SWE 632 - Design & Development of User Interfaces

George Mason University

Instructor:
Dr. Kevin Moran

Teaching Assistant:
Xu Han

Class will start in:

20:00

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Spring 2021

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Week 6:

Think-Aloud Usability Evaluations

Administrivia

- Project Checkpoint 3 due today
- In-class Midterm Exam next week
- Project Checkpoint 4 out now - let's discuss the due date
- Discussion Question 6 - (Optional) Midterm Review - Posted after class

Project Checkpoint 4

In this Project Checkpoint, you will improve the interaction design of your web app by making changes to fix at least 9 potential usability issues that have been identified with your app.

1. Each project group will be provided a document listing at least 15 potential usability issues identified with your app. If your document is missing usability issues or you do not understand any of the issues, please contact the TA.
2. You should provide separate URLs for (1) the original HW1 version of your web app and (2) the new, updated version of your web app addressing the usability issues.
3. You should select 9 of the reported potential usability issues to address. For each issue, (1) copy the text and original screenshot(s) describing the issue from the provided document, (2) describe in a short paragraph how the reported issue has been addressed, (3) include a new screenshot(s) depicting the new behavior of your web app
4. If two (or more) of the usability issues that were reported are similar or identical in nature, you can count the fix that you make multiple times for each of the reported usability issues it addresses.
5. In grading your assignment, we will evaluate the effectiveness and thoroughness of each change in addressing the reported usability issue.
6. All of your submitted documents should include your name and the names of the other group members (if applicable).

Project Checkpoint 4

- Two potential Due Dates:
  - *Option 1:* Due Week after Midterm, current schedule stays the same
  - ***Option 2:*** Due March 24th (gives you an extra week), however would alter schedule so that you have less time to work on a later checkpoint.

Expectations for Midterm Exam

- Free response, essay questions (writing intensive!)
- Will include definitions, key ideas & concepts, how to use methods
  - May link multiple ideas together in applying them to a scenario
- Lectures, assigned readings, tech talks
- Open book, open notes, open to all materials
- *Xu and I will be available for questions via Zoom in our Office Hour rooms during class.*
  - Special office hours next week which will be announced on Piazza

Midterm Exam Logistics

- Will be released on Weds 3/10 at 4:30pm
- *Will be due on Fri 3/12 at 4:30pm*
- Exam will be posted to Piazza, Submission to Blackboard
- You must use the Answer Template (also posted to Piazza). Answers ***must*** be turned in as a PDF.
- Must answer questions in the order they appear.

Class Overview

1. *Midterm Review:* Revisiting Key Topics

2. *5 Minute Break*

3. *Usability Studies:* Empirically Evaluating Design Ideas

4. *In Class Activity:* Conducting a Usability Study

5. *7 Minute Break*

6. *Tech Talk -* Cypress

Midterm Exam Review

Week 1 Lecture - Heuristic Evaluation

Heuristic Evaluation

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition vs. recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose, and recover from errors
10. Help and documentation

Advantages of Heuristic Evaluation

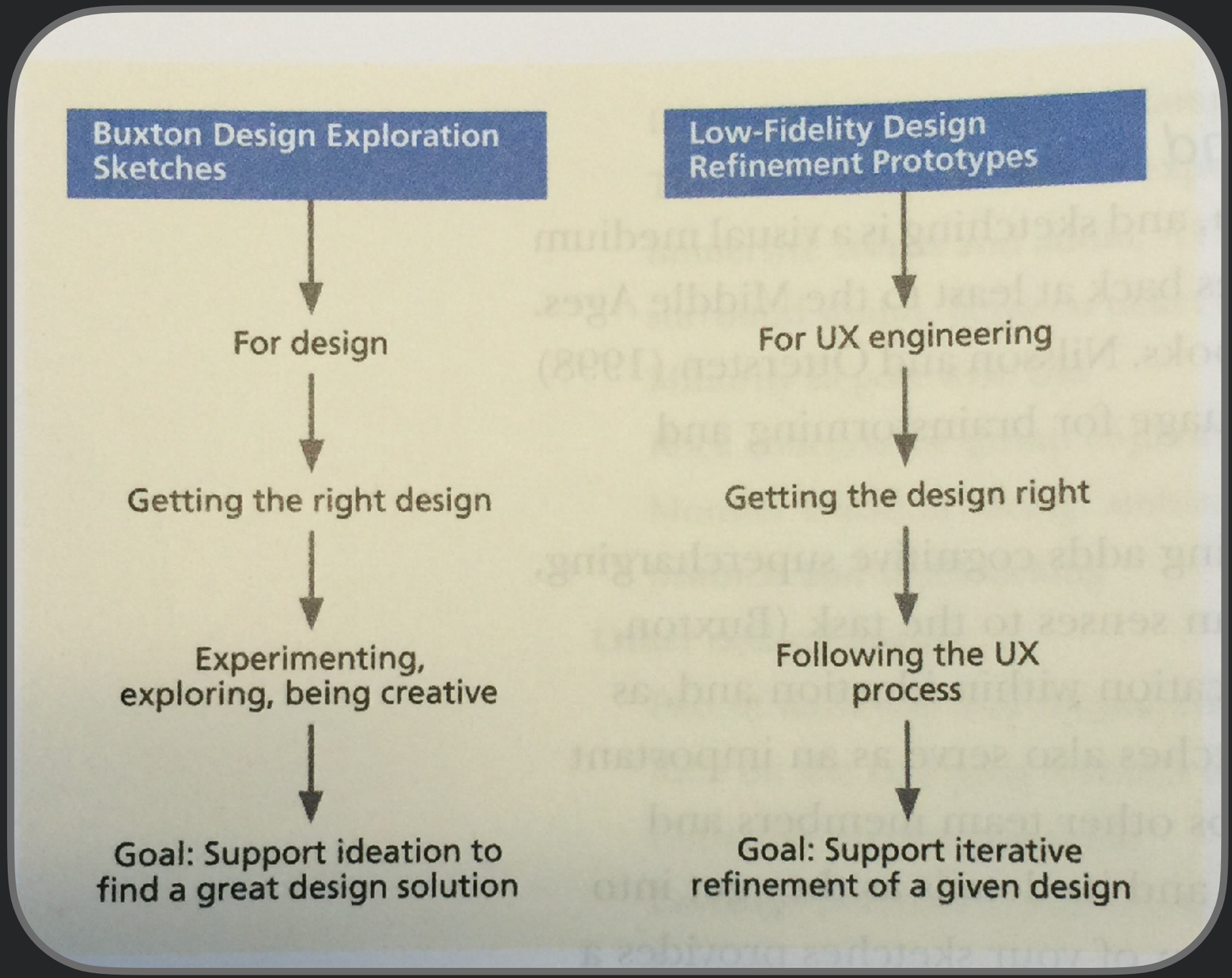
- “Discount usability engineering” - Intimidation low
- Don’t need to identify tasks, activities
- Can identify some fairly obvious fixes
- Can expose problems user testing doesn’t expose
- Provides a language for justifying usability recommendations

