

SWE 632 - Design & Development of User Interfaces



George Mason
University

Instructor:

Dr. Kevin Moran

Teaching Assistant:

David Gonzalez Samudio

Class will start in:

20:00

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Fall 2020



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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, due Oct 20th (3 weeks from today)
- Discussion Question 6 - Posted after class (Optional)



Project Checkpoint 4

Description

In this Project Checkpoint, your project group will conduct a usability evaluation study of your revised web app from Project Checkpoint 3 to identify 5 usability issues. The usability study will

1. Involve 4 participants, who may be friends, family, coworkers, or students in this class but may not be members of your project group
2. Consist of a single task that should last 10 - 20 minutes and must be at least 5 minutes long. Your task should have an overall objective but might enumerate several inter-related objectives (e.g., plan a home remodeling project, including listing materials you need to purchase and the steps you will take)
3. Collect think-aloud data and a screencast (w/ audio) of each participant. You are free to use whatever screen recorder you would like to use. For ease of use, you can conduct these studies over Zoom and record the screen using Zoom's built in tools.
4. Identify and report critical incidents that occur during the tasks
5. Collect subjective reactions from participants through a brief open-ended post-task interview conducted immediately following each task.
6. Analyze critical incidents and participant reactions to identify at least 5 usability issues.



Project Checkpoint 4

Designing the Study

You should first design your study taking into consideration the following:

1. Design a task that exercises one or (ideally) more of your web app's use cases. Your task should describe a concrete, fictional scenario and a specific objective for the participant to accomplish within this scenario. A task might involve interacting with software other than your web app (e.g., searching the web, and using your app to record notes) to understand how your app fits into a larger context, particularly if your use cases can be accomplished very quickly. For example, if your app is a todo app, you might have the user use your app to brainstorm a plan.
2. Prepare a one or two paragraph description of your scenario and task.
3. Conduct a pilot test to ensure the task is understandable and of the right length and difficulty, revise your task, and repeat (as needed).



Project Checkpoint 4

Conducting the Study

Next, conduct your study with 4 participants. For each participant, ensure that you

1. Introduce the experimenter(s) and the purpose of the study
2. Answer any questions the participant has about the purpose of the study.
3. Begin the task
 - a. Give participant the task description
 - b. Prompt participant to think-aloud
 - c. Start the screen recorder
4. Observe the participant as they work
 - a. Take notes on participant behavior
 - b. Prompt participant to continue to think-aloud, when necessary
 - c. Note critical incidents as they occur, jotting down both the time and the context of what occurred
5. Conduct a post-task interview
 - a. When unclear, ask participants clarification questions about what they did and why they did it
 - b. Ask open-ended questions such as what they liked best, what they found most challenging, and what they think might be improved.
6. Wrap up the study
 - a. Thank the participants
 - b. Stop the screen-recorder and reset the study setup for the next participant (if any)



Project Checkpoint 4

Analyzing and Reporting Results

First, review your notes and the screencasts to identify and report critical incidents. For each critical incident, you should report:

1. A participant letter (A - D) and a critical incident number (1 - n) (e.g., A5)
2. Problem statement: summary of problem and effect on user (but not a solution!)
3. User goals: what was the larger goal that the user was working towards
4. Immediate intention: at the moment in time when problem occurred, what was user trying to do
5. Possible causes: speculate on what might have led the user to take the action they did.

Next, analyze the responses to the post-task interview questions. For each participant, build a short writeup summarizing responses to the interview questions.

Finally, from the critical incidents and interview responses from all of the participants, group common issues and try to find an underlying cause. For the 5 issues you believe to have the largest impact on the usability of your app, write a one to two paragraph description that summarizes the usability issue, citing all of the related critical incidents (e.g., A1, B5, C3, C6) and any related interview responses.



Expectations for Midterm Exam

- Free response, essay questions
- 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
- *David and I will be available for questions via Zoom in our Office Hour rooms during class.*



Class Overview

1. Midterm Review: Revisiting Key Topics
2. Usability Studies: Empirically Evaluating Design Ideas
3. In Class Activity: Conducting a Usability Study
4. 7 Minute Break
5. Tech Talk - Svelte: Adam & James
6. Tech Talk - JamStack: Will, Aimee & Brian

