# Today's Agenda

- Evaluation methods
  - Surveys
  - Functional Analysis & Allocation
    - Functional flow diagrams
    - Decision-action diagrams
  - Task Analysis

# Announcement: Quiz #4

Quiz # 4

- Tuesday, Oct. 24 in class
- Via Blackboard – Bring your laptop to class!
- Open book and open notes

# Recall: 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.

# 5: Develop the Question Wording: Question Considerations

- **Are the questions leading?**
  - How wonderful is this new interface?
  - What did you dislike about the interface?
    - What if they didn't dislike anything about it?
  - Sometimes best to ask that directly (yes/no), then ask the 'what' question

# 5: Develop the Question Wording: Question Considerations

- **Are the questions loaded?**
  - On a scale of 1 to 5, how ugly are you?
  - Do you believe that big bureaucratic insurance companies spend your health care dollars wisely?

"Loaded" is often subtle and elusive

# 5: Develop the Question Wording: Question Considerations

- **Are there implied alternatives in the question?**
  - 1) Will you upgrade to Windows 11?

☐$_1$ Yes ☐$_2$ No

Explicit alternative gives user a context to answer

- 1) When Windows 11 comes out will you…
  - A) Immediately upgrade
  - B) Upgrade when you change computers
  - C) Wait for the second version and then upgrade
  - D) Stay with current operating system as long as possible

# 5: Develop the Question Wording: Question Considerations

- **Are there 2 questions in the question?**
  - Are you concerned by spyware and Trojans on your computer?
  - Are you pleased with the speed and reliability of your new computer?

You don't know which question users are answering!

# 5: Develop the Question Wording: Question Considerations

- **Have you asked everything?**
  - Oftentimes you only get 1 opportunity to question the user
    - No follow-ups
    - No clarifications
  - Might miss an important question

# 6: Determine a Meaningful Order

- Don’t ask embarrassing or hard questions first
- Questions should lead to one another
  - Aids users recall
- Try not to mix too many different scales
  - Agreement –disagreement
  - Like –dislike
  - Satisfactory-unsatisfactory
- Provide enough space to answer open ended questions
  - Users will judge the length of the answer by the form of the response area

# 7: Check the Length of the Questionnaire

**Make sure that the questionnaire is not too long (or too short!)**

- User boredom – User fatigue
- Cost/benefit ratio can be exceeded
  - Reduces response rate
- How do you know if it is too long or short?

# 8:Pre-test the Questionnaire

- Makes sure that all the considerations have been met
  - Always consider your research questions
- Helps ensure that novices and experts can use the survey(s)
  - Comprehension

# 9: Develop the Final Survey Form

- Gets survey ready for actual use
- If mailing, expect 30% or less response rate (make lots of copies)
- Contrast, figure/background, etc.

# In Closing

- Much of what we discussed today related to questionnaire design
- These tips also apply to:
  - Interviews
  - Focus groups

# Some Common HCI Standard Questionnaires

- System Usability Scale (SUS)
  - https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html
- Technology Acceptance Model (TAM)
- Satisfaction Surveys (e.g., IBM has one)
- And many more… all available online

Remember – do NOT modify standard questionnaires. But you can create your own custom questionnaires if you can't find a standard one that measures what you need to measure.

# Regarding Your Team Project

- You can survey:
  - Classmates in this class ⇦ Preferred
  - Family members
  - Friends
  - (**please no strangers – IRB**)

# Evaluation Methods

Pre- & Post-prototype

- ✓Surveys: questionnaires
- ✓Surveys:  interviews
- ✓Surveys: focus groups
- **Functional analysis & allocation**
- **Task analysis**