Disadvantages of Heuristic Evaluation

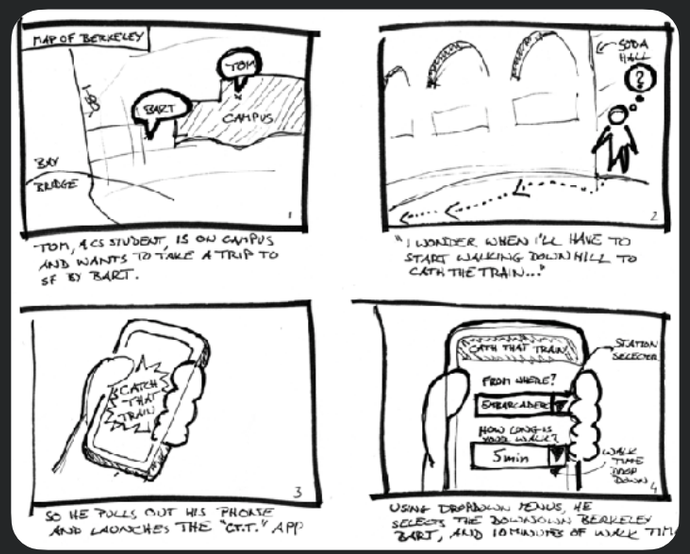
- Un-validated
- Do not employ real users
- Can be error prone
- Better to use usability experts
- Problems unconnected with tasks
- Heuristics may be hard to apply to new technology

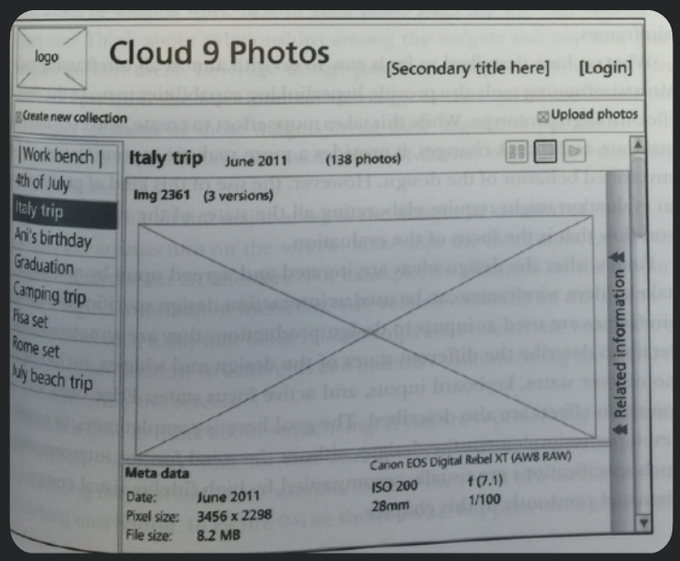
Week 2 Lecture - Sketching & Prototyping

