Today's Agenda

- Review for Exam2

Announcement

Exam 2 is scheduled on Thursday, **Oct. 29, 1:15pm -2:30 pm** in class through Blackboard

Cover materials until Oct. 27

Most of materials from class lecture notes

90% materials are from class lecture notes after Exam 1.

Open-book and open-notes

Make-up exams are not allowed except excusable absences (http://bulletin.sc.edu/content.php?catoid=52&navoid=1280#Attendance_Policy) with appropriate documentation and advanced notice.

Review

What is HCI?

- **HCI** "concerned with the design, evaluation, and implementation of **interactive computing systems for human use".**"

What is Interaction Design?

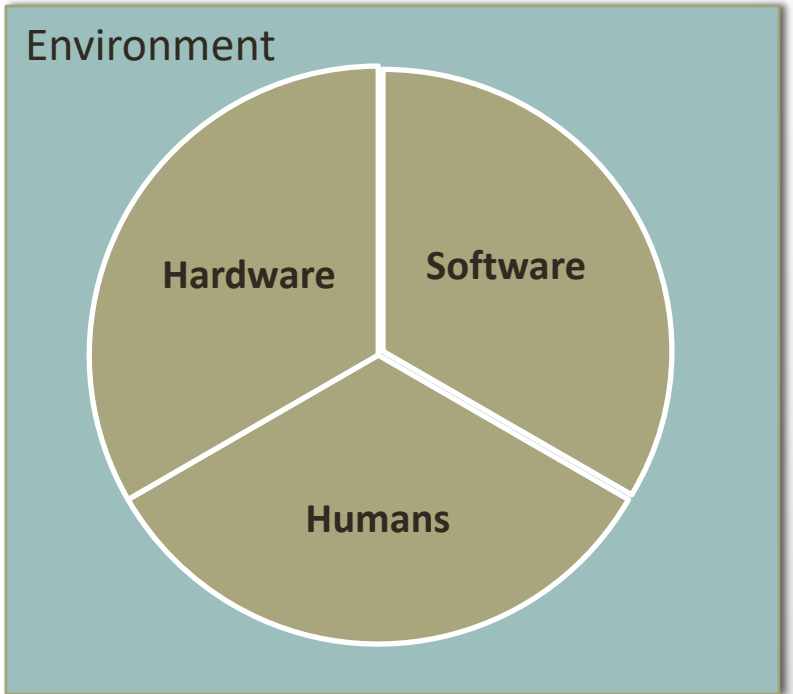
- **Interaction Design** focuses on designing **interactive products** to support the way **people communicate and interact** in their everyday and working lives

Which one is a broader concept?

HCI: Approach to Understanding A System

- A system is a collection of entities that interact to accomplish a goal/task which could not be obtained independently
- System optimization should include all elements:
  - Hardware
  - Software

  } Technology variables
  - Humans → person variables
  - Environment → environment variables



Goals of HCI – Usability Goals

Usability refers to ensuring that interactive products are:

1. Easy to use (effectiveness)
2. Efficient to use (efficiency)
3. Safe to use (safety)
4. Having good utility (utility)
5. Easy to learn (learnability)
6. Easy to remember how to use (memorability)

Fundamental to the quality of UX

Goals of HCI – UX Goals (Table 1.1 ID)

UX goals cover a range of emotions and felt experience

- Desirable aspects
  - Satisfying, enjoyable, exciting,
  - Helpful, engaging, …
- Undesirable aspects
  - Boring, frustrating, unpleasant, …

Most of them are subjective

Interactive Design Process

Four basic activities:

- Establish requirements
- Design alternatives
- Make prototype
- Evaluate

The design process is executed iteratively

Six Design Principles (ID Ch. 1)

1. Visibility – Can I see it?
2. Feedback – What is it doing now?
3. Affordance – How do I use it?
4. Mapping – What is the relationship between things?
5. Constraint – Why can't I do that?
6. Consistency – I think I have seen this before?