Midterm Exam Review



Week 1 Lecture





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





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

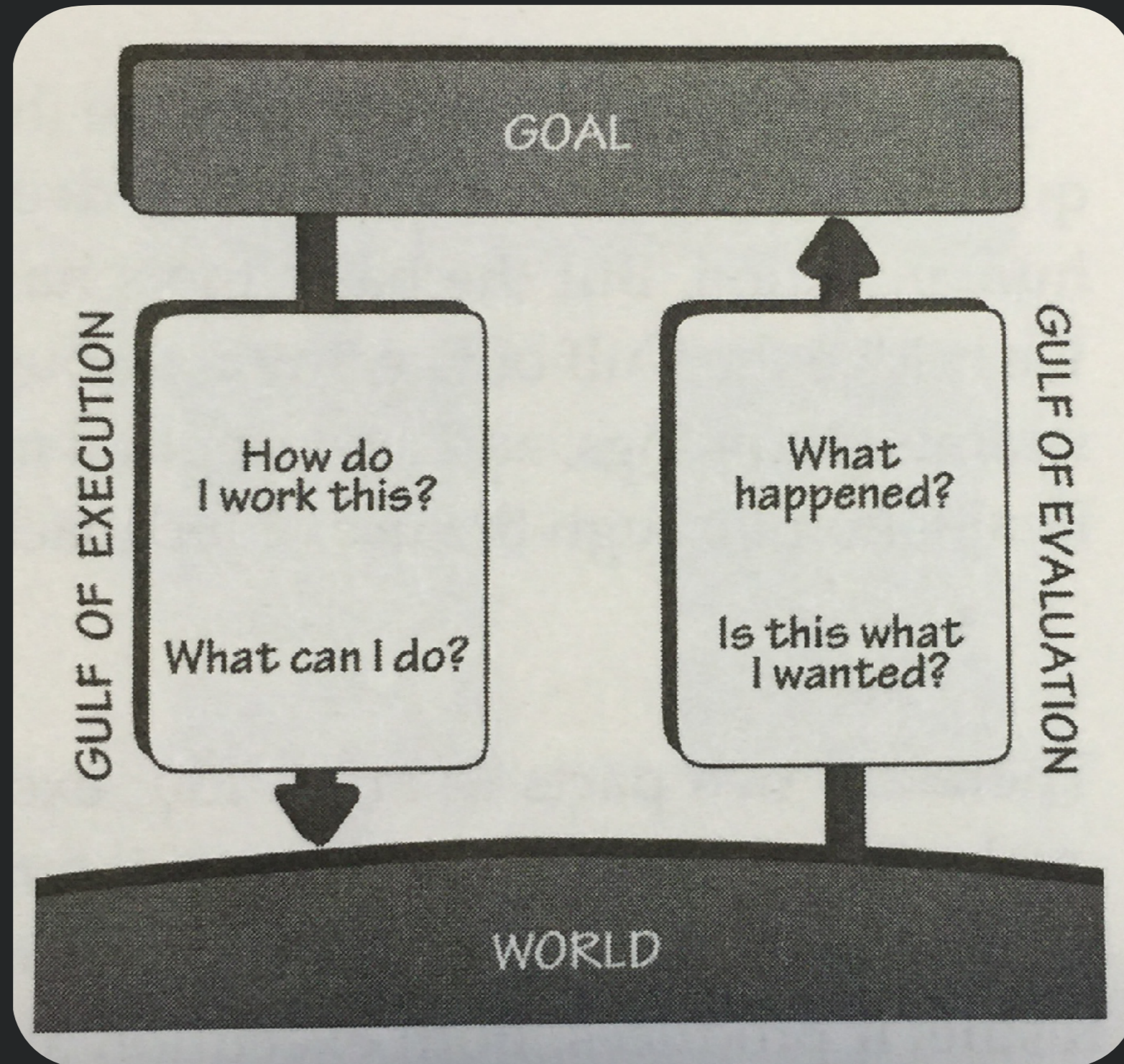
- System 2 activity takes conscious attention
- Attentional resources are fixed
- Pupils dilate as mental effort increase
- If demands exceed max, tasks prioritized.



Some Design Implications

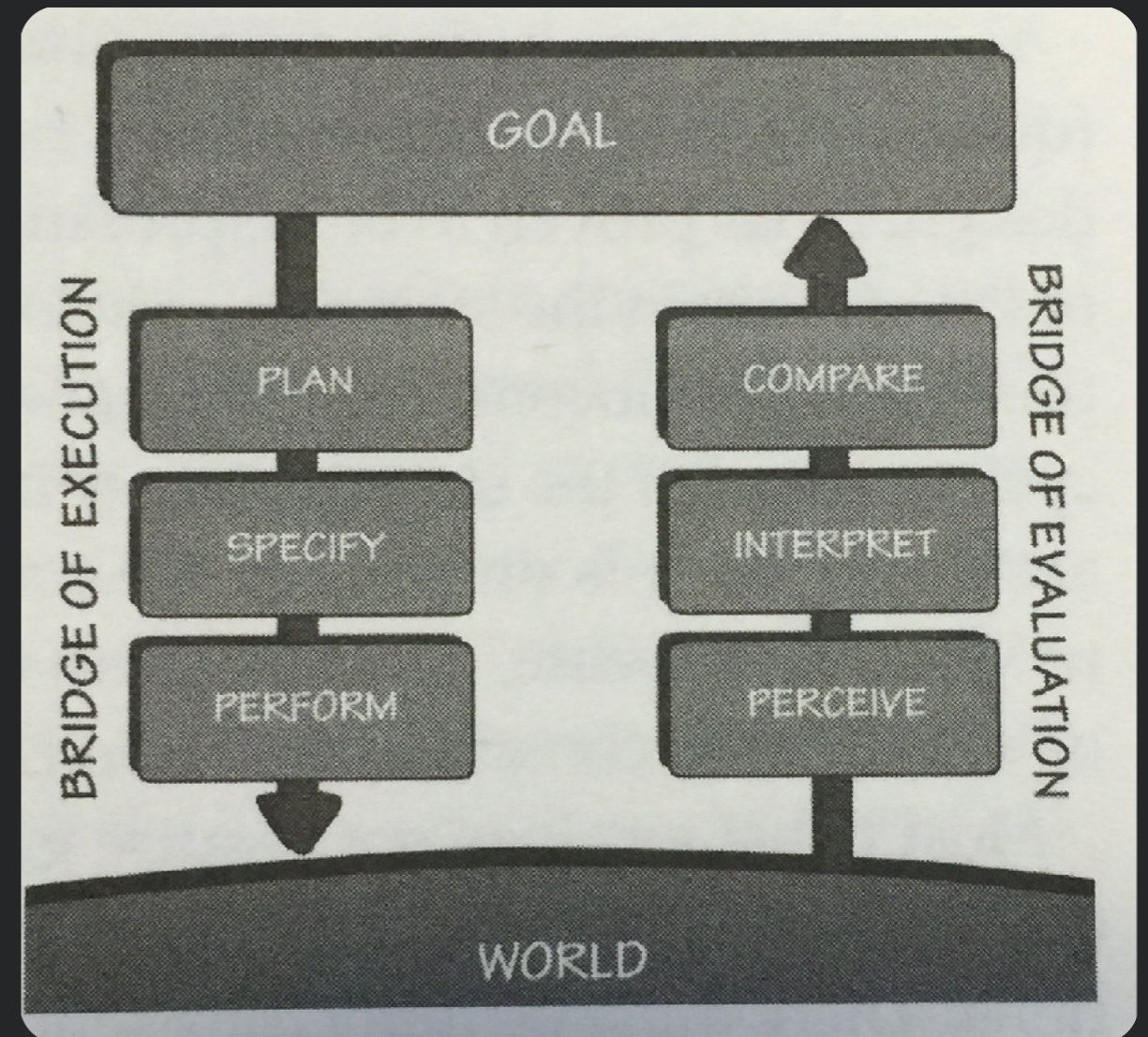
- Take advantage of System 1 where possible
- Don't confuse System 1 (e.g., consistent mapping in next lecture)
- Users can be stubborn (sunk cost investment in current strategy)
- People can get upset when have goals they cannot accomplish, as attentional resources exhausted solving problem and less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