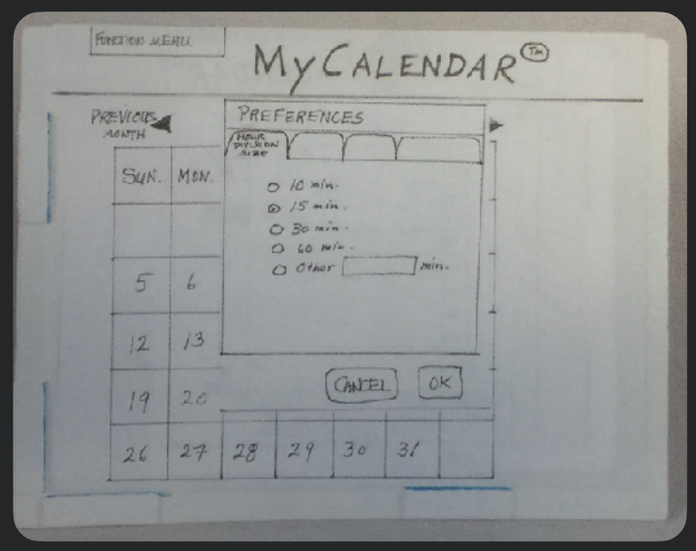
Sketching vs. Prototyping



Fidelity of Sketches & Mockups







Storyboard —— Wireframe —— Prototype

low ← → high

Fidelity

(many details left unspecified)

(more polished & detailed)

Storyboards for UI Design

- Sequence of visual “frames” illustrating ***interplay*** between user & envisioned system
- Explains how app fits into a larger ***context*** through a single scenario / story
- Bring design to ***life*** in graphical clips - freeze frame sketches of user interactions
- “Comic-book” style ***illustration*** of a scenario, with actors, screens, interaction, & dialog

Wireframes

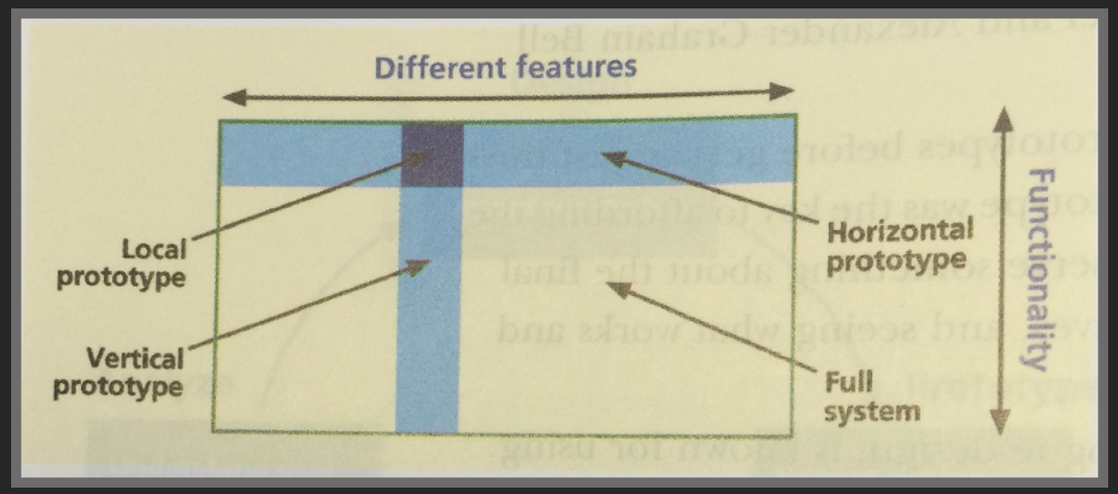
- Lines & outlines (“wireframes”) of boxes & other shapes
- Capturing emerging interaction designs
- Schematic designs to define screen content & visual flow
- Illustrate approximate visual layout, behavior, transitions emerging from task flows
- Deliberate unfinished: do not contain finished graphics, colors, or fonts

Design Critiques

- Stylized meeting for getting feedback on design sketches & prototypes
- Solicit feedback from peers
- History: studio art education

http://www.flickr.com/photos/pjchmiel/2972140234/

Types of Prototypes



- Which details do you leave out?
- **Horizontal**: ***broad*** in features, less depth
  - Explore overall concept of app, but not specific workflows
- **Vertical**: lots of ***depth***, but only for a few features
  - Enables testing limited range of features w/ realistic user evals
- **T**: most of UI realized at low depth, few parts realized in depth
  - Combination of vertical & horizontal
- **Local**: focused prototype on ***specific*** interaction detail

Week 3 Lecture - Human Cognition

Two Types of Human Cognition

Type 1 System

- Automatic (unconscious)
- Effortless
- “Fast” thinking
- Associative
- Heuristic
- Gullible
- Can’t be turned off

Type 2 System

- Voluntary (conscious)
- Effortful
- “Slow” thinking
- Planning
- Logical
- Lazy
- Usually only partly on