What is Evaluation

Evaluation, in general…

- Gather data about the usability of a design for a particular activity by a specified group of users

- **Goals**
  - Assess extent of system's functionality
  - Assess effect of interface on user
  - Identify specific problems with system

Forms of Evaluation

- **Formative (predictive) evaluation**
  - As project is in progress. All through design lifecycle. Early, continuous, and iterative.
  - “Evaluation of the design”
- **Summative evaluation**
  - After a system has been finished. Make judgments about final product.
  - “Evaluating the implementation”

Evaluation Methods

Pre- & Post-prototype

- **Surveys: questionnaires**
- **Surveys: interviews**
- **Surveys: focus groups**
- **Functional analysis**
- **Task analysis**

Post-prototype

- **Heuristic evaluation**
- **Personas**
- **Cognitive walkthrough**
- **Card Sorting**
- **Field/ ethnographic**
- **User testing**
- **Experiments**

You should know

- How to perform these evaluation methods
- When we should apply these methods
- What the pros and cons of these methods are

Questionnaires

Surveys capture information about the individual

- Demographic data
- Preference and attitude data
- Performance and use data



Questionnaires

Two fundamental types of questionnaires:

1. **Standardized**
   - E.g., IQ, ACT/SAT, LSAT, NASA-TLX
   - Usually have validity and reliability measures
   - Comparative data is available from other studies
   - Cannot collect product specific information
2. **Custom**
   - You create your own
   - Can collect specific information (e.g., specific problem or product)
   - Must establish validity and reliability measures
   - Cannot compare to other studies

Qualities of a "**Good**" Questionnaire

1. The responses to the questionnaire help meet the objectives of the research
2. It has high reliability & validity
3. It is easy for the users to take
   - Easy to understand
   - Maintains the users interest throughout the questionnaire
4. It is easy to administer
5. It is easy to analyze

Steps in Developing a Questionnaire, Interview, or Focus group

1. Decide what information is required.
2. Define the target respondents.
3. Choose the method of reaching your target respondents.
4. Decide on question content.
5. Develop the question wording.
6. Put questions into a meaningful order and format.
7. Check the length of the questionnaire/interview/focus group.
8. Pre-test the questions.
9. Develop the final survey form.

Step 5: Develop the Question Wording

- Four types of questions
  - Closed-ended,
  - Open-ended,
  - Open response-option,
  - Likert-scale questions
- Question considerations
  - Can the user answer the question?
  - Are there external events that bias the answers?
  - Is there ambiguity in the question?
  - Are the questions leading/loaded?
  - Are there implied alternatives in the question?
  - Are there 2 questions in the question?
  - Have you asked everything?

Functional Analysis

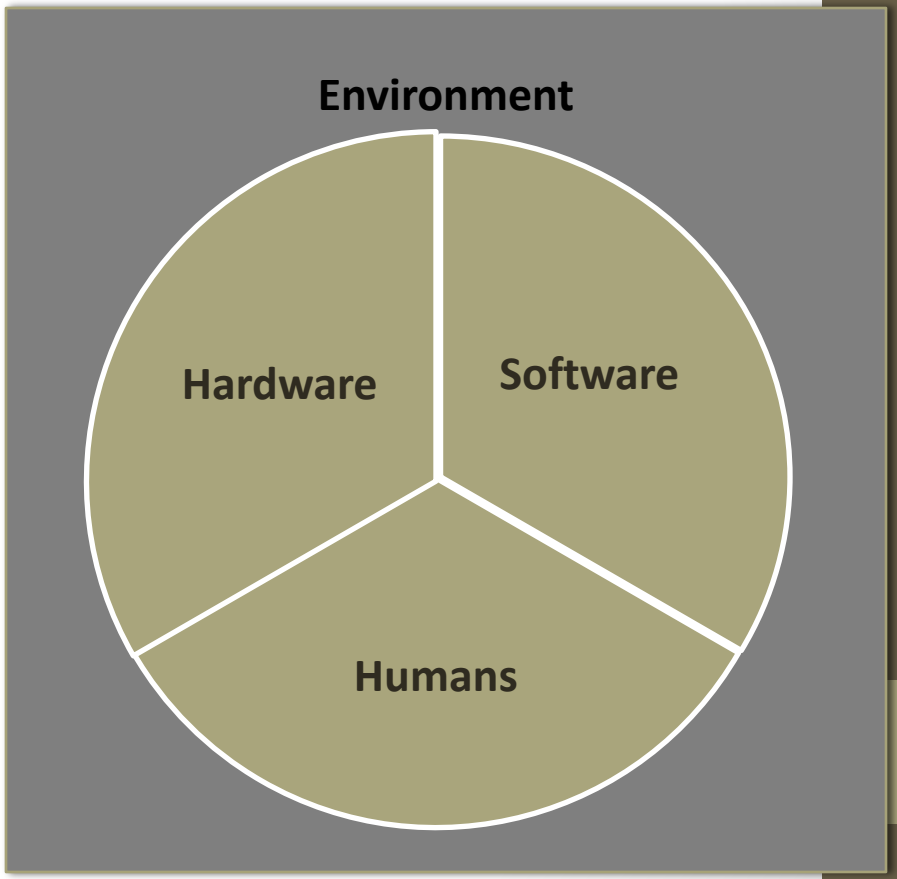
- What are functions?
  - the activities that must be performed to accomplish a goal
- What are the major functions to be performed by the system?
- Two methods
  - Functional flow diagrams
  - Decision-action diagrams