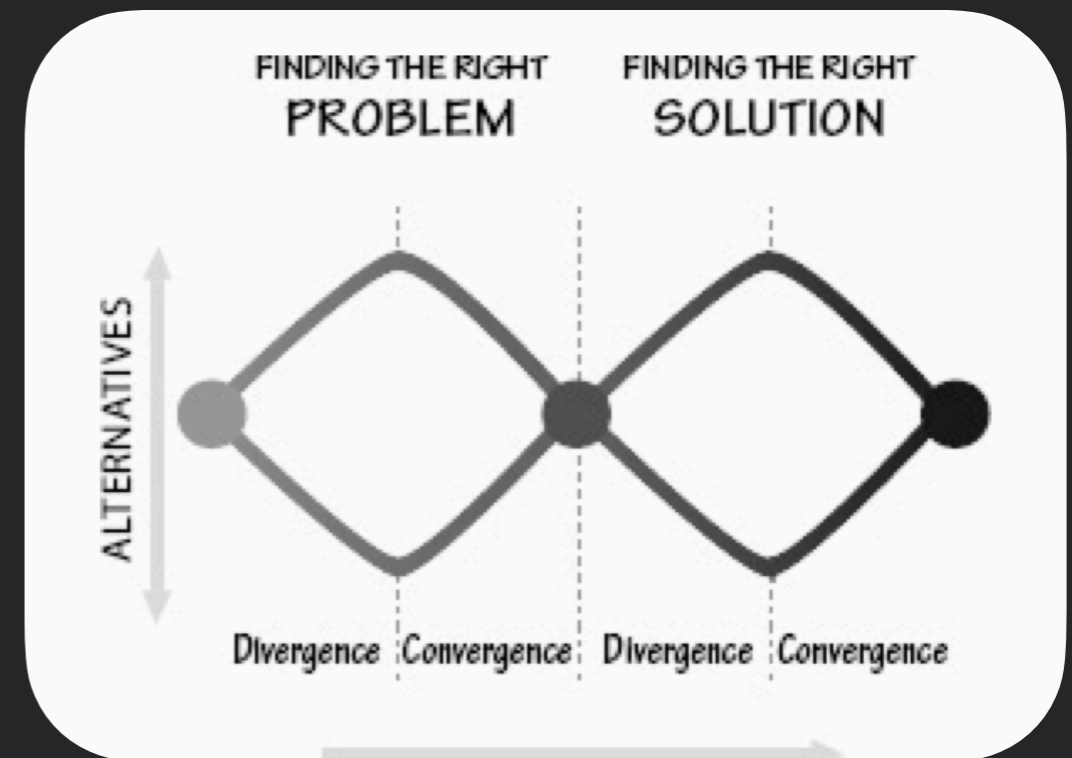
1. Discoverability
2. Feedback
3. Conceptual Model
4. Affordances
5. Signifiers
6. Mappings
7. Constraints

