# Human-Computer Interaction

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# Tasks Analysis

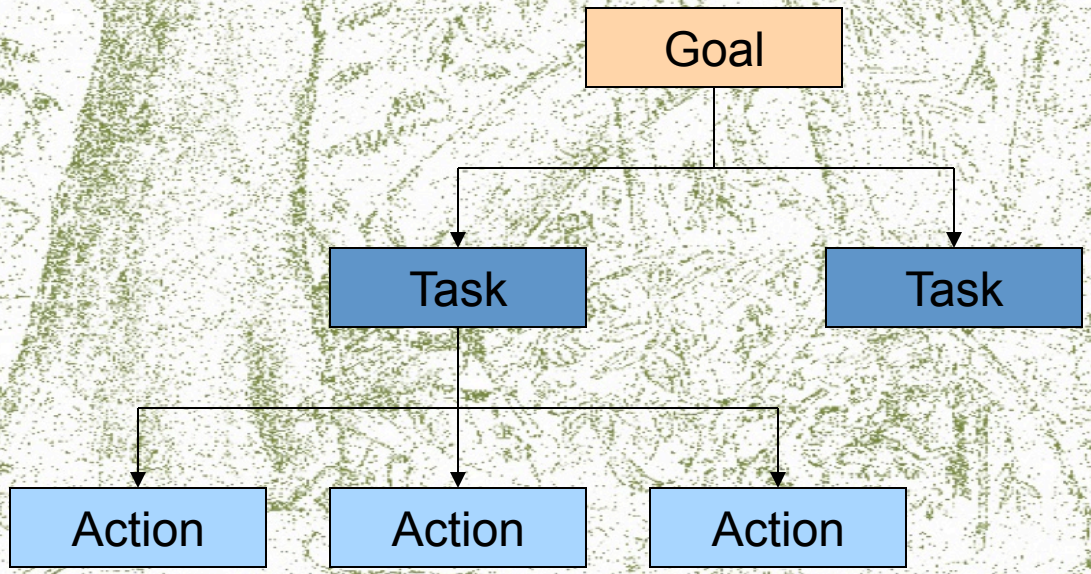
# Describing Users' Work

- After identifying the users of the system, the next step in the requirements-gathering process is to discover what the system will be used for?
- Task analysis is the activity used to gain an understanding of what a computer system must do and what functionality the system must provide to support users in their goals and tasks.

# Goals, Tasks and Actions

- A goal is an end result to be achieved.
  - Must be described at a high level of abstraction, indicating what is to be achieved.
  - Eg. Enjoy a meal, see a movie, etc.
- A goal can be accomplished by performing a particular set of tasks.
- A task is a structured set of related activities that are undertaken in some sequence.
  - What a person has to do in order to accomplish a goal.
  - A person will need to physically interact with a device by performing actions.
- An action is defined as an individual operation or step that needs to be undertaken as part of the task.

# Relationship between a goal, a task and an action (Stone et al., 2005)



# Example

- **Goal**
  - Communicating with a friend by writing a letter by hand.
- **Task**
  - Obtaining some writing paper and a pen or pencil.
  - Finding a flat surface upon which to write and a place to sit.
  - Using the pen or pencil to write words on the paper to convey a particular meaning.
- **Action**
  - Writing the individual letters of the alphabet to form the appropriate words.

# Characteristics of Tasks

- The extent to which tasks vary from one occasion to another.
- Whether tasks will be carried out regularly, infrequently or only once.
- The knowledge and kinds of skill required to perform tasks.
- How much the work is affected by changes in the environment.
- Whether time is critical for the work.
- Whether there are safety hazards.
- Whether the user will do the work alone or with others.
- Whether the user will normally be switching between several tasks