Function Allocation

- Purpose:

  Determine whether it be performed by human or machine

- What element can best perform each function?
  - Need to understand the capabilities of each of the elements
  - Use MABA-MABA lists



MABA – MABA List

- **Human are better at:**
  - Detecting small changes of visual, auditory, chemical energy
  - Perceiving patterns of light or sound
  - Improvising and using flexible procedures
  - Reasoning inductively
  - Exercising judgment
- **Machines are better at:**
  - Responding quickly to control signals
  - Applying great force smoothly and precisely
  - Erasing information completely
  - Reasoning deductively

Functional Flow Diagrams

- Illustrates the activities that must be performed to accomplish a goal
- Arranges these functions within the system in sequential manner

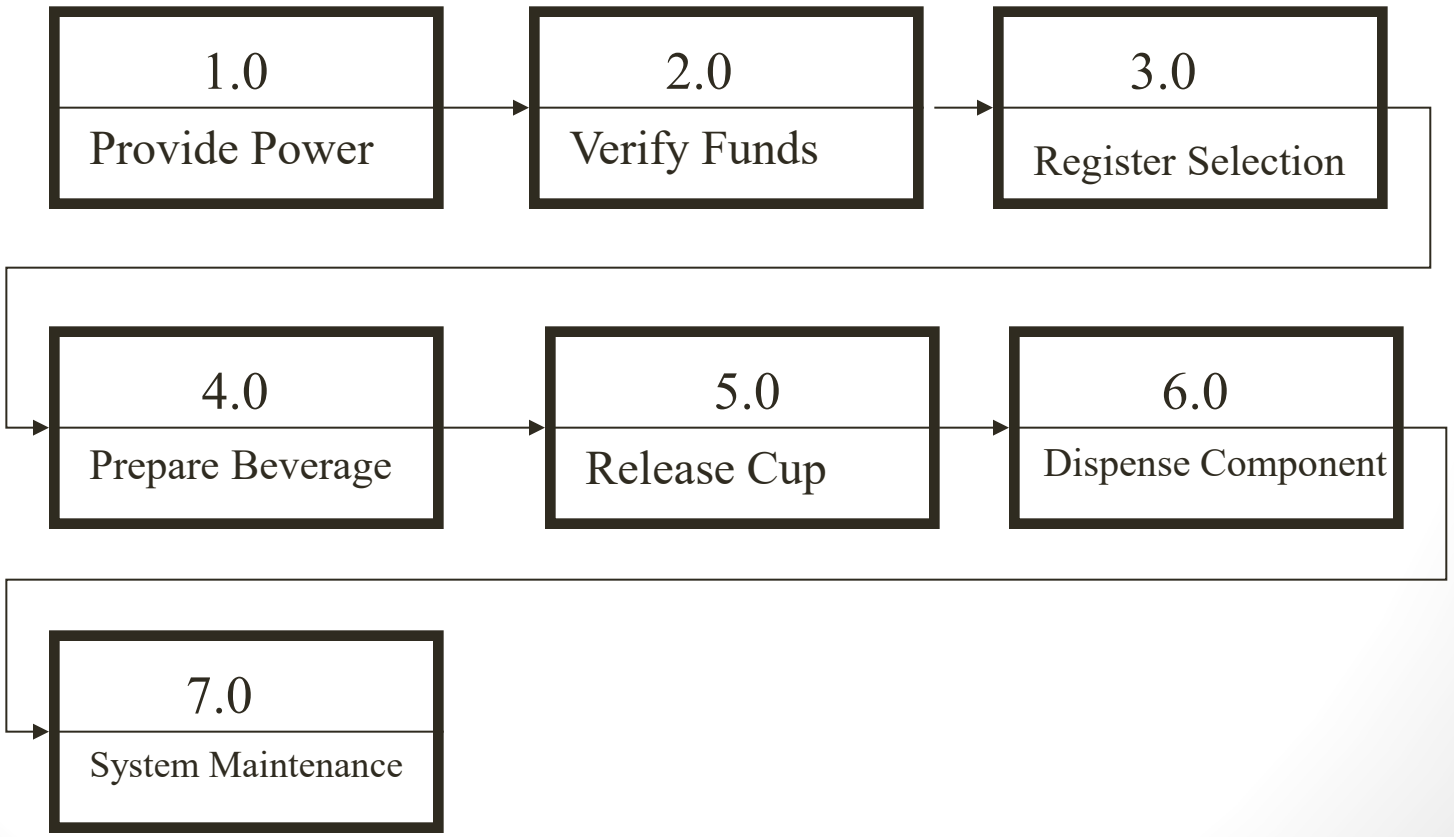
Rules:

1. Functions represented as rectangles
2. Functions represented as verb + noun
3. Numbering (1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0)
4. Go down to the level of detail that is necessary, and usually, each level is a separate page

Functional Flow Diagrams

Rules: 5. Top level

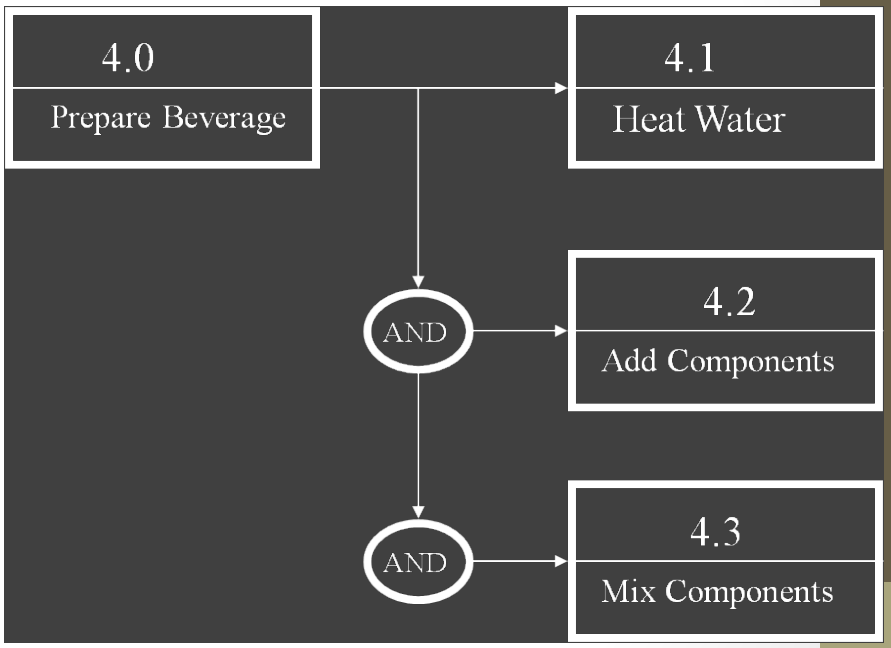
- Put top level functions horizontally
- Top level functions end in .0



Functional Flow Diagrams

Rules:

6. Note numbering (4.1, 4.2, etc)
7. Goes left to right, top to bottom
8. Use AND/OR
9. Guideline: don't want more than 3 things ANDed



