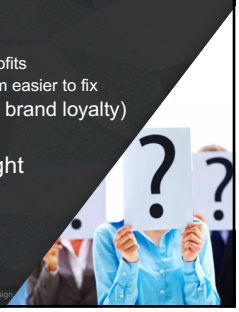


HCI Approach to UX Design



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

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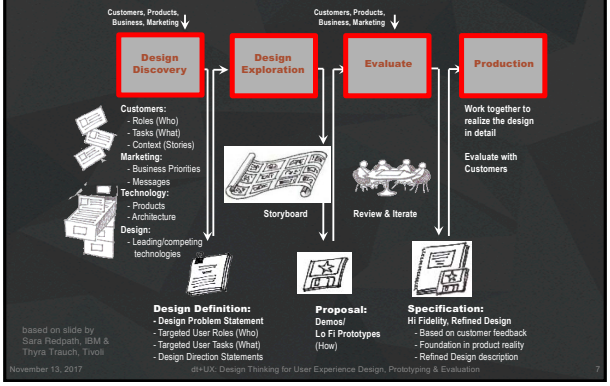
User Interface Development Process



based on slide by Sara Redpath, IBM & Thyra Trauch, Tivoli

Iteration

At every stage!

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

A design represents the artifact

- for UIs these representations include (?)
  - screen sketches or storyboards
  - flow diagrams/outline showing task structure
  - executable prototypes
- representations *simplify*

Usability(?)

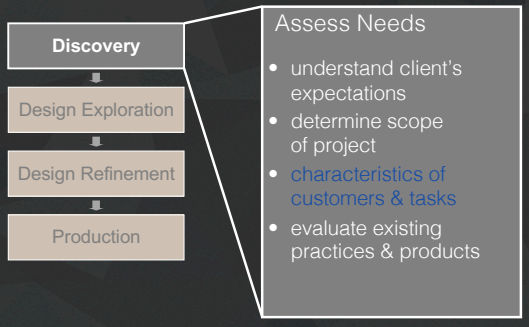
According to the ISO:
The *effectiveness*, *efficiency*, and *satisfaction* with which specified users achieve specified *goals* in particular environments

This doesn't mean you have to create a "dry" design

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

Design Process: Discovery



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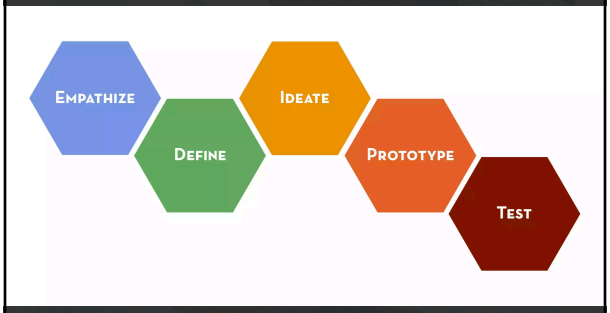
Design Thinking Process



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

Tuned CI participant

Tuned field work in record store

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

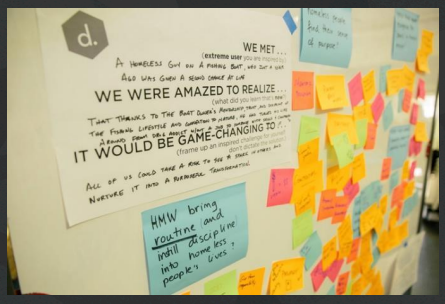
Ideate: From POV to How Might We

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.

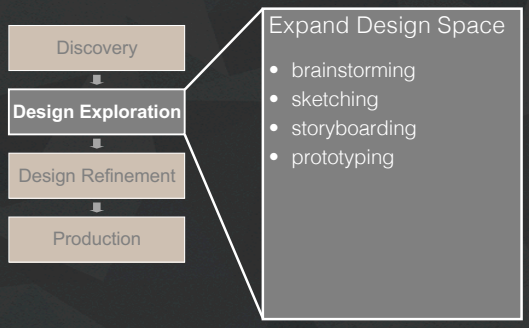
Break POV into pieces
Amp up the good/Remove the bad
Explore the opposite
Question an assumption
Go after adjectives
ID unexpected resources
Create an analogy from need or context
Change a status quo