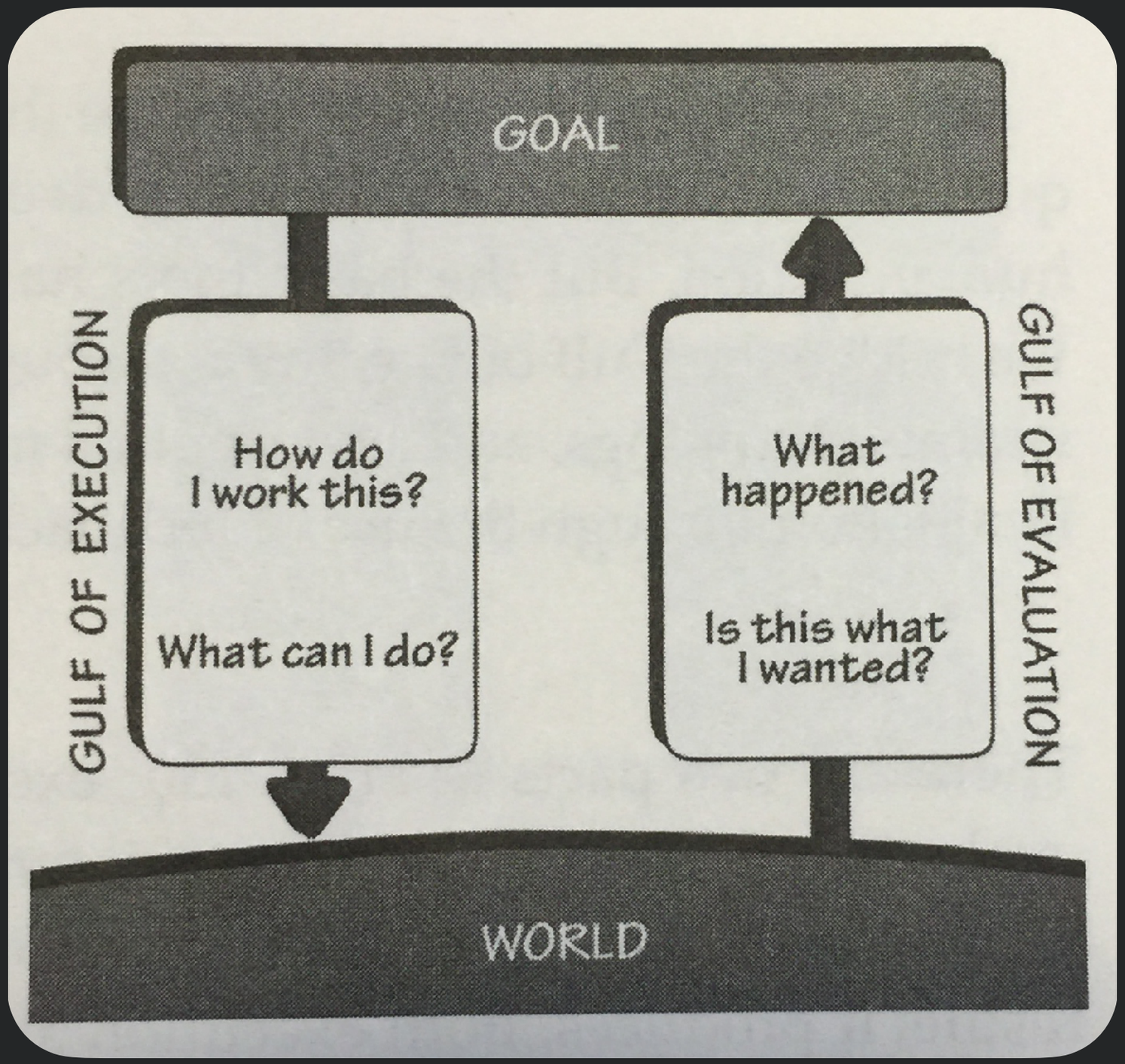
Attentional Resources are Fixed

- System 2 activity takes conscious attention
- Attentional resources are fixed
- Pupils dilate as mental effort increase
- If demands exceed max, tasks prioritized.

Some Design Implications

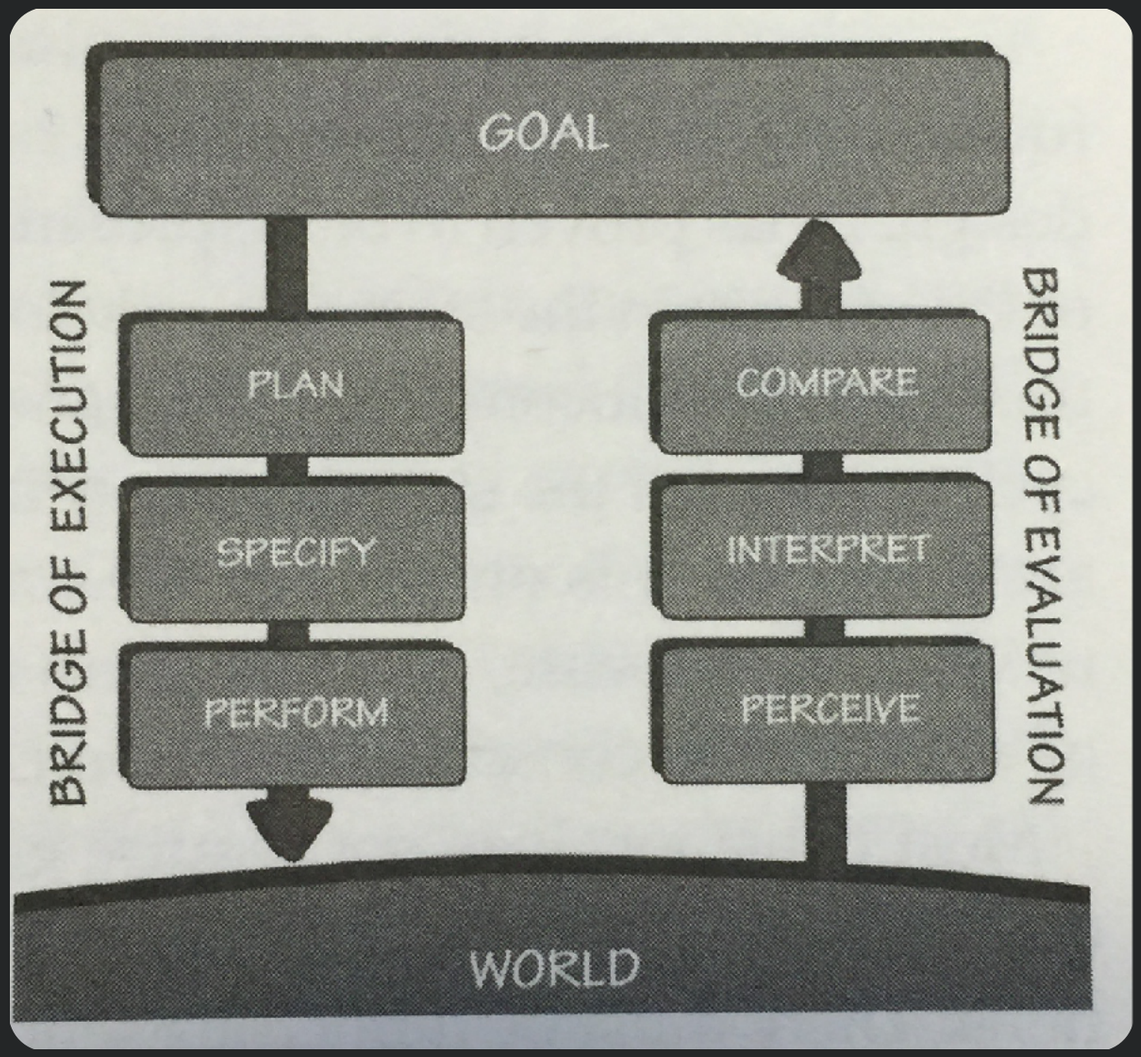
- Take advantage of System 1 where possible
- Don’t confuse System 1 (e.g., consistent mapping in next lecture)
- Users can be stubborn (sunk cost investment in current strategy)
- People can get upset when have goals they cannot accomplish, as attentional resources exhausted solving problem and less self control
- Let users doing something else while waiting