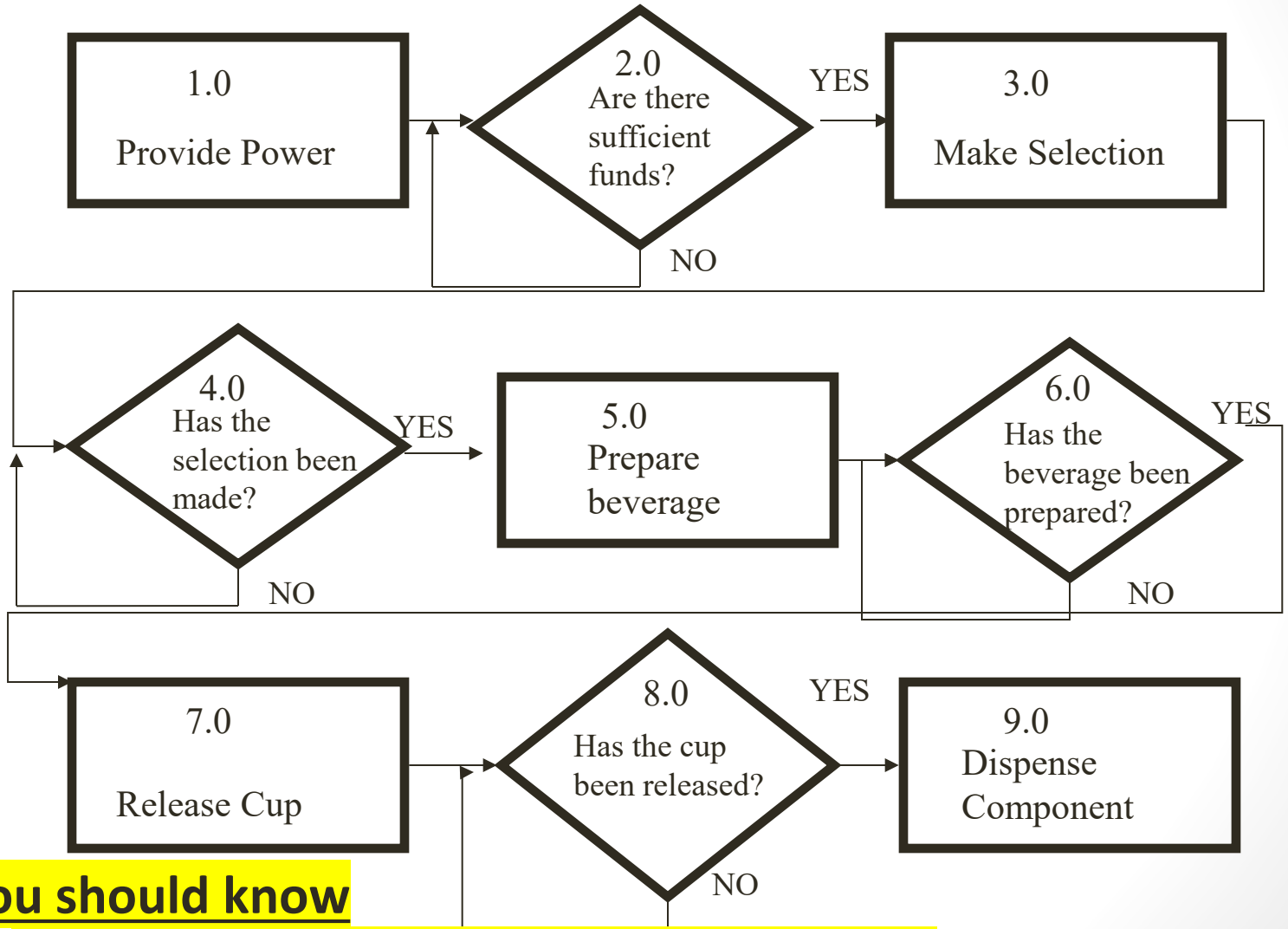
You should know

- **How to create a functional flow diagram**

Decision-Action Diagram

- Similar to functional flow diagram, BUT it includes decisions (cognitive component)
  - Functions are still rectangles
  - Decisions (Yes/No) are diamonds
- Decisions require displays/controls if that decision is allocated to humans

Top Level



You should know

- **How to create a decision-action diagram**

Task Analysis

- **Definition**: "Systematically describing human interaction with a system to understand how to match the demands of the system to human capabilities" (Wickens, Lee, Liu, & Becker, 2004)

- What will the human do?
  - Identify the full range of tasks that the **user** performs with the product or system
- Uncovers
  - Criticality - Potential errors and how those affect performance
  - Duration - Time allowed or time required
  - Difficulty - Conditions that are incompatible with human performance capabilities

When do we conduct a task analysis?

At early stage before performing design work

Conducting a Task Analysis

- Step 1: Decide the purpose of the analysis
- Step 2: Define the top level task goal

For each new goal, repeat

- Step 3: Describe the task actions
- Step 4: Decompose the goal
- Step 5: Stop

Hierarchical Task Analysis (HTA)

0: Cook orders

You should know how to perform an HTA

Plan: 1 > 2 > 3 > 5 > 6 > 4

- 1: setup equipment
- 2: take order
- 3: prepare orders
  - 3.1: Obtain ingredients
  - 3.2: Prepare ingredients
    - 3.2.1: Measure ingredients
    - 3.2.2: Mix
  - 3.3: Cook ingredients
  - 3.4: Plate ingredients
- 4: cleanup
- 5: track order
- 6: hand-off order



RULES

1. **Top to bottom hierarchically organized**
2. **Top level goal and sub-goals are numbered (2, 2.1, 2.2, etc)**
3. **Plan that specifies order**

Cognitive Walkthrough

- The HCI evaluators (more than one is best) step though using system
- Assess usability through simulation of way users explore with interactive system
- Try to predict what user will do
- Great for the early stages of development



What do You Need for a Cognitive Walkthrough?