Post-prototype

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

# FUNCTIONAL ANALYSIS & ALLOCATION

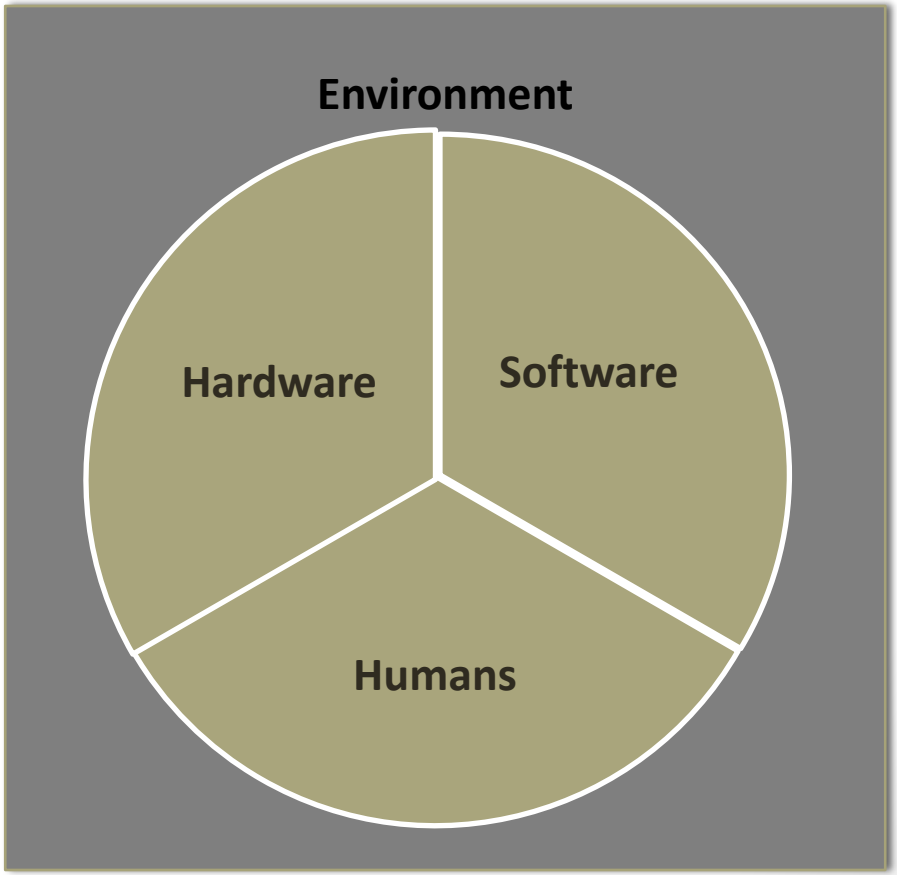
# Functional Analysis

- What are functions?
  - the activities that must be performed to accomplish a goal
- What are the major functions to be performed by the system?
  - whether it be performed by the person or machine
- Who will perform a function?

– Function Allocation

# Purpose of Function Allocation

- *What element can best perform each function?*
- Determine what the hardware, software and human should do



# Function Allocation

- Need to understand the capabilities of each of the elements

  For examples,

  - Human can’t lift easily 500 pounds
  - Software can’t easily determine how you feel
  - Hardware can't easily compute the trajectory of a missile
- Use MABA-MABA lists
  - Human-are-better-at, machines-are-better-at

# MABA - MABA

- Human are better at:
  - Detecting small amounts of visual, auditory, chemical energy
  - Perceiving patterns of light or sound
  - Improvising and using flexible procedures
  - Reasoning inductively
  - Exercising judgment

# MABA - MABA

- Machines are better at:
  - Responding quickly to control signals
  - Applying great force smoothly and precisely
  - Erasing information completely
  - Reasoning deductively
- What else do you think?

# Changing Times…

- Function allocation used to be thought of as fixed
- Allocation can change on the fly! – Dynamic Allocation
  - Autopilot
  - Automobile auto-brake
  - Manual safety overrides

# Dynamic Allocation

- If dynamic allocation is used, be very cautious!
  - Human must be able, ready and willing to take over functions
- Machine must interact with human in an intelligent way when it has control
  - Human must stay “in-the-loop”

# Function Analysis & Allocation

- Functional flow diagrams
- Decision-action diagrams

# FUNCTIONAL FLOW DIAGRAMS

# Example

- Functions that must be allocated
  - Set time
  - Set date
  - Set alarm
  - Set music
  - Adjust display brightness
  - Adjust radio volume
  - Adjust alarm volume