Gulfs of Execution and Evaluation



Norman's 7 Stages of Action

1. Goal (form the goal)
2. Plan (the action)
3. Specify (action sequence)
4. Perform (action sequence)
5. Perceive (the state of the world)
6. Interpret (the perception)
7. Compare (outcome w/ goal)



Designing for Action

- Key challenge is designing interactions that help users to accomplish their goals

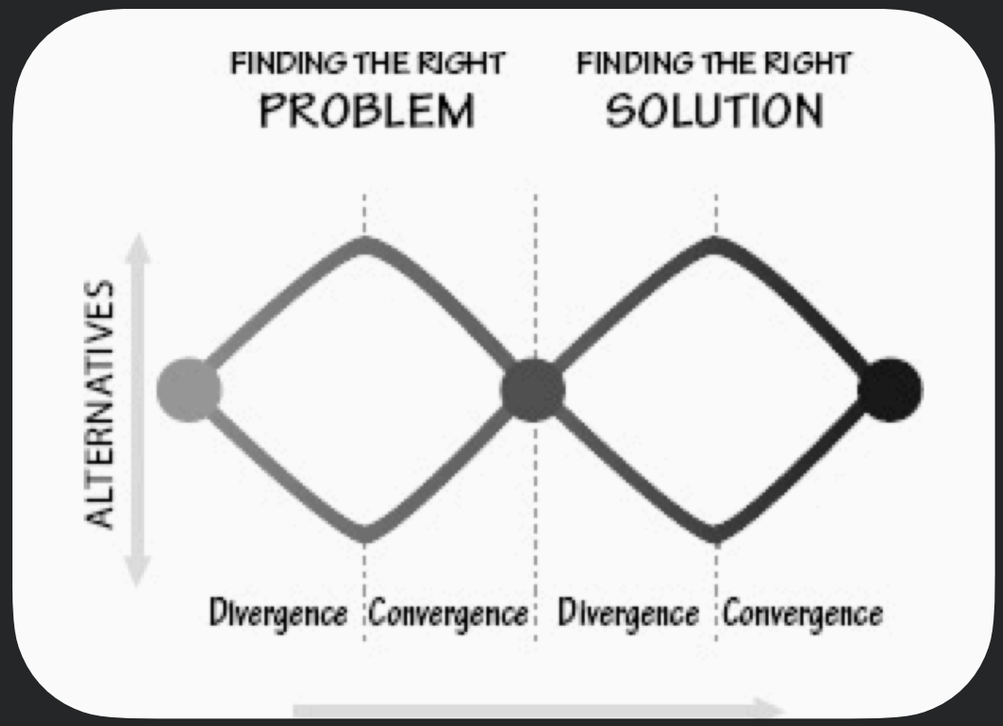
7 Principles of Designing for Action

1. Discoverability
2. Feedback
3. Conceptual Model
4. Affordances
5. Signifiers
6. Mappings
7. Constraints

Week 4 Lecture - User Centered Design

Double Diamond Model of Design

- Question problem, expand scope, discover fundamental issues
- Converge on problem
- Expand possible solutions
- Converge on solution