# ATM Example (Stone, D. et al., 2005)

| | |
|---|---|
| Does the task vary from one occasion to the next? | No. |
| How frequently is the task carried out? | May be daily, weekly or less frequently. |
| What kinds of skills or knowledge are needed? | Must remember PIN to access machine. |
| Is the task affected by the environment? | Weather conditions could affect use of machine<br>Users maybe using gloves in winter, it may be raining, bright sunlight may make reading the display difficult. |
| Is the task time critical? | Users may be in a hurry when using the ATM, since ATMs are often used for their speed and convenience. |
| Are there any safety or security hazards? | There are no safety hazards in the use of the ATM itself. However, users' personal safety in relation to onlookers and the safeguarding of their PINs and the cash withdrawn are considerations. |
| Will the work be done alone or with others? | The work will be done alone. |
| Will the users normally be switching between several tasks? | Many users will check their balance before withdrawing money. The users will not switch between tasks when withdrawing money, but external factors (like children) may divert their attention. |

# Task Sequences

- There are many ways that tasks may be undertaken.
- You will need to know about them to ensure that the UI supports the different ways of undertaking the same task.
- The UI design must be flexible enough to accommodate these different ways of working.
- Should not force users to work in one set way unless it is compromising a safety issue.

# Task Sequence Example

| How Person A sends a letter | How Person B sends a letter |
|---|---|
| Write the letter. | Get an envelope. |
| Get an envelope. | Address the envelope. |
| Address the envelope. | Write the letter. |
| Put a stamp on the envelope. | Put the finished letter in the envelope. |
| Put the finished letter in the envelope. | Put a stamp on the envelope. |

# Task Analysis

- The process of examining the way in which people perform their tasks.
- Involves an in-depth analysis of the tasks and actions a person undertakes,
  - Along with the knowledge they need to perform those tasks and reach a goal.
- Collect information on users' tasks by interviewing users, observing them in their work environment and consulting relevant documentation.

# Scenarios and Use Cases

- Scenarios and use cases are stories about the use of a computer system.
- During observation, compile a list of tasks that you see the users doing and describe the tasks by writing scenarios and use cases.
- Scenarios and use cases are developed and refined over time and can later on be used for evaluation and usability testing of the system being developed.
- The focus of this course is on these 3 types of scenarios and use cases.
  - Task scenarios, concrete use cases and essential use cases.

# Types of Scenarios and Use Cases

- A task scenario
  - A narrative description of a task and it describes the current use of a computer system (Hackos and Redish, 1998).
  - Usually describe a specific instance and situation of use.
  - Detailed, describe step by step, the procedures to get a task done.
  - Describe the features and behaviour of the system with which the user interacted while performing the task.
  - Problems and difficulties that the user may have will also be included in the description.

# Example of Task Scenario (Stone, D. et al., 2005)

- Currency Exchange ATM Task Scenario
  - Emily Adams has just arrived at KLIA enroute to a large conference. Looking around for a bank in order to get some local currency, she sees a foreign currency exchange ATM that seems similar to the one she uses at home.

    She parks her suitcase, takes out a credit card and inserts it into the slot. A message is displayed on the screen.

    `Enter your PIN.`

    Emily thinks for a few moments and then types a four-digit number on the numerical pad, listening to the reassuring beep that follows each key press. The machine pauses for a few seconds and then displays:

    `Select currency required.`

# Example of task scenario

Emily pauses again. What is the currency in Malaysia? Fortunately the machine offers a default of "Ringgit", so she guesses that must be the local currency and presses the key. The machine displays the message:

```
Exchange rate is 3.75 Ringgit to one dollar U.S.
Enter amount required in Ringgit in units of
[10].
Press (Proceed).
```

Emily enters 380 and presses <Proceed>. There is a whirring noise and a few other indeterminate clunks and clicks. Her credit card is returned from the card entry slot and the money is deposited in the delivery slot, along with a print-out of the transaction.

# Types of Scenarios and Use Cases

- Concrete use case
  - Detailed description of a task.
  - Describe the use of a system at a slightly more generic level.
  - Describe in terms of the detailed features and behaviour of the user interface.