# Functional Flow Diagrams

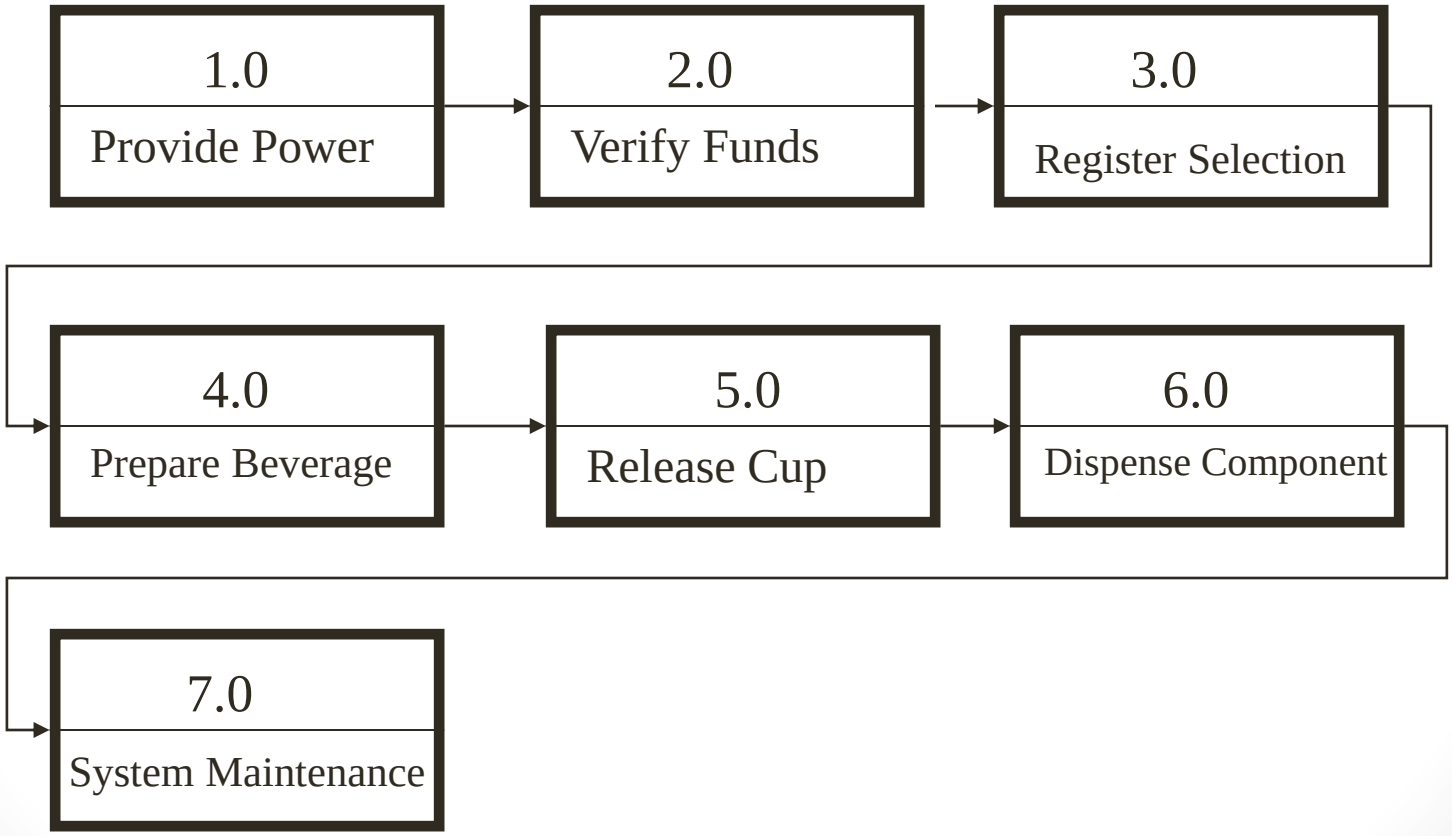
- Helps with function allocation because functions are not specific to human or technology
- Illustrates the activities that must be performed to accomplish a goal
  - Activities/functions can be organized in a hierarchy
- Arranges these functions within the system in sequential manner

# Let's Look at An Example…

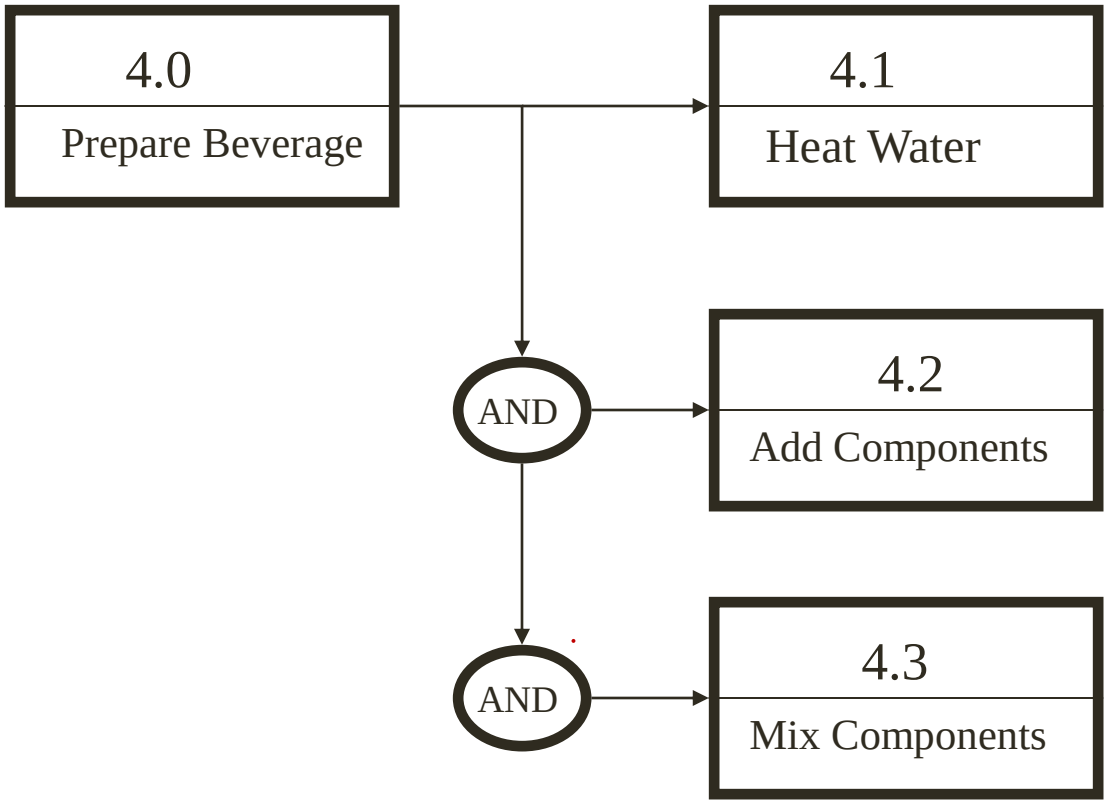
- What functions are involved for making a hot beverage by a vending machine?