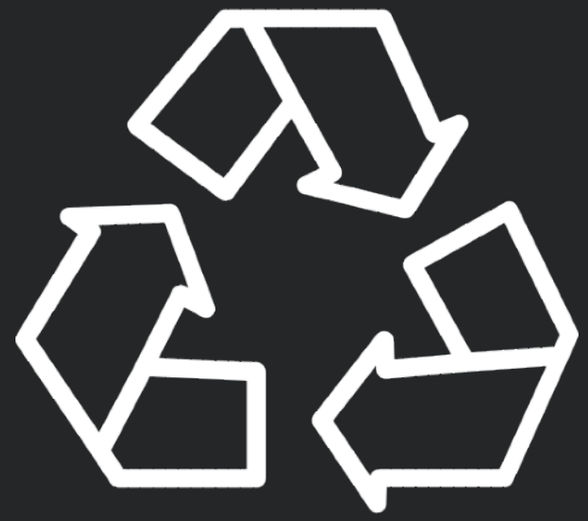


Iterative Model of Design

Observation

(Re)Define the Problem

Understand User Needs



Idea Generation

Brainstorm
what to build

Prototype

Build

Test

Evaluate what
you have built

Week 5 Lecture - Contextual Inquiry

Why Perform Contextual Inquiry?

- Need to understand what will help people do their work better while fitting into their lives and matching their culture.

An "Apprenticeship" with the User

Purposes of Contextual Inquiry (CI)

- To obtain ***data*** from users in their context
  - insights about the users' ***environment***
  - insights about their many ***tasks***
  - insights about the ***people*** they work with
  - insights about ***cultural influences*** on work (expectations, desires, policies, values, etc.)
  - understanding of ***breakdowns*** in current processes
- To help define requirements, plans and designs and to prioritize

Approach of Contextual Inquiry

- ***Actions*** speak louder than words
  - People usually cannot say what innovations they would like and even when they can, are sometimes wrong about what would be helpful.
- Have ***conversations*** with users in the ***context*** of their work
  - “Direct observation” when possible
  - When not possible
    - Cued recall of past experience, or
    - Re-creation of related experience
      (we’ll eventually see that this is similar to Think Aloud usability studies)

Principles of Contextual Inquiry

1. **Context:**

   Understand users' ***needs*** in their work environment

2. **Partnership:**

   Work with users as ***co-investigators***

3. **Interpretation:**

   Assign ***meaning*** to the observations

4. **Focus:**

   Listen & ***probe*** from a clearly defined set of concerns

Key Differences in Methods

Interviews, surveys, focus groups

- Remembered experience (or summary data & abstractions)
- Subjective
- Limited by reliability of human memory
- What customers think & say they do

Contextual Inquiry

- Ongoing experience & concrete data where work is happening
- Objective
- Limited by ability to observe directly
- What customers do

Steps in a Work-based Interview

1. Introduction
2. Transition
3. Observation and Interpretation
4. Wrap-up

End of Midterm Review

5 Minute Break

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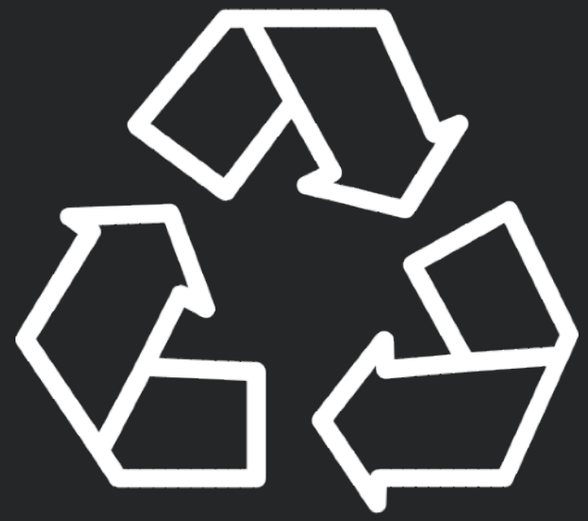
Usability Studies

Iterative Model of User-Centered Design

Observation

(Re)Define the Problem

Understand User Needs



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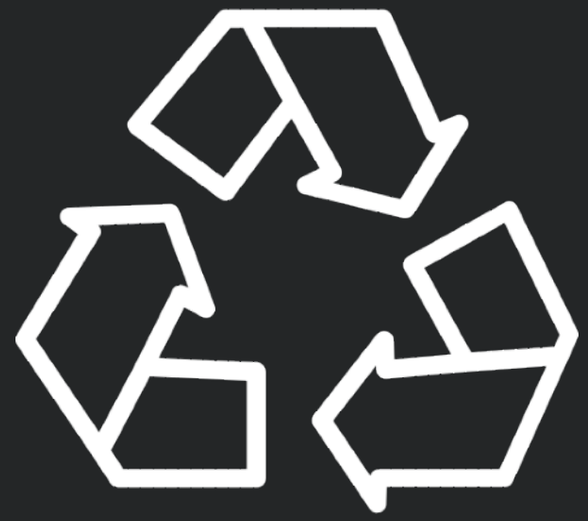
Iterative Model of User-Centered Design

Observation

(Re)Define the Problem

Understand User Needs



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Iterative Model of User-Centered Design

Observation

(Re)Define the Problem

Understand User Needs

Idea Generation

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Evaluate what
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Iterative Model of User-Centered Design

Observation

(Re)Define the Problem

Understand User Needs

Contextual Inquiry
(Week 5)