# Example of Concrete Use Case (Stone, D. et al., 2005)

| User action | System response |
|---|---|
| User inserts credit card into the slot. | System requests PIN. |
| User types in 4-digit PIN number using the keypad. | System verifies user's identity.<br>System requests foreign currency required, to be selected using menu keys. |
| User presses the key corresponding to the required currency. | System displays the exchange rate.<br>System requests the user to enter the amount of foreign currency required using the keypad.<br>The unit of currency is also displayed, as the system only deals with banknotes. |
| User enters amount required using the keypad. | System returns the credit card via the slot.<br>System dispenses the currency via the currency delivery slot.<br>System delivers a printout of the transaction via the receipt slot. |

# Types of Scenarios and Use Cases

- Essential use case
  - Describes a task at a high level of abstraction.
  - Simple and general description of a task that contains no assumptions about the type of UI or technology to be used.
  - Focuses more on what a user would like to do (the user's intention or purpose) and what the system's responsibilities need to be.

# Example of Essential Use Case (Stone, D. et al., 2005)

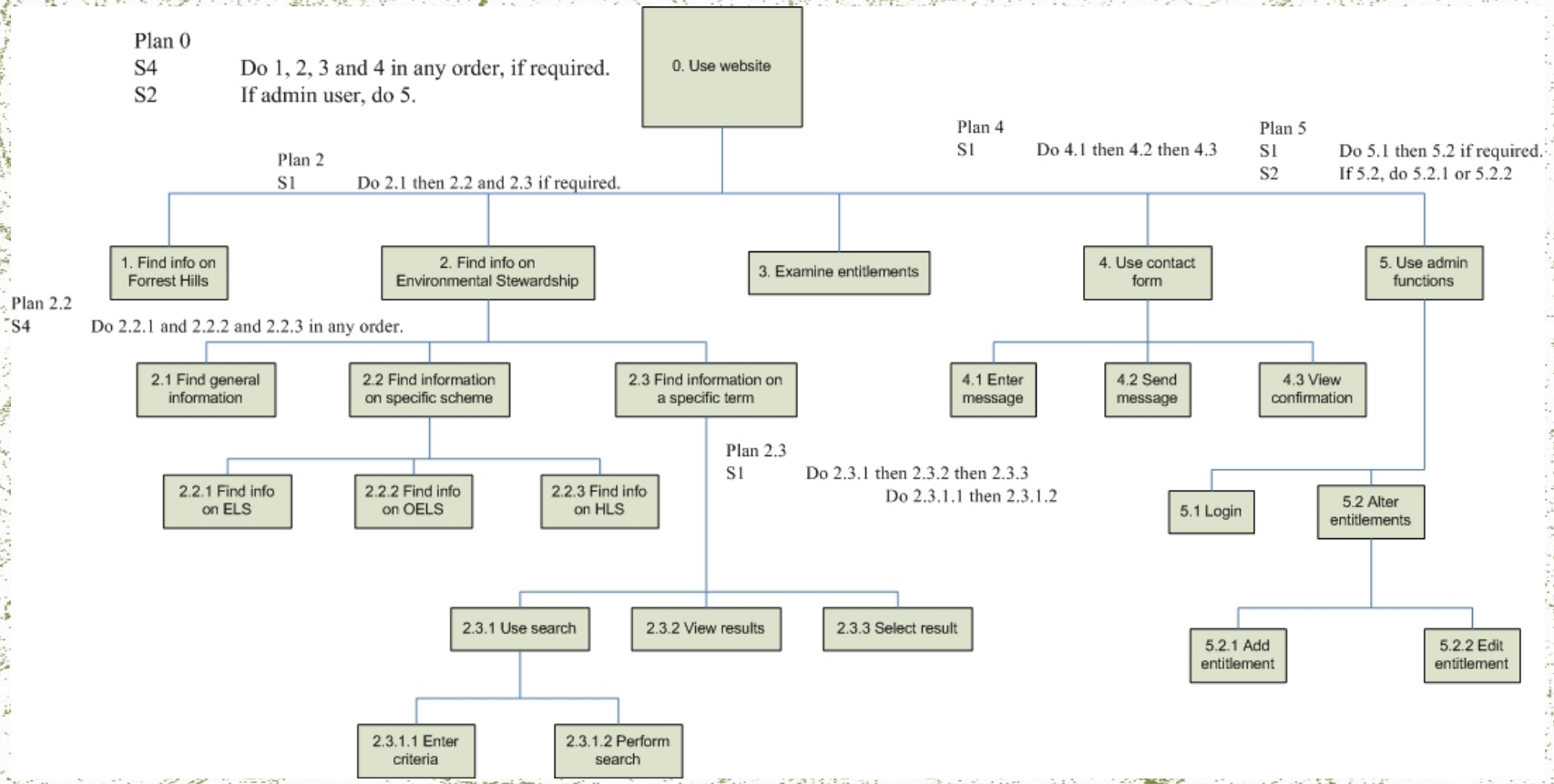
| **Get foreign currency** | |
|---|---|
| **User's purpose** | **System responsibility** |
| Identify self. | Validate user's identity.<br>Display currency available. |
| Select currency required. | Display exchange rate. |
| Enter amount of foreign currency required. | Calculate amount multiplied by exchange rate. |
| Confirm amount. | Request initiation of payment.<br>Obtain authorization for amount.<br>Give money. |
| Take money and go | |