- Let's think of some major functions…
  - Provide power
  - Verify funds
  - Register selection
  - Prepare beverage
  - Release cup
  - Dispense component
  - System maintenance

# Top Level


1.0
Provide Power
2.0
Verify Funds
3.0
Register Selection
4.0
Prepare Beverage
5.0
Release Cup
6.0
Dispense Component
7.0
System Maintenance

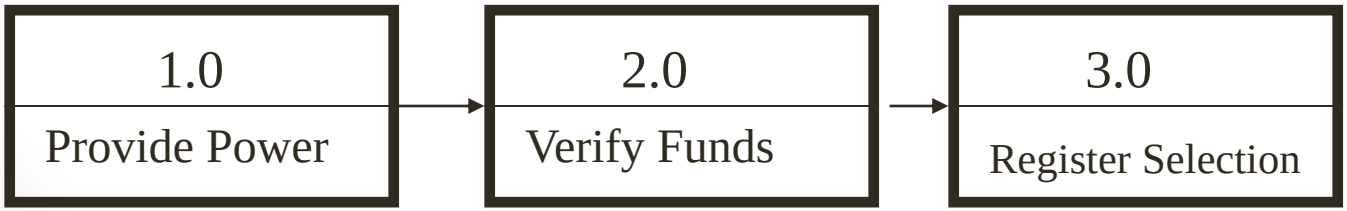
# Function 4.0




You could then expand on what is meant by "prepare beverage"

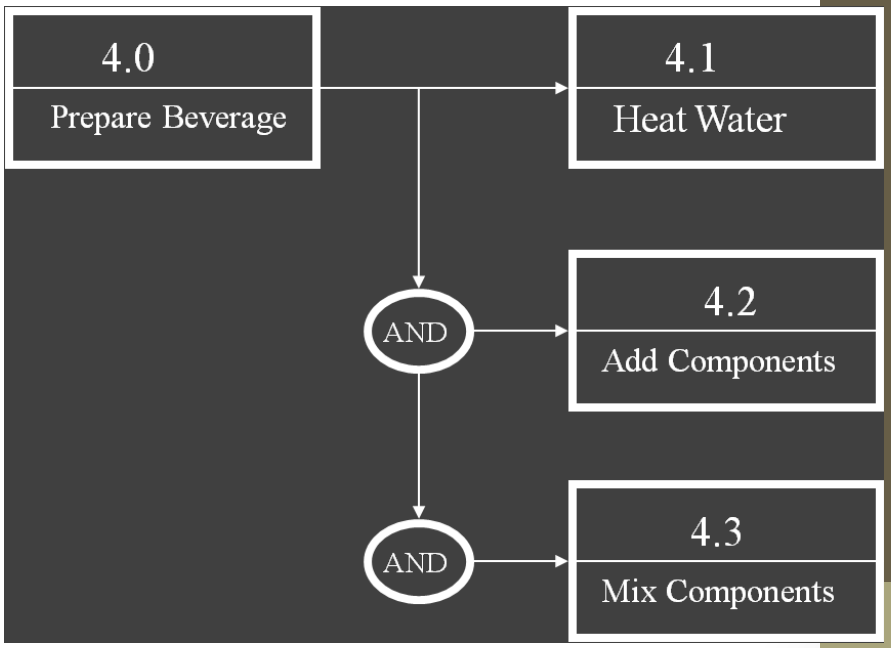
# Functional Flow Diagrams

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



# Functional Flow Diagrams

6. Lower level:
   - Note numbering (4.1, 4.2, etc.)
   - Goes left to right, top to bottom
   - Use AND/OR
   - Guideline: don't want more than 2 AND