Week 3 Lecture



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



Test

Evaluate what
you have built

Prototype

Build

Week 4 Lecture



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



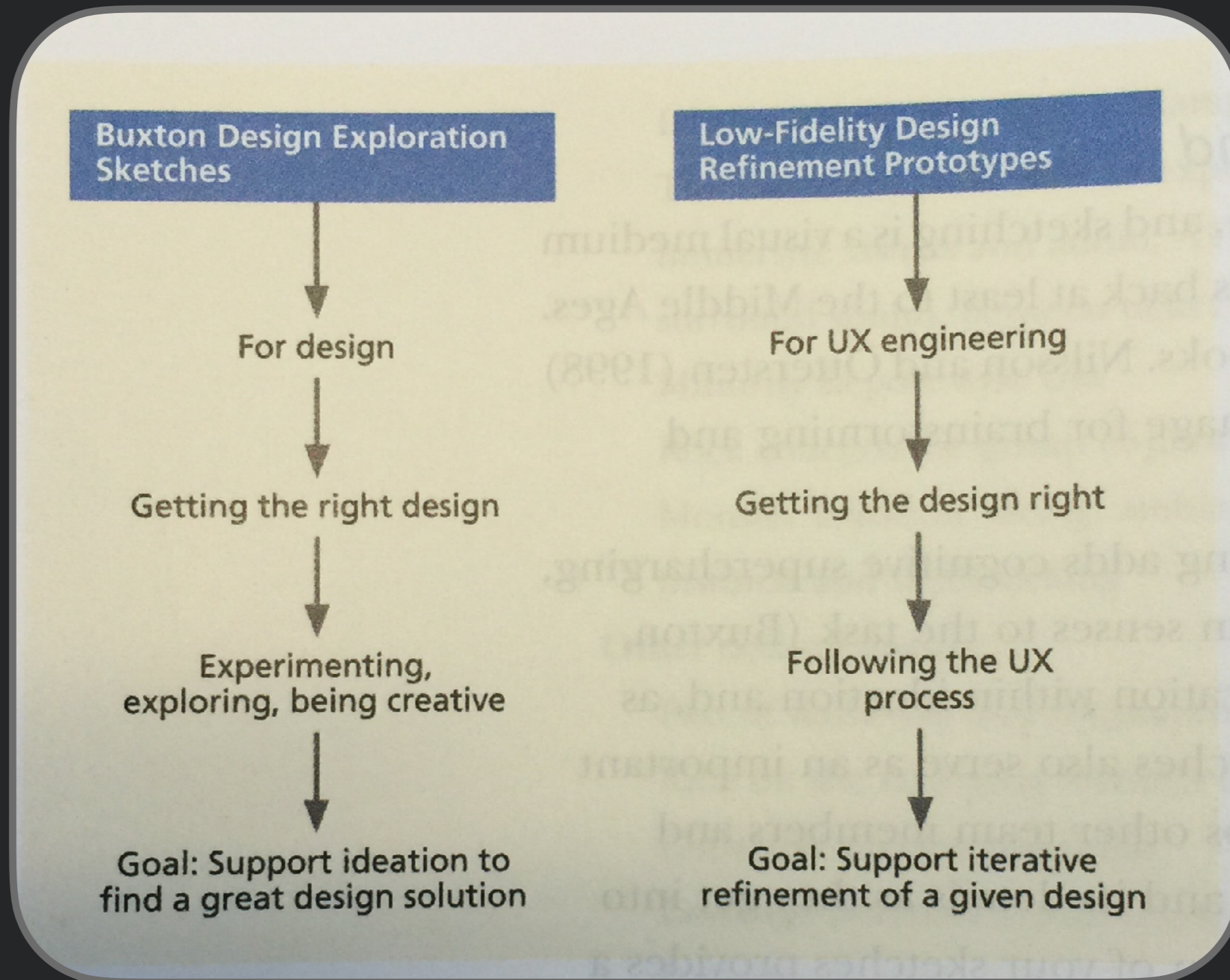
Steps in a Work-based Interview

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

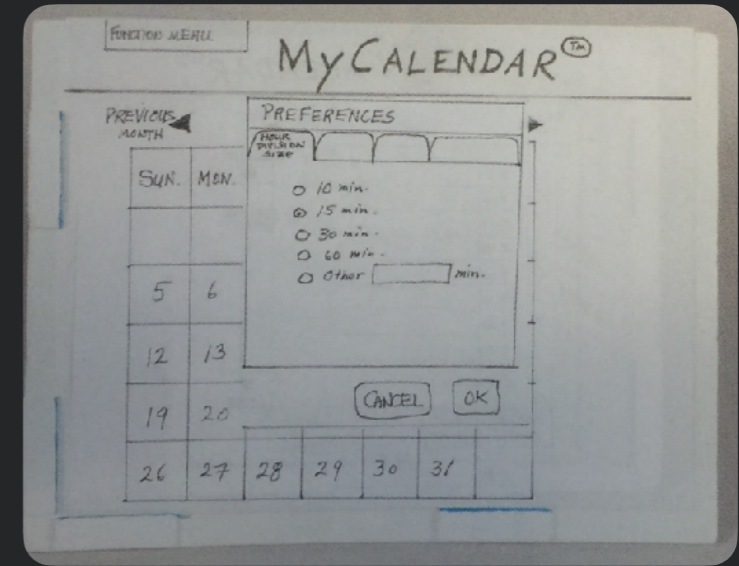
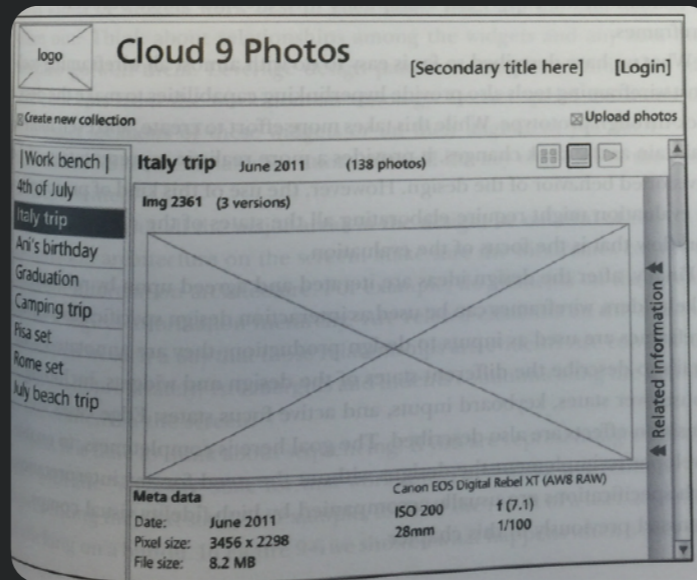
Week 5 Lecture



