Lecture 5: 
HCI, advanced course, 
Task Analysis, HTA

To read: *Shepherd*: HTA as a framework for task analysis
Outline

• What is Task analysis (TA)?
• How do we use TA?
• What methods support TA?
• Results from using TA
What is TA?

• A process of analysing the way people perform their tasks
  – the things they do
  – the things they act on
  – the things they need to know
• Finds reasons for some problems, helps attending to problems
• Organising information about a system
What are tasks?

• What the user has to do to accomplish a goal
• Each task should be
  – meaningful
  – associated with a goal
  – identifiable by the user
Goals of task analysis

- Elicit descriptions of what people do
- Represent those descriptions
- Predict difficulties, performance
- Measure learnability, transfer of knowledge between systems
- Evaluate systems against usability and/or functional requirements
Motives for using TA

- Finding problems
- Gathering information about problems
- Organising gathered information
- Modelling sub-processes for finding sources of problems
- Forming hypotheses for solving problems
- Actions seen in a context
- Anything that supports predictions is welcome
Procedure, TA

• Data gathering
  – Manuals, instructions
  – Observation, interview
  – Iterative

• Description
  – Method used -> task described

• Analysis

• Interpretation -> design
Terminology

- Goal = external task, such as producing a letter
- Device = method, tool, or technique appropriate for achieving goals
- Tasks = activities necessary to achieve goals using a device
- Subtasks = components of tasks
- Actions = simple tasks
- Method = plan = number of tasks or actions linked into a sequence
Some analysis techniques

• Many techniques are mentioned in HCI literature, we will talk about:
  – HTA (today)
  – KLM (Tuesday)
  – CMN-GOMS (Tuesday)
  – CPM-GOMS (Tuesday)
Hierarchical Task Analysis, HTA

- Developed by John Annett & Keith Duncan 1967 and forward
- From line work to system supervision
- Context
- Complex tasks
- Flexible method
HTA: Goals and operations

• Goals
  – Goal to achieve and describe
  – Expressed as verb-noun, e.g. book lecture room, clean kitchen, watch power plant

• Operations
  – what a human being does to make the system approach the goal
Example of HTA analysis

0. Clean house

plan 0: do 1-2-3-4, any order

1. Clean kitchen
   1.1 Remove the dust

2. Clean bedroom
   1.2 Clean floor

3. Clean bathroom

4. Clean living-room
Generating Hierarchy

• Identify the Major Task to be Analyzed
  – e.g. clean house, purchase a flight ticket online, copy a ten-page paper, etc.

• Break Down the Major Task into Subtasks
  – What subtasks must be accomplished in order to perform the main task
  – Refer to various sources (e.g. direct observation, expert opinion, documentation, etc.)
  – Try to be specific in terms of the objectives of subtasks

• Decide Upon the Level of Detail into Which to Further Decompose the Subtasks
  – Some stopping rule

• Continue the Decomposition Process
  – Keep decompositions and numbering consistent

• Group Some Subtasks (If Too Detailed) into Higher-Level Subtasks

• Present the Hierarchy to a Domain Expert to Check for Errors or Omissions
HTA: Two kinds of analysis

• Human-task interaction
  – Operations in terms of
    • Input – what is needed?
    • Action – is it doable?
    • Feedback – is the goal closer?

• Re-description
  – goals are described as sub-goals and a plan
  – when human-task interaction is not clear
Example of HTA analysis

1.2 Clean floor

- 1.2.1 Prepare vacuum cleaner
  - 1.2.1.1 Change bag
  - 1.2.1.2 Throw away old bag

- 1.2.2 Start and use vacuum cleaner

- 1.2.3 Scrub floor
  - 1.2.3.1 Find scrubbing rag
  - 1.2.3.2 Find bucket

Plan 1.2: do 1.2.1 and 1.2.2 if necessary do 1.2.3
Plan 1.2.3: do 1.2.3.1 do 1.2.3.2, any order

Plan 1.2.1: if necessary do 1.2.1.1 and 1.2.1.2
Example explained

• Each level is a full description of the task
• Lower levels are going into more detail
• Iterations and control structures are described in the plan following each level
  – they are NOT described using arrows
  – the levels of the diagram are not illustrating the workflow
• Each subtask is described with a verb and a noun
HTA: Types of plan

- **Fixed sequences**
  - The same sequence of subtasks is always followed

- **Optional subtasks**
  - Circumstances control whether a subtask should be performed or not (if-then-else)

- **Waiting-For Events**
  - wait for a certain point in time
  - wait for a certain event to occur
HTA: Types of plan

- Optional completion
  - subtasks can be performed in any order
- Concurrent operations
  - some subtasks can or must be performed in parallel
- Cycles
  - Repeat until a condition is reached
- Mixtures
  - most plans are a mixture of different types
HTA: Stopping analysis

- **P x C rule**
  - \( P = \) probability of inadequate performance
  - \( C = \) cost of inadequate performance
  - if security aspects are crucial

- when re-description has reached operational level

- expand only relevant tasks, depends on purpose of analysis
HTA: Documenting results

- Diagrams
- Sequential formats
- Numbering
- Plans
- Stop criteria
- Gathered data
Sequential format

0. Clean floor
   1. Prepare vacuum cleaner
      1.1. Change dust bag
      1.2. Throw away old bag
   2. Start and use vacuum cleaner
   3. Scrub floor
      3.1. Find/get scrubbing rag
      3.2. Find/get bucket
      3.3. Fill the bucket with water
      3.4. Get down on knees and do the actual scrubbing

Plans
   Plan 0: do 1 - 2 - 3 in that order.
   Plan 1: if necessary do 1.1, 1.2 in that order.
   Plan 3: do 3.1, 3.2, 3.3, 3.4 in that order
HTA: How to use the results

- Documenting an activity
- Identifying problems
- How to educate users
- Writing a user manual
- Error reduction
- Starting point for further analysis, such as Cognitive Walkthrough
Benefits using HTA

- Flexible
- Any type of activity
- Different abstraction levels
- Combined with other analysis methods, a supplement
- Graphical presentation
HTA: Drawbacks

- Diagrams might be big
- Large number of diagrams
- Stop criteria not accurate or exact
- If the level of detail is low, it might affect how the design is perceived
Commence task analysis

1. Identify and state next goal to be examined
2. Explore its constraints
3. Judge whether the goal will be met to an acceptable standard given prevailing circumstances

**Current performance is acceptable**

4. Cease redescription at this point

**Current performance is unacceptable**

5. Examine the operator-system interaction

6. Estimate the cost-benefits of the hypotheses

- An acceptable (or best) hypothesis has been selected
  - 7. Record the hypothesis and cease further analysis at this point
  - Yes
    - Are there further goals remaining to be examined?
  - No
    - No acceptable hypothesis has been selected
      - 8. Attempt to redescribe the goal
        - Redescription unsuccessful
          - either
            - 9. Seek advice or review constraints
              - constraints are not relaxed
        - Redescription was successful
          - constraints are relaxed
          - Repeat from 5.
    - One or more hypotheses have been identified to enable current performance to become acceptable
      - 6. Estimate the cost-benefits of the hypotheses
        - constraints are relaxed
      - 5. Examine the operator-system interaction
        - constraints are not relaxed
      - 4. Cease redescription at this point

Finish task analysis – move on to development and evaluation
Summary

- TA - focus on tasks/actions
- HTA - complex tasks, in context
  - Finds problems
  - Ideas for redesign
  - Systematic walkthrough