# DECISION-ACTION DIAGRAMS

# Decision-Action Diagram

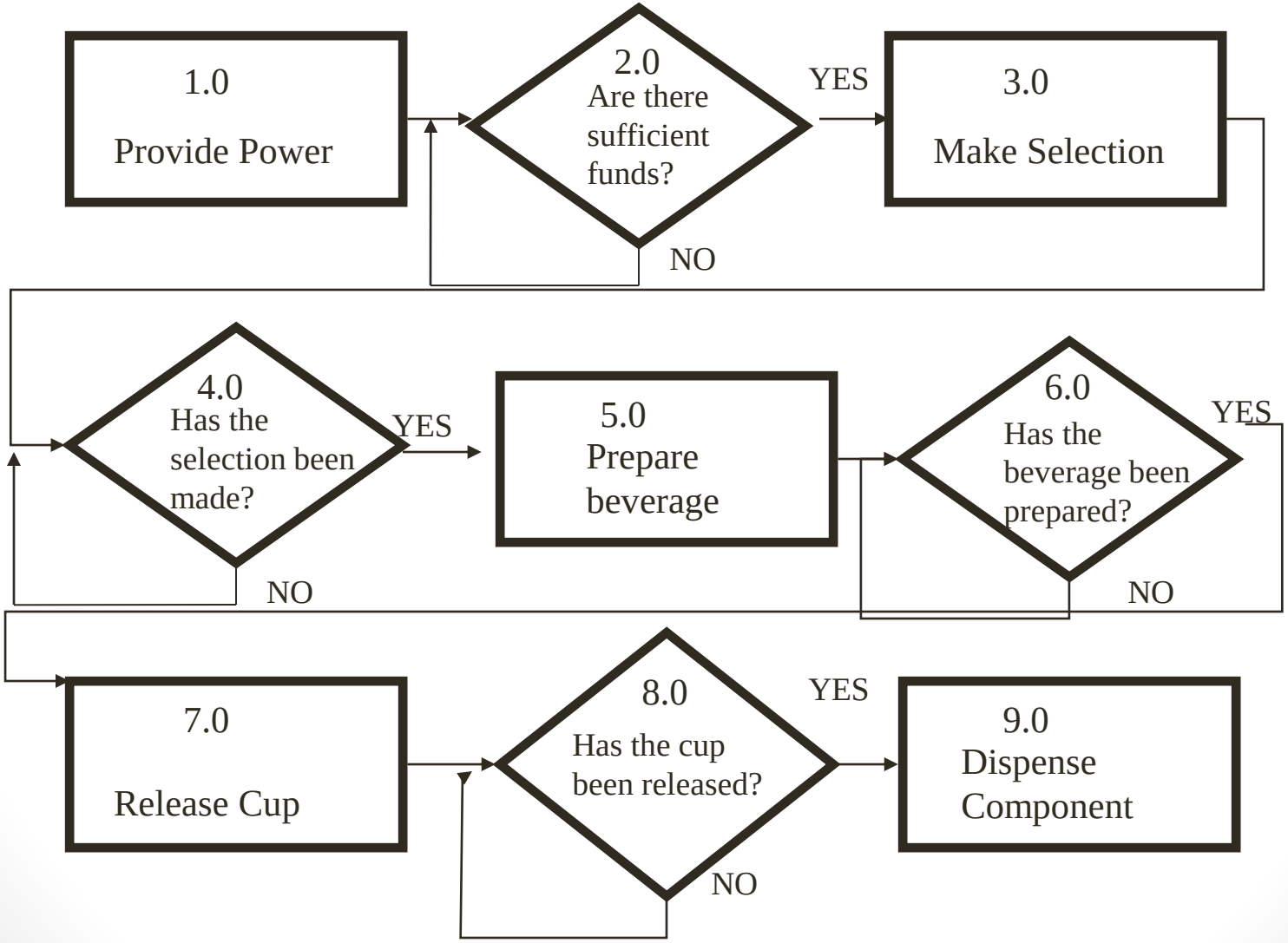
- Similar to functional flow diagram, **BUT it includes *decisions*** (cognitive component)
  - Functions are *rectangles*
  - **Decisions (Yes/No) are *diamonds***

- Decisions require displays/controls (if that decision is allocated to humans)

# Let's Look at an Example…

- What decisions could be made for using a hot beverage vending machine?
- Let's consider decisions made by…
  - **Human**
    - Do I have enough money to afford a drink?
    - What beverage do I want to buy?
  - **Machine**
    - Are there sufficient funds?
    - Has the selection been made?
    - Has the beverage been prepared?
    - Is the component dispensed?
    - Has the cup been released?

# Top Level


1.0
Provide Power
2.0
Are there sufficient funds?
YES
NO
3.0
Make Selection
4.0
Has the selection been made?
YES
NO
5.0
Prepare beverage
6.0
Has the beverage been prepared?
YES
NO
7.0
Release Cup
8.0
Has the cup been released?
YES
NO
9.0
Dispense Component

# TASK ANALYSIS

# Tasks Include…

**Physical tasks**

**Cognitive tasks**

# 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)
- “Task analysis is the process of learning about ordinary users by observing them in action to understand in detail how they perform their tasks and achieve their intended goals.” – usability.gov

# Task Analysis

- 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
  - Developing a new system
  - Modifying an existing system
  - Troubleshooting an existing system
  - Developing operator training