Sketching vs. Prototyping



Fidelity of Sketches & Mockups



Storyboard ————— Wireframe ————— Prototype

low

(many details left unspecified)

Fidelity

high

(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

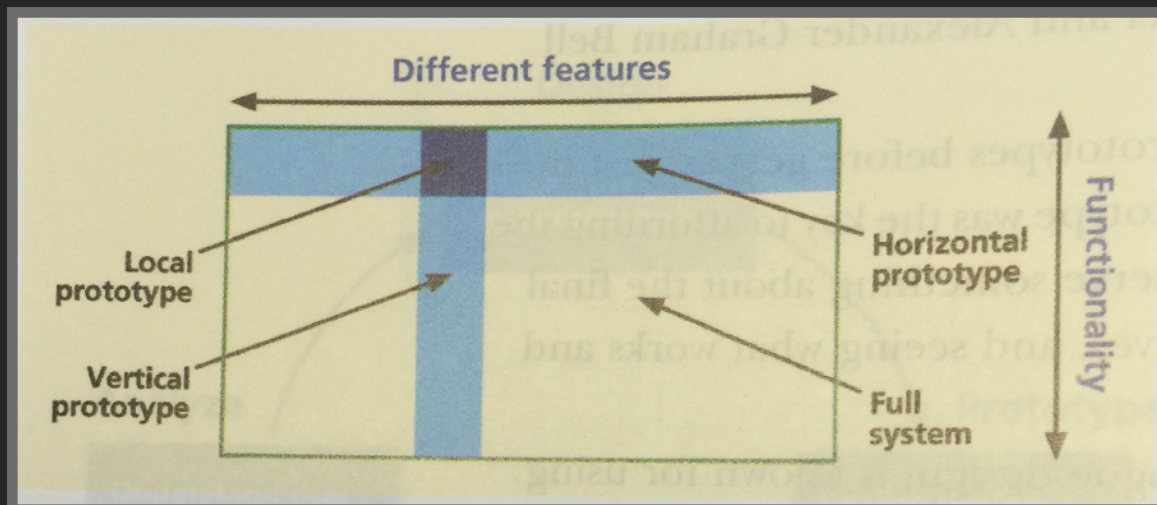
- Stylized meeting for getting feedback on design sketches & prototypes
- Solicit feedback from peers
- History: studio art education