Test

Evaluate what
you have built

Idea Generation

Brainstorm
what to build

Week 3

Prototype

Build

Iterative Model of User-Centered Design

Observation

(Re)Define the Problem

Understand User Needs

Contextual Inquiry
(Week 5)

Test

Evaluate what
you have built

Idea Generation

Brainstorm
what to build

Week 3

Prototype

Build

Sketching,
Prototyping,
Storyboard (Week 2)

Iterative Model of User-Centered Design

Observation

(Re)Define the Problem

Understand User Needs

Contextual Inquiry (Week 5)

Idea Generation

Brainstorm what to build

Sketching, Prototyping, Storyboard (Week 2)

Prototype

Build

Test

Evaluate what you have built

Empirical

Usability Evaluation (Week 6)

Week 3

Iterative Model of User-Centered Design

Empirical

Usability Evaluation (Week 6)

Observation

(Re)Define the Problem

Understand User Needs

Contextual Inquiry (Week 5)

Test

Evaluate what you have built

Idea Generation

Brainstorm what to build

Week 3

Analytical

Heuristic Evaluation (Week 1)
Designing for Action (Week 3)
Design Principles (Weeks 8-14)

Prototype

Build

Sketching, Prototyping, Storyboard (Week 2)

Iterative Model of User-Centered Design

Observation

(Re)Define the Problem

Understand User Needs

Test

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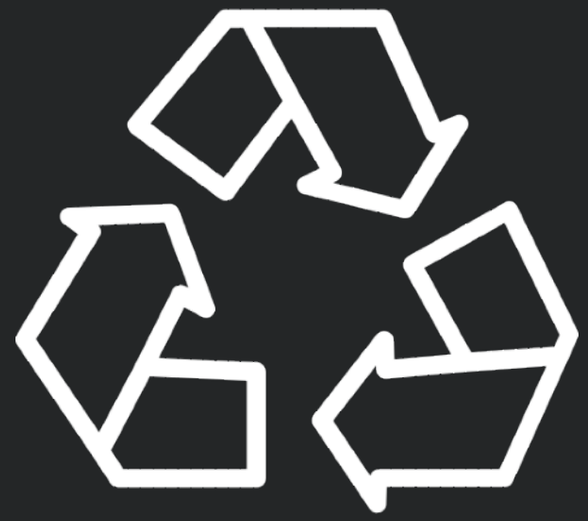

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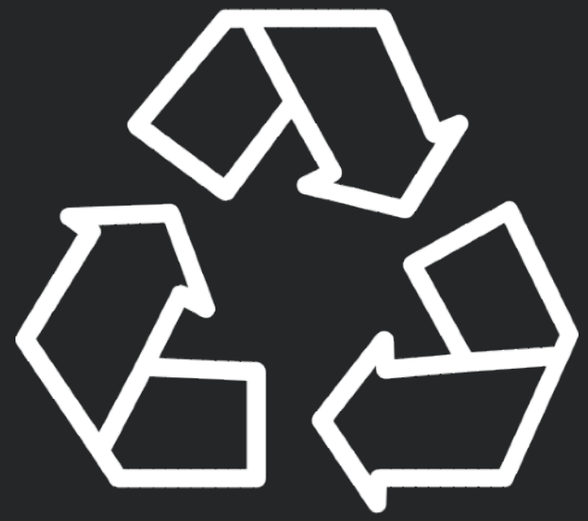

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Prototype

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Empirical

Usability Evaluation (Week 6)

Why Conduct Usability Studies?

- Evaluate interaction design with ***real*** empirical data, gathering ground truth of user performance
- Identify ***usability issues***

Think-aloud Usability Study

- Goal: observe users using app, identify usability issues
- Can use with
  - paper prototype
  - HTML prototype
  - Wizard of Oz study
  - actual app

Steps in a Usability Evaluation Study

- Formulate ***goals*** of study
- Design study protocol, tasks, materials, data collection, …
  - Pilot study design
- ***Conduct*** study
- ***Analyze*** data to assess task performance and identify usability issues

Formulate Study Goals

Study Goals

- Where are you in the design process? What feedback do you seek?
  - Exploring new design idea
  - Validating high-level approach
  - Identifying important usability issues
  - Evaluating a new feature just added or a particular corner case
  - Studying performance by specific users (e.g., expert users familiar with old version)
  - Comparing performance against competitors

Study Design

Selecting Participant Population

- Who will be the users?
- Goal: users representative of system's ***target users***
- Are there multiple ***classes*** of users (e.g., data analysts, site administrators)?
  - If so, which are appropriate given goals?
  - May choose several classes
- System ***novices*** or ***experts***?
- Might choose to include ***UX experts*** to help flag potential issues

Number of Participants

- More participants —> different participant interactions, more data
- Fewer participants —> faster, cheaper
- No right answer, as depends on potential diversity of interactions and users
- Nielsen & Morlich (1990) found that 80% of problems could be detected w/ ***4-5*** participants
  - Most serious usually detected with first few
  - Krug suggests 3

Informed Consent

- Important for participants to be told up front what they will do and provide affirmative consent
- Helps allay potential participant fears
- Make clear purpose of study
- Make clear that you are evaluating your design, **not** the user

Tasks

- What will users do?
- Goals for task design:
  - Provide specific goal: something that the user should accomplish
  - Comprehensive enough to exercise key features of your app
  - Short enough to minimize participant time commitments