# Conducting a Task Analysis

- Step 2: Define the top level task goal
  - Goals, *not behaviors*
    - Goal: design an interactive interface for a visitor kiosk
    - *Not* implement design process

# Conducting a Task Analysis

- Step 3: Describe the task actions
- Obtain these from
  - Observation
  - Expert reports
  - Documents, training materials

# Conducting a Task Analysis

- Step 4: Decompose the goal
  - Identify plans
    - Tasks that are arranged in the required order
  - Fixed sequence: do this, then that
  - Decision: if this, then that
- Continue for each new goal

# Conducting a Task Analysis

- Step 5: Stop
- How do you know when to stop?
  - Simplest stop rule: stop when further decomposition is of no further use

# Example: Replace Printer Cartridge

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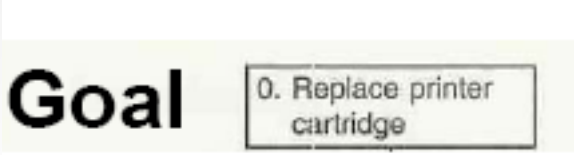

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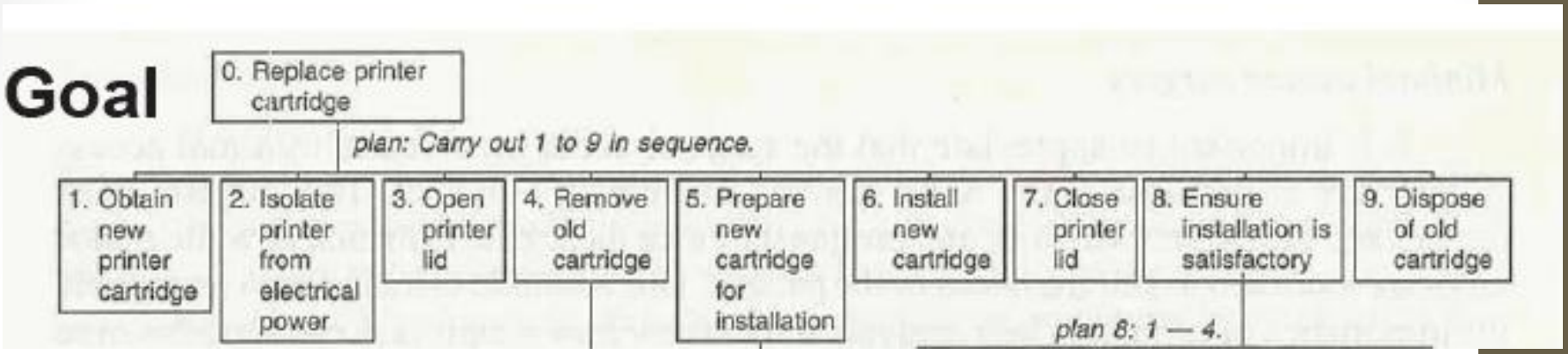