<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



End of Midterm Review



Usability Studies



Iterative Model of User-Centered Design

Observation

(Re)Define the Problem
Understand User Needs

Test

Evaluate what
you have built



Idea Generation

Brainstorm
what to build

Prototype

Build

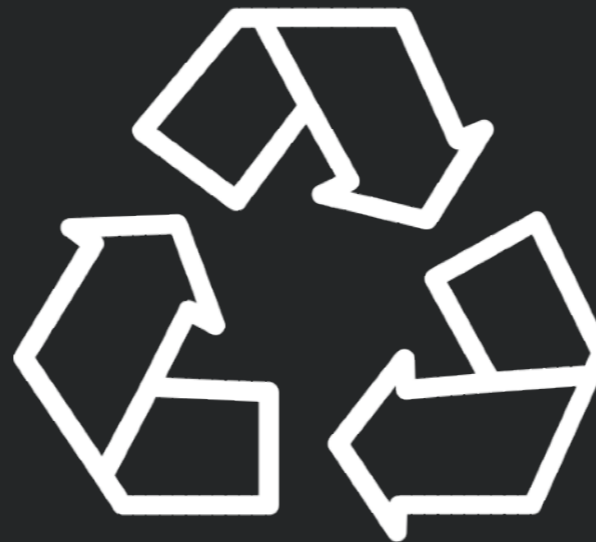
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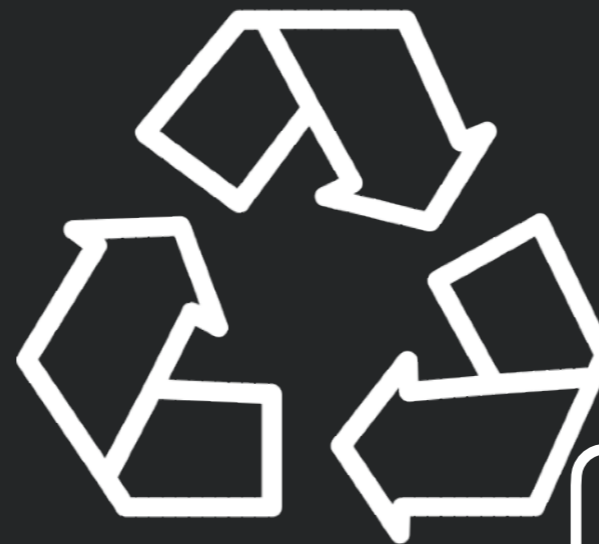
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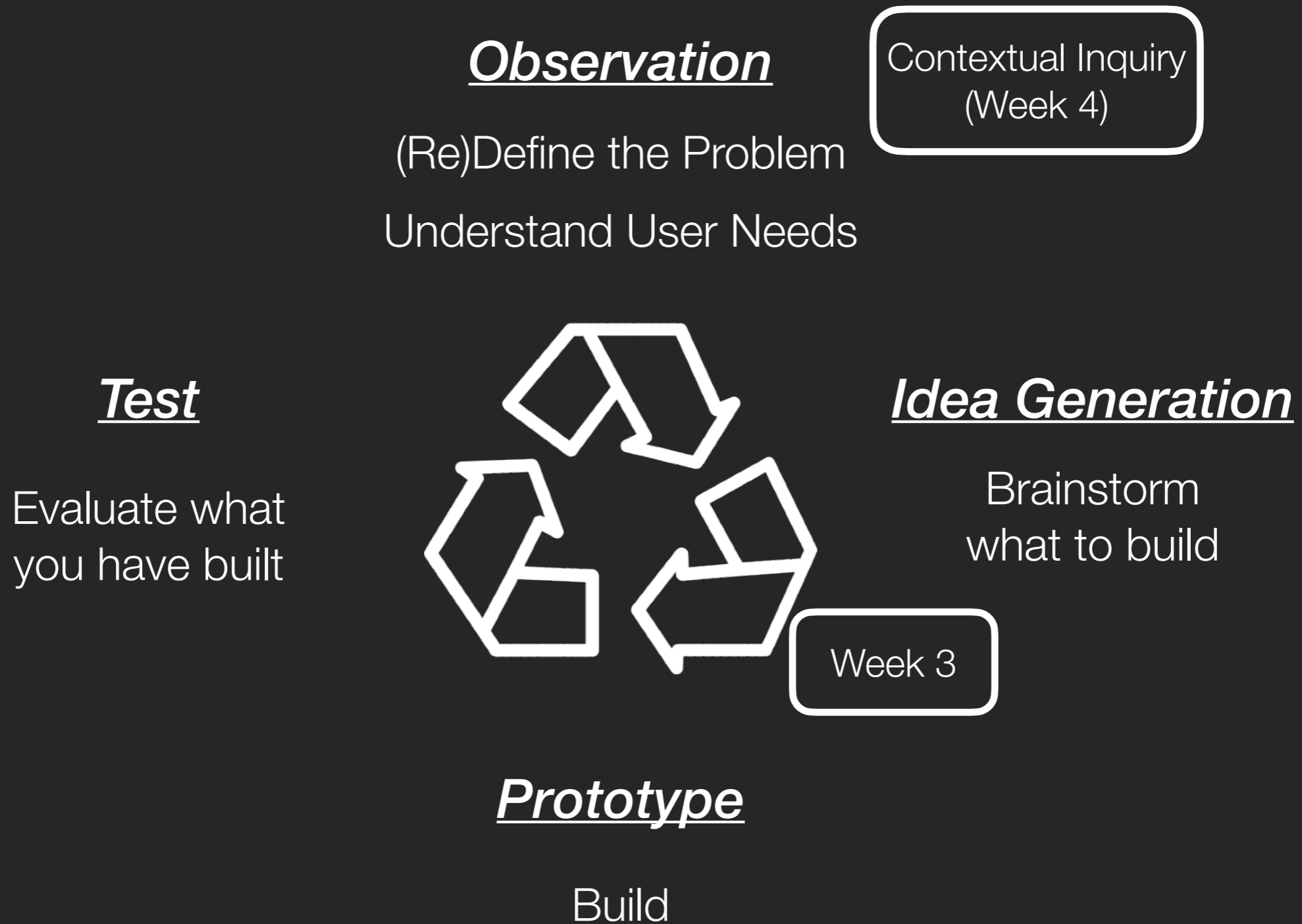
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Prototype