http://dschool.stanford.edu/wp-content/uploads/2012/05/HMW-METHODCARD.pdf

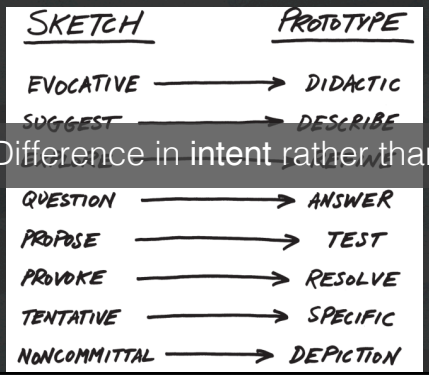
Brainstorm "How Might We"s → Solutions



Design Process: Exploration



From Sketch to Prototype



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

Courtesy Bill Buxton

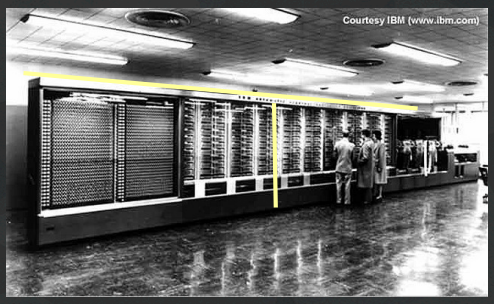
Design Exploration Summary

- 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



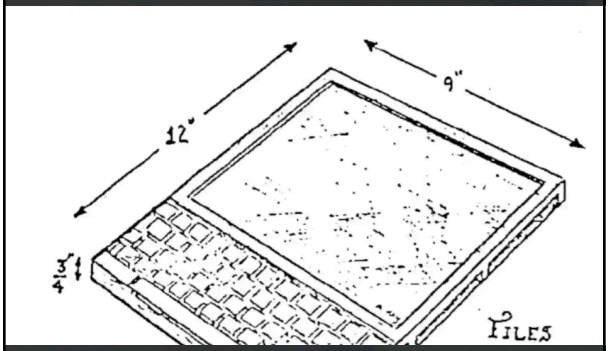
Harvard Mark I : 55 feet long, 8 feet high, 5 tons
http://piano.dsi.uminho.pt/museuv/indexmark.htm

Computing in 1965

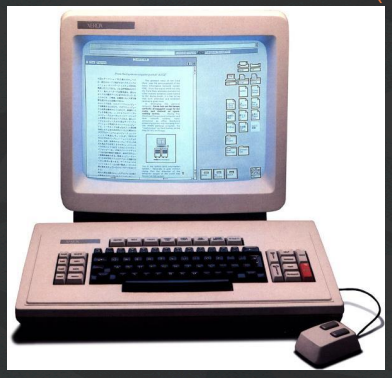
IBM System/360
360-91-panel. Licensed under Public Domain via Wikimedia Commons.

Augmenting Human Intellect

Dynabook – Kay (1974)



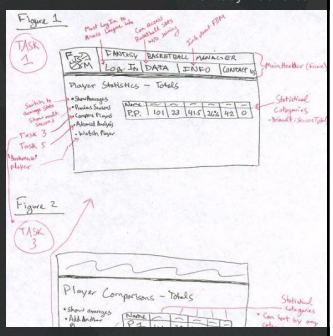
Xerox Star – 1st Commercial GUI (1981)



Rapid Prototyping

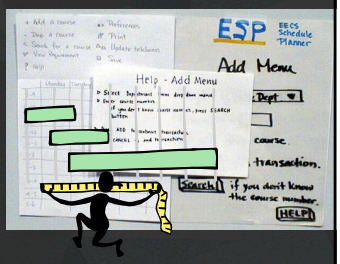
- Build a mock-up of design so you can test it
- **Low fidelity techniques**
  - **paper sketches**
  - **cut, copy, paste**
  - **low-fi testing allows us to quickly iterate**
  - **get feedback from users & change right away**
- Interactive prototyping tools
  - HTML, SketchFlow, Balsamiq, Axure, proto.io,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