1. An indication of who the users are (**personas**)

2. Fairly detailed prototype of the system.

3. A complete, written list of the actions needed to complete tasks with the given prototype

Cognitive Walkthrough – What do You Ask?

1. **Does the user understand that this subtask is needed to reach the user's goal?**
   - Will users try to produce whatever effect the given action has?
2. **Will the user notice that the correct action is available?**
   - E.g. is the button visible?
3. **Once found, will they know it is the right action for the desired effect?**
   - E.g. the right button is visible but the user does not understand the text and will therefore not click on it.
4. **Does the user get feedback?**
   - Will the user know that they have done the right thing after performing the action?

Why (or Why Not) Use Cognitive Walkthroughs

- **Strengths?**
  - No need for untrained users
  - Fast results

- **Weaknesses?**
  - Need a group of experts – practice makes perfect
  - Need to make assumptions about what user will do

What is Card Sorting?

- Card sorting is a user-centered design method for increasing a system's "findability".
- Card sorting is a link between
  - how people think/organize → Website structure
- The process involves sorting a series of cards, each labeled with a piece of content or functionality, into groups that make sense to the users.

Why is It Useful?

- **Why use it?**
  - Quick
  - Inexpensive
  - Reliable
- **What it gives you**
  - an overall structure for your information, as well as suggestions for navigation, menus, and possible taxonomies
- **You learn..**
  - How different people think about, organize, and expect to access your content
  - A bit about the language/terminology used by a particular group

Open Sort vs. Closed Sort

Open Sort

- Participants are asked to organize topics from content within your website into groups **that make sense to them**
- Then **they name each group** they created in a way that they feel accurately describes the content
- Use an open card sort to learn how users group content and the **terms or labels they give each category**

Closed Sort

- Participants are asked to sort topics from content within your website into **pre-defined categories**
- A closed card sort works best when you are working a already fixed navigation/menu, and you want to **learn how users sort content items into each category**

Card Sorting Tips

1. Don’t expect the same results – discrepancies are good
2. Look for more info in the conversations than in the results (can ask participants to “think aloud”)
3. Be clear on your intentions – are validating (closed) or discovering (open)
4. Don’t equate your final card sort as your site structure --- look at the data as “input” because translation is still required
5. Run with actual users, but you can also use internally within your design team!
6. Can be conducted individually and in groups of people

Heuristic Evaluation

- Several “evaluators” independently critique a system using shared set of heuristics (principles or rules of thumb)
- Perform two or more passes through system
  - Inspect
  - Evaluate against heuristics
  - Find “problems”
    - Subjective & liberal (if you think it is a problem, then it is)

Heuristic Evaluation: The Process

1. Gather inputs
2. Evaluate system
3. Severity rating
4. Debriefing



Jakob Nielsen's 10 Heuristics

1. **Visibility of system status**
   - keep users informed via feedback
2. **Match between system and the real world**
   - Speaking users' language
3. **User control and freedom:**
   - Support undo and redo
4. **Consistency and standards**:
   - Follow conventions
5. **Error prevention**:

Jakob Nielsen's 10 Heuristics

6. Recognition rather than recall:

- Minimize the need of memorization

7. Flexibility and efficiency of use:

- Accelerators for experienced users

8. Aesthetic and minimalist design:

- Concise and relevant information

9. Help users recognize, diagnose, and recover from errors:

- Helpful error messages

10. Help and documentation:

Heuristic Evaluation: Benefits and Weaknesses

- **Benefits**
  - Highly cost effective and very fast to employ
  - Easy to learn and use
- **Weaknesses**
  - Need to employ more than one evaluator to get robust results.
  - Want at least 3 evaluators – preferably 5

Field / Naturalistic Observation

Planning

- What, where, and when to observe / record?