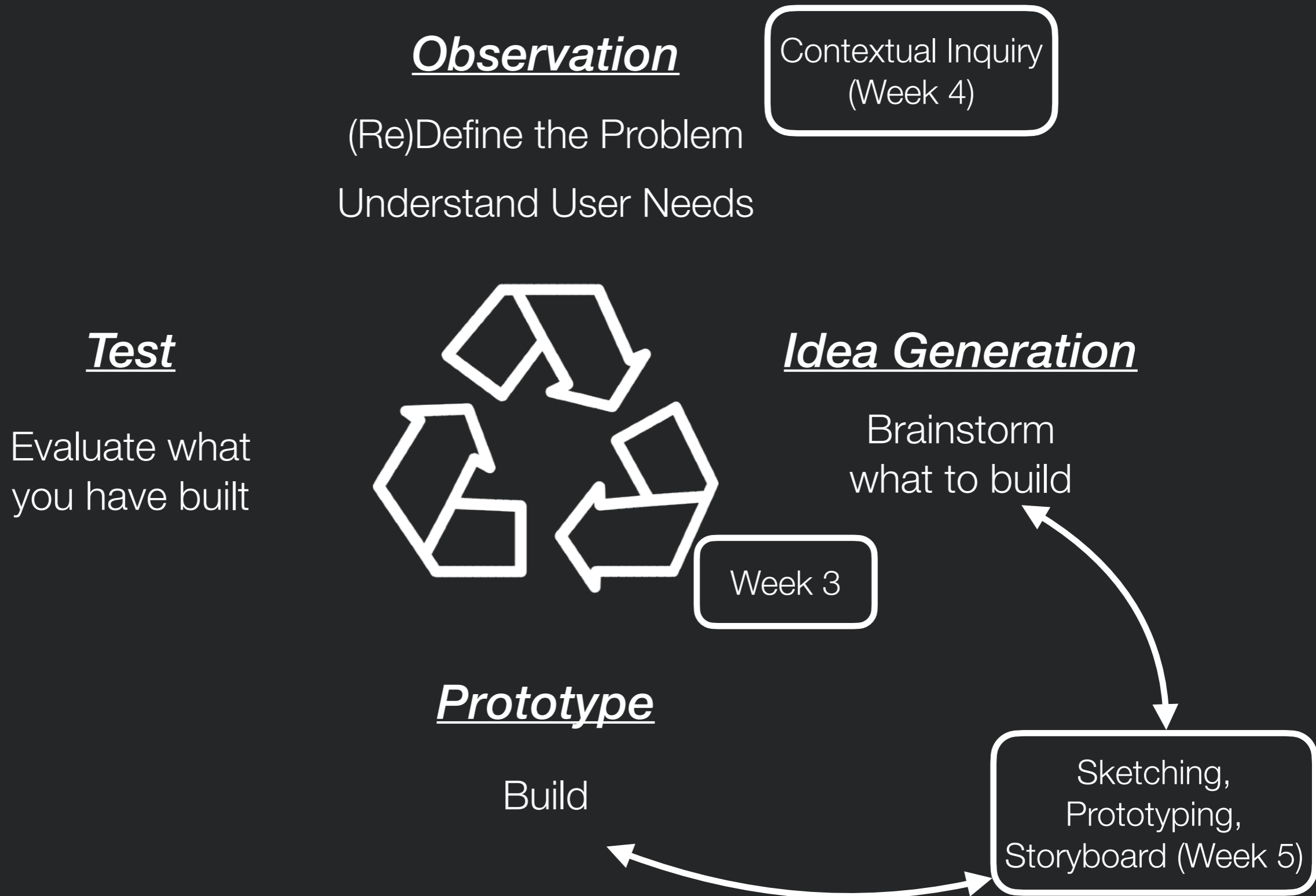
Build

Week 3

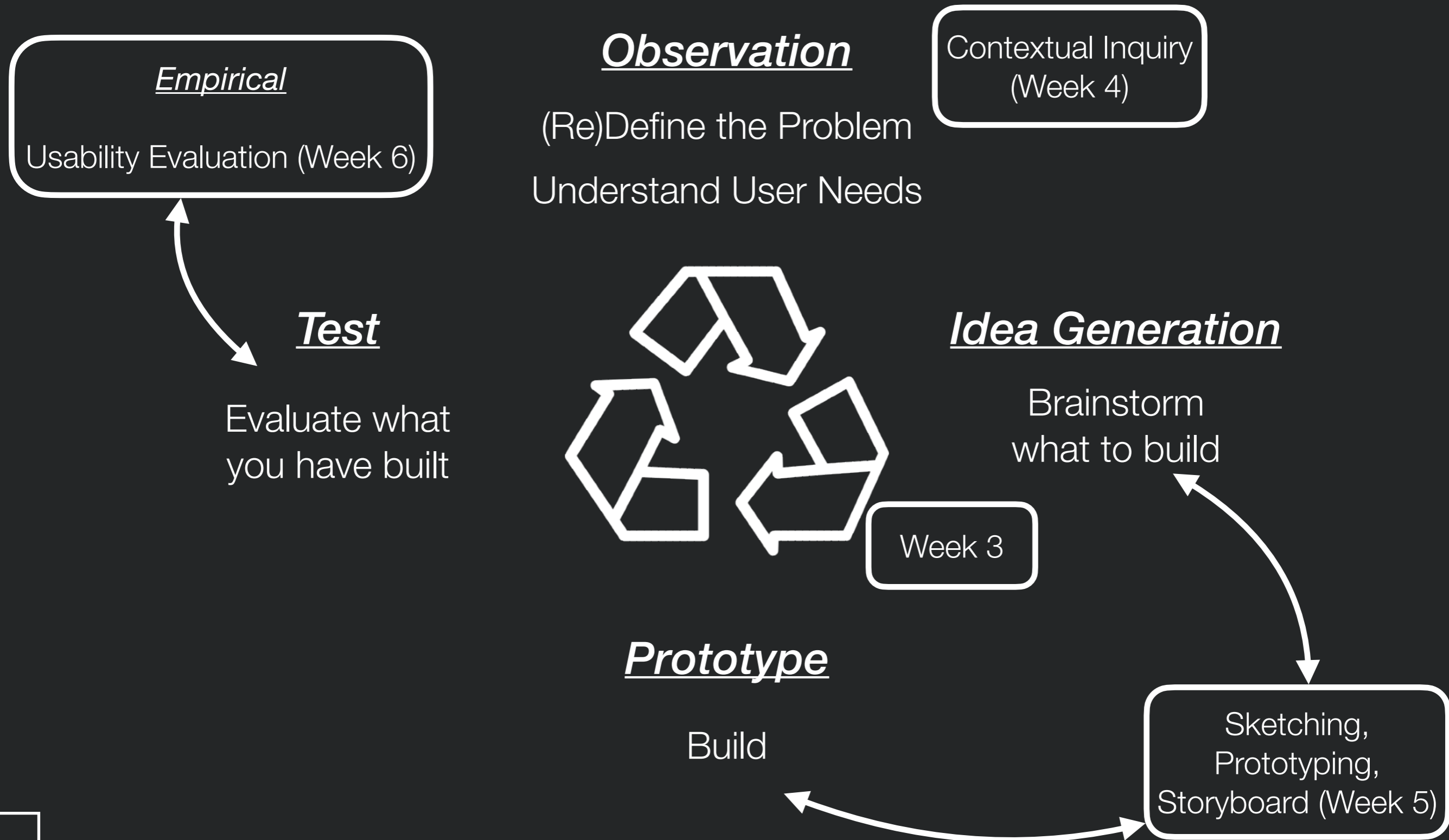
Iterative Model of User-Centered Design



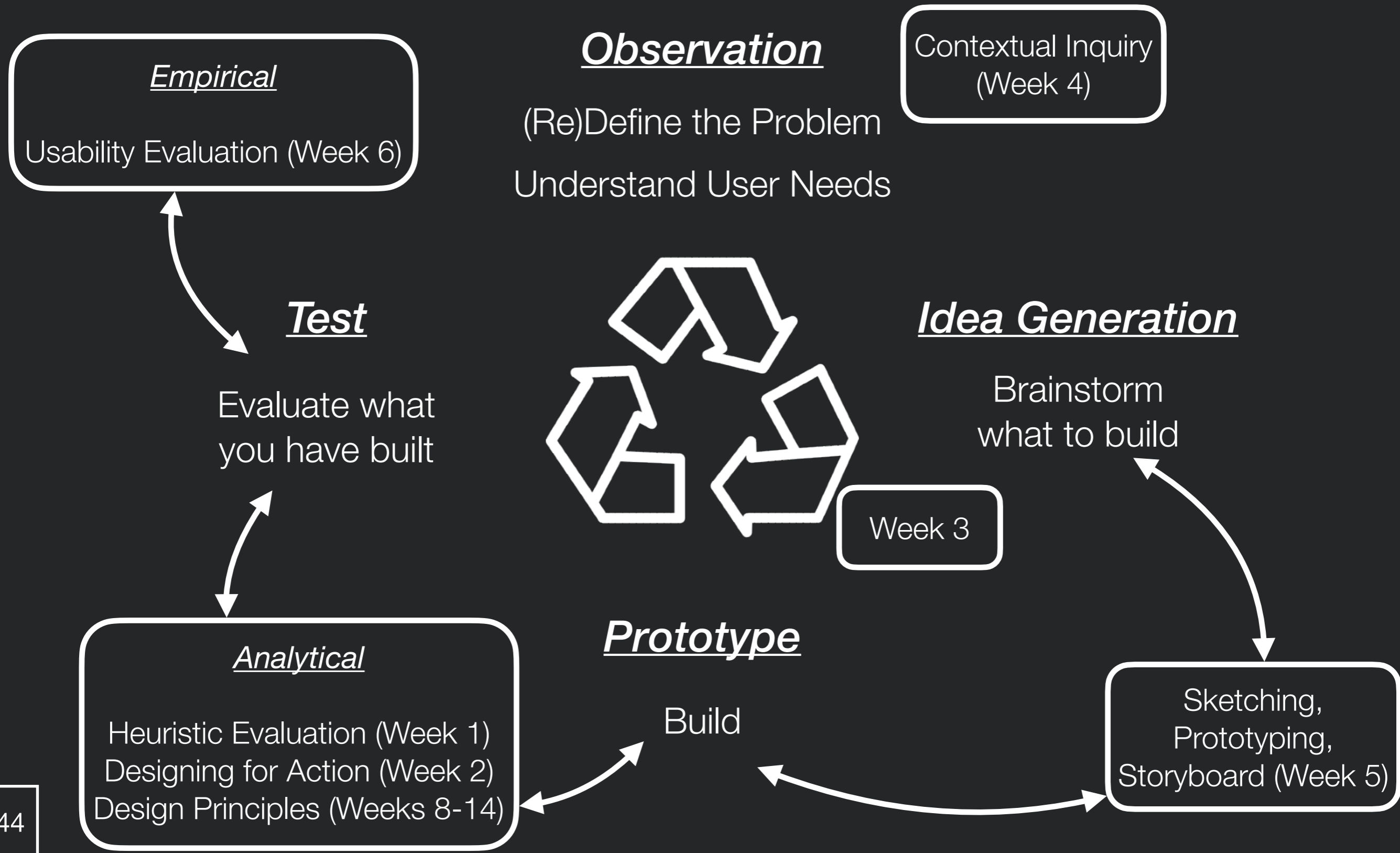
Iterative Model of User-Centered Design



Iterative Model of User-Centered Design



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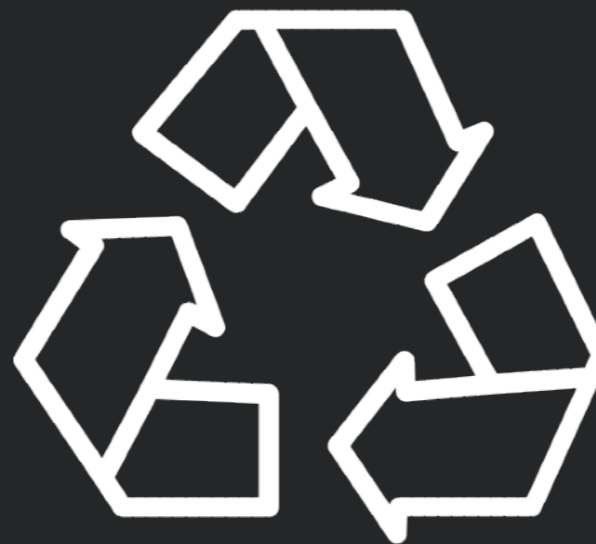
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Empirical

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



- 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 (I)

- 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

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)

7 Minute Break



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Tech Talks





Tech Talks

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Acknowledgements

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