Fantasy Basketball



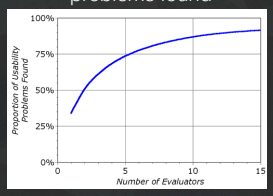
Evaluation

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

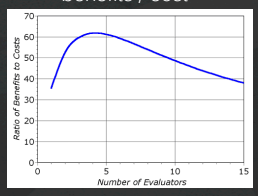


Heuristic Evaluation Decreasing Returns

problems found



benefits / cost



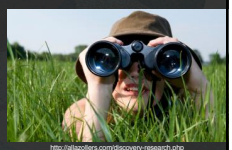
* Caveat: graphs for a specific example

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

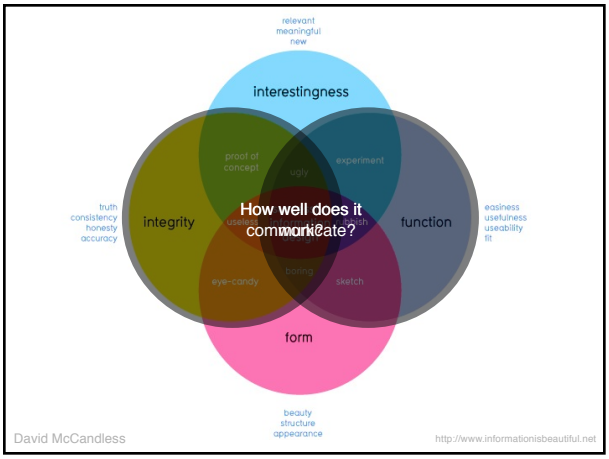
- Process data
  - observations of what users are doing & thinking
  - *qualitative*



- 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



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

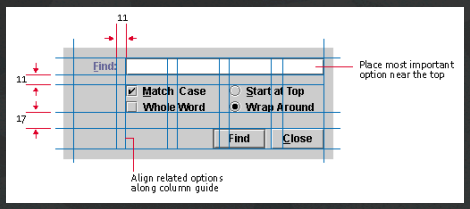
"The whole is greater than the sum of the parts."
– David Hothersall

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.

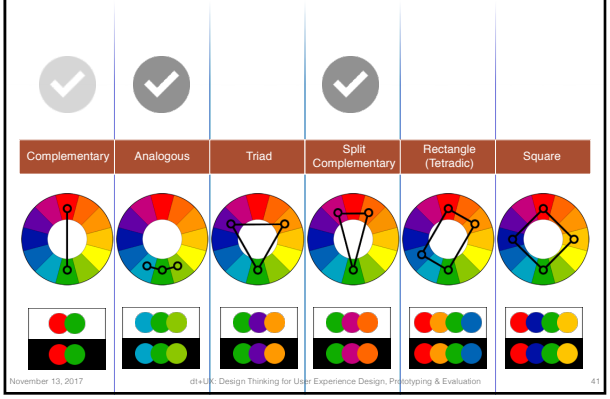
Grid Systems

- A key pattern for implementing rationality, modernism, asymmetry
- Note that no elements are "centered"



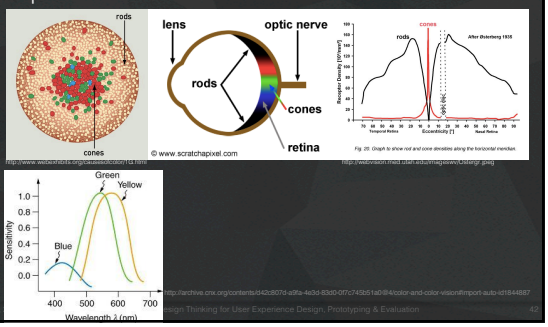
Java Look and Feel Design Guidelines

Using Appropriate Color "Harmonies"



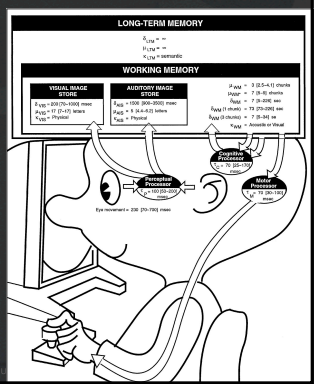
Human Abilities: Retina

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



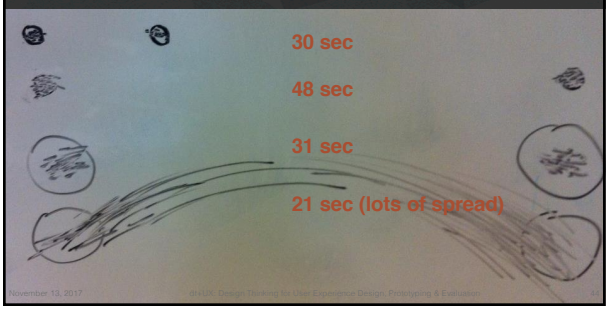
The Model Human Processor

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



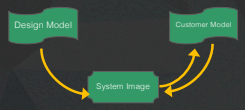
Fitts' Law Experimental Results

- Task:
  Quickly tap each target 50 times accurately



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

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