# Types of Scenarios and Use Cases

- Task scenarios and concrete use cases are used as part of requirements gathering for examining and modeling tasks.
- Concrete use cases, essential use cases and use scenarios are used in the design phase.

# Tasks Analysis

- Hierarchal Tasks Analysis
- Cognitive Tasks Analysis


Plan 0
S4 Do 1, 2, 3 and 4 in any order, if required.
S2 If admin user, do 5.
0. Use website
Plan 2
S1 Do 2.1 then 2.2 and 2.3 if required.
Plan 4
S1 Do 4.1 then 4.2 then 4.3
Plan 5
S1 Do 5.1 then 5.2 if required.
S2 If 5.2, do 5.2.1 or 5.2.2
1. Find info on Forrest Hills
2. Find info on Environmental Stewardship
3. Examine entitlements
4. Use contact form
5. Use admin functions
Plan 2.2
S4 Do 2.2.1 and 2.2.2 and 2.2.3 in any order.
2.1 Find general information
2.2 Find information on specific scheme
2.3 Find information on a specific term
4.1 Enter message
4.2 Send message
4.3 View confirmation
Plan 2.3
S1 Do 2.3.1 then 2.3.2 then 2.3.3
Do 2.3.1.1 then 2.3.1.2
2.2.1 Find info on ELS
2.2.2 Find info on OELS
2.2.3 Find info on HLS
5.1 Login
5.2 Alter entitlements
2.3.1 Use search
2.3.2 View results
2.3.3 Select result
5.2.1 Add entitlement
5.2.2 Edit entitlement
2.3.1.1 Enter criteria
2.3.1.2 Perform search

# Textual HTA description

- Hierarchy description ...

0. in order to clean the house
    1. get the vacuum cleaner out
    2. fix the appropriate attachment
    3. clean the rooms
        3.1. clean the hall
        3.2. clean the living rooms
        3.3. clean the bedrooms
    4. empty the dust bag
    5. put vacuum cleaner and attachments away

# Cognitive Task Analysis

- Tasks are accomplished by performing actions in some order using a suitable device.
- Cognitive task analysis recognizes that some of these actions are physical (pressing buttons, moving pointers, etc.) but some of them are internal (mental or cognitive) operations.
- Cognitive walkthrough evaluates the steps required to perform as task and attempts to uncover mismatches between how the users think about a task and how the UI designer thinks about the task.