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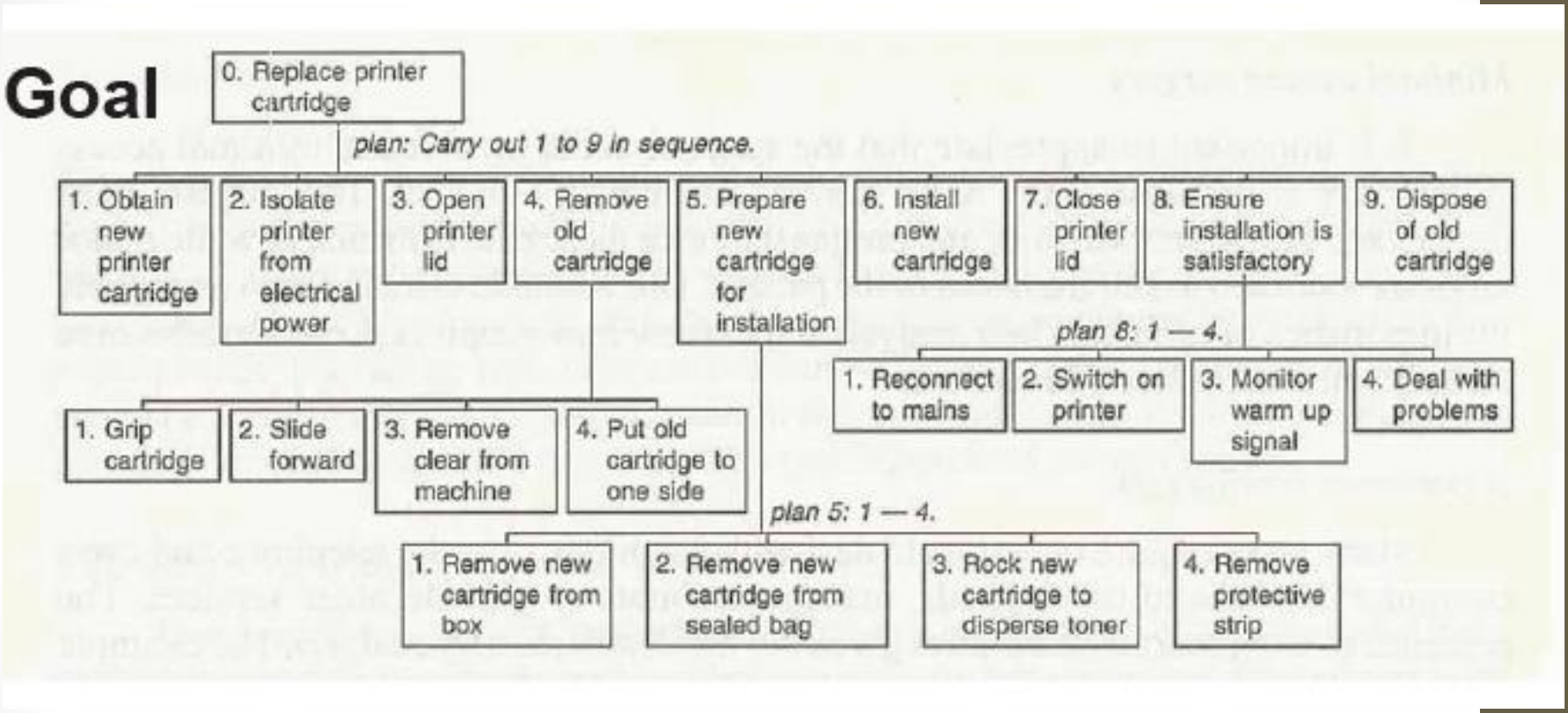
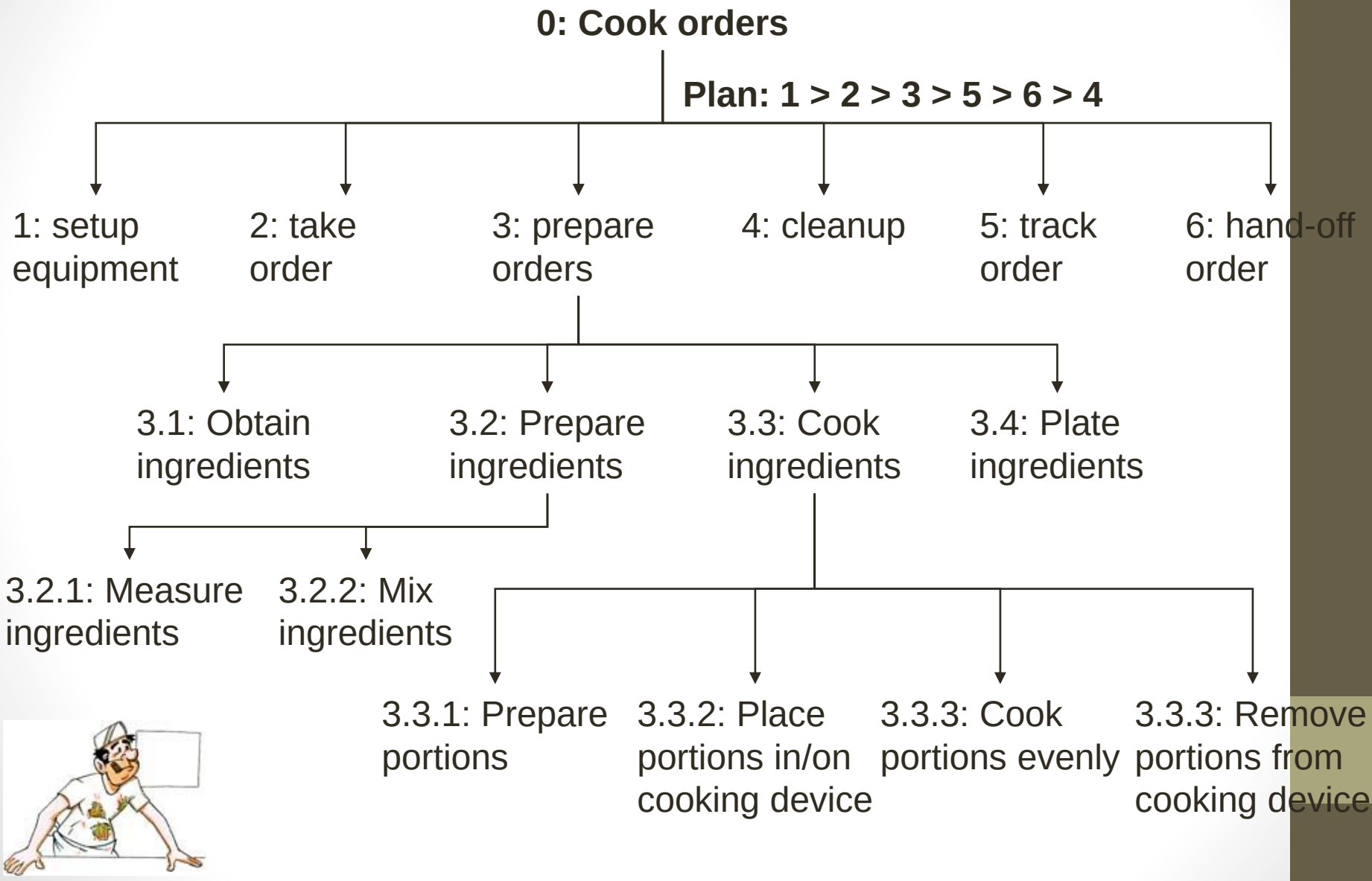
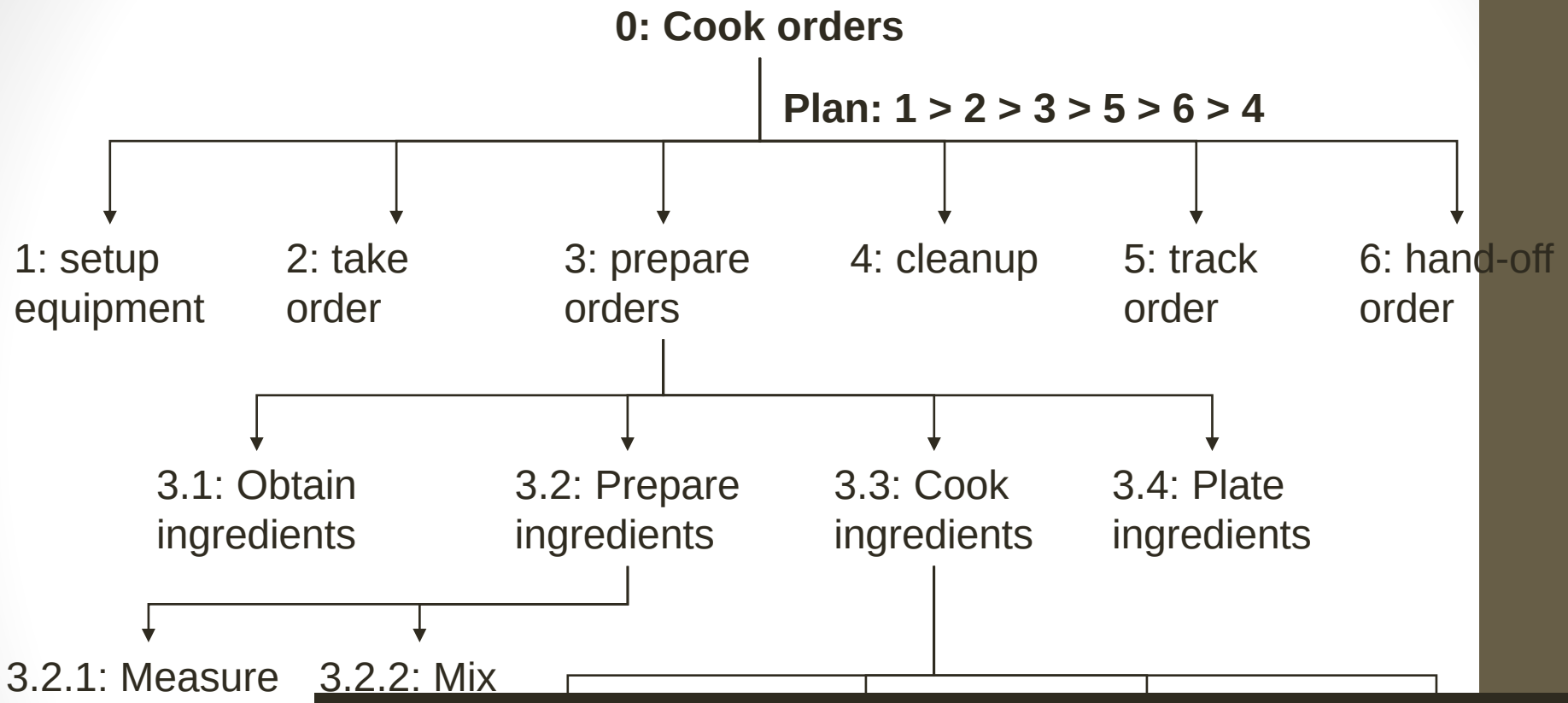


# Hierarchical Task Analysis (HTA)



# Hierarchical Task Analysis (HTA)




**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**

# In Summary

**Functional analysis** and **task analysis** are organized way to think about functions

I encourage you to conduct

- A functional flow diagram,
- A decision-action diagram, and/or
- A hierarchical task analysis

as you prototype.

# Reading Assignment

- ID Chapters 6, 7 and 10
- UYU Chapters 7, 9, 10