  Video recordings or screen capture (if ethical)
- Taxonomy of behaviors
- Performance measures, such as
  - # of clicks
  - Time to complete task





Assembly line workers

Hawthorne Effect (observer effect)- changes in behavior that occur when people know that others are observing them

Pros / Cons

Pros:

+ Large amounts of rich data
+ Capture events not duplicated in lab
+ In depth understanding

Cons:

– People act differently
– Observer expectancies

User Testing

- Often less “experimental” than normal lab studies
- Used in industry
- **Procedure**
  - Select a set of tasks (10-30 common tasks)
  - Give the user the information required to do the task
  - Watch
  - Record behaviors of interest
- As your prototype becomes more refined, usability testing becomes more quantitative.

User Testing Metrics

The most common metrics

- Errors
- Time to perform tasks
- Time to perform subtasks
- User subjective reactions (e.g., satisfaction, preferences)

General categories of metrics

- Efficiency
- Effectiveness
- User satisfaction

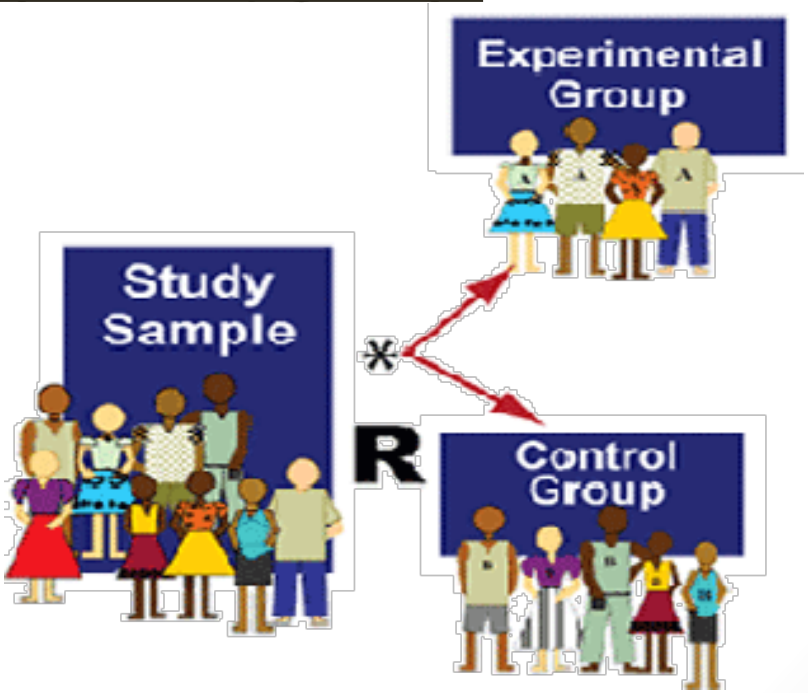
Experimental Designs

- Allow the researchers to test specific hypotheses
- Examine relationships between an **independent variable** and a **dependent variable**
- Two types of variables in experimental designs
  - The **independent variable (IV)** is *manipulated* by the experimenter
  - The **dependent variable (DV)** is *measured* by the experimenter to assess the impact of the independent variable

Experimental and Control Groups

Participants are assigned to one of two groups

- **Experimental (or Treatment) group** receives some sort of intervention or manipulation
- **Control (or Comparison) group** receives no intervention



http://aidsetc.org/target/fxbclinicalresearch/Module1/images/Exper_Research.gif

Experimental Designs

- **Between-Subjects Design**
  - Each participant is assigned to only one of the possible conditions or groups
- **Within-Subjects Design**
  - Each participant experiences every condition

Establishing Causality

- A **confound** is a variable that affects the dependent variable and may also vary between conditions or groups
  - Provides an alternative explanation for relationship
  - To establish cause, a researcher must control for all confound variables

Analyzing Descriptive Data

- ***Descriptive* statistics**
  - Summary of data
  - “describes” the data
- Measures of Central Tendency
  - **Mode:** Most frequently occurring score
  - **Median:** Halfway point in a set of data
  - **Mean:** Arithmetic average of the scores
- Measures of Variability
  - **Range:** Difference between highest and lowest score
  - **Standard Deviation:** Average difference between each score and the mean of the data set

Ethical Guidelines for HCI Researchers

All researchers must:

1. Obtain informed consent from participants
2. Minimize any discomfort and risk to participant
3. Ensure participants will not suffer any long-term negative consequences
4. Treat any information from participant as confidential
5. Debrief the participant afterward

– The Role of the IRB

Good luck on your exam!

Quiz #5

- Starts from 2:15pm,
- Due at 2:30pm
- Open book and open notes