# Cognitive Walkthrough

- Step 0: The user selects a task to be performed and writes down all the steps (actions) in the task.
- Then for each action in the task.
- Step 1: The user explores the artifact, prototype or task scenario, looking for the action that might enable him or her to perform the selected task.
- Step 2: The user selects the action that appears to match most closely to what he or she is trying to do.
- Step 3: The user interprets the system's response and assesses if any progress has been made towards completing the task.

# Questions

- For each action of the task in Step 0, the evaluators try to answer the following questions as the user explores the prototype or task scenarios.
- Question 1: In relation to Step 1, how does the user know what to do next? Is the correct action sufficiently evident to the user (i.e. the user can recognize it) or does the user have to recall what to do from memory?
- Question 2: In relation to Step 2, will the user connect the description of the correct action with what he or she is trying to do?
- Question 3: In relation to Step 3, on the basis of the system's response to the chosen action, will the user know if he or she has made a right or wrong choice?

# Cognitive Walkthrough Example

- Task:  To set the timer on the VCR to record a movie that starts at 21:00 and finishes at 22:30 using the remote control.
- Action 1:  Press the PROG button on the handset.
- Action 2:  Press the up arrow until the number 21 is showing.
- Action 3, 4, 5, …

# Cognitive Walkthrough Example

| | |
|---|---|
| User Action 1 | Press the PROG button on the handset. |
| Question 1 | *Is the correct action sufficiently evident to the user?*<br><br>Neither the remote control nor the VCR display give any indication that the user needs to press the PROG button to do a timed recording. |
| Question 2 | *Will the user connect the description of the correct action with what he or she is trying to do?*<br><br>Experienced users might associate timed recording with setting or programming (PROG) the VCR. However, this is probably not the case for novice users. |
| Question 3 | *Will the user know if he or she has made a right or wrong choice on the basis of the system's response to the chosen action?*<br><br>Once the PROG button is pressed, the VCR display changes to a form fill-in that guides the user in entering the information (although the display on the remote control does not change). Any user who notices the VCR display, or remembers where the form fill-in appears, will know that he or she has made a right choice. |

# Work Environment

- The physical environment
  - Physical condition
    - Lighting sufficient, temperature comfortable, noise level, dirty or dusty?
  - Physical design or layout
    - Space provided, number of people in the space provided.
- The safety environment
  - Any hazards or health and safety issues?
    - Need special clothing, is it a safety critical system with high level of stress, any pollution?
- The social environment
  - How users interact or are prevented from interacting?
    - Users under pressure, users cooperate, share tasks, users help each other to learn, any social hierarchy?

# Work Environment

- The organizational environment
  - Organizational factors influencing the design of the UI
    - Organizational mission and aims
    - Structural working factors (working hours, job function, work practices, etc…)
    - Attitudes and cultural factors (policies on computer and IT, etc…)
    - Flexibility, performance monitoring and feedback
- The user support environment
  - Provision of assistive devices if required
  - Offering manuals for reference
  - Making training available

# How environmental characteristics affect design? (Stone, et al., 2005)

| Environmental characteristics | How it affects the design |
|---|---|
| The environment is noisy. | The use of sound for alerting users to problems may not be effective. |
| The environment is dusty or dirty. | Equipment might require some type of protective covering. |
| Users wear protective clothing such as gloves. | Input devices will need to accommodate this. |
| The work is highly pressured and subject to frequent interruptions. | The application must allow the user to stop his or her work and restart it later, preferably from the point where the user left off. |
| There is a need for workers to share information, or the work is designed so that they work in groups rather than in isolation. | The workplace will need to be laid out carefully to take this factor into consideration. |

# Chapter Summary

- Task analysis
- Environmental analysis
- User-centered system design focuses on people, their work, their work environments and how technology can best be deployed and designed to support them.
- Requirements gathering is a central part of computer systems development.

# Q & A

# Thank you

# for your attention