Communicating Tasks

- Provide a scenario explaining the background of what users will be doing
- Provide a specific goal that the user should accomplish
  - But ***not*** how they should accomplish it
  - Don’t give away how you hope users will accomplish goal
- Communicate ***end criterion*** for task - how do they know they’re done?
- Provide maximum time limit after which they will be stopped

Recruiting Participants

- Many potential sources
  - Co-workers, colleagues, friends, family
  - Email, mailing lists, online forums
  - Announcement at related user groups
- Important to select sources that best match the background & knowledge of target users

Incentives for Participants

- Often (but not always) helpful to pay participants
- Most applicable when seeking participants with specialized expertise with whom you do not already have a personal or professional relationship
- Can also offer other incentives, such as gifts, coffee mugs, gift certificate; or free consulting, training, or software
- In some cases, just learning about future product can be incentive

Managing Participants

- Participants are valuable resource
  - Often finite resource
  - Think carefully about how participants will be used
  - Devise mechanisms for scheduling participants & reminders

Training

- Goal: ***avoid*** unless really necessary
- Training necessary when
  - Participants require specialized knowledge to act as target users
  - Target users will have access to specialized training materials before they begin study

Data Collection

- Think aloud
- Screencast
- Questionnaires interview questions to gather participant feedback

Questionnaires and Interviews

- Gather background or demographics about participants (if important)
- Supplement task performance data with subjective reactions
    - Perceptions of design, comments on potential issues, ideas for features
- Questionnaire - pre-defined questions, focused, less bias
- Interviews - more open ended, longer responses

Example Open-ended Questions

- What did you like best about the UI?
- What did you find most difficult or challenging?
- How might the UI better support what you're trying to do?

Piloting Study Design

- Dress rehearsal for conducting actual study
- Goals
  - Ensure software / prototype won’t “blow up”
  - Test tasks - ensure right length & difficulty
  - Test that materials are comprehensive and comprehensible
- As-needed piloting
  - Use first study session as pilot only if issues arise and must be addressed

Conducting the Study

Introduction (1)

- Greet participants, introduce yourself, thank them
- Build rapport, socialize
- Introduce them to the setup

Introduction (2)

- Give participant Informed Consent
- Answer any questions about study design
- Relieve anxiety and curiosity as much as possible
- Make clear evaluating design, not participant
- Let participants know you can’t answer questions about how to do task

Starting Session

- Give participants description of task
- Start any video recording
- Start encouraging participant to think aloud
- Begin observing participants work on task

Interactions During the Task

- Goal: listen, not talk
- Prompt participants to think aloud when necessary
  - e.g., What are you trying to do? What did you expect to happen?
- If show signs of stress / fatigue, let them take a break
- Keep participants at ease
  - If participants frustrated, reassure & calm participants
  - If so frustrated they want to quit, let them

Giving Help

- If participants totally off track, small reminder of goal might help
- Should ***not*** give participants information about how to complete the task
- What if user asks for help?
  - Direct them to think through it or work it out for themselves

Collecting Critical Incidents

- *Any action that does not lead to progress in performing the desired task*
- Often related to a gulf of execution or gulf of evaluation
- Generally does not include
  - accessing help
  - random acts of curiosity or exploration

Understanding a Critical Incident

- Important to understand in the moment what users goal is and what actions they are taking
- When a critical incident occurs, jot down
  - The time
  - What user was trying to do
  - What user did

Wrapping Up the Study Session

- Provide questionnaire (if applicable) / conduct interview (if applicable)
  - Probing into causes of behavior
- Answer any lingering questions the participant may have
- Thank the participant!!
- Provide any incentives (if applicable)

Reset Study Environment

- Make sure study environment is in the same state for all participants
  - Reset browser history / cache (if applicable)
  - Delete any user created content or materials

Analyzing Data

Critical Incident Analysis

- Identify critical incidents where something went wrong
- Easiest to catch in the moment - ***important to take good notes***
- Going back and looking at screencast can help you study context of issue in more detail

Reporting a Critical Incident

- Problem statement: summary of problem and effect on user (but not a solution!)
- User goals: what was user trying to do?
- Immediate intention: at the moment in time when problem occurred, what was the user trying to do
- Possible causes: speculate on what might have led user to take action they did

Critical Incidents → Usability Issues

- Group together similar incidents to form ***usability issue***
  - Match similar critical incidents within and across study sessions
  - Identify underlying cause
- Brainstorm potential fixes

Usability Study vs. Contextual Inquiry

Usability Study

- Used for evaluation
- Generally conducted via observation
- Identification and analysis of “critical incidents”
- Intended to identify usability issues

Contextual Inquiry

- Used primarily for “needfinding”
- Conducted more like a conversation
- Obtain data about users in their context
- Intended to help in the design phase of a project

7 Minute Break

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In-Class Activity

Group Activity

- In groups of two (breakout rooms)
- Take turns conducting a usability study of your project app
  - 5 mins to brainstorm 5-10 min task for each app
  - 10-15 mins to conduct each study
  - Identify critical incidents (if any)

Tech Talks

Tech Talk

1. Tech Talk - Cypress

Acknowledgements

- Slides adapted from Dr. Thomas Latoza's SWE 632 course