chapter 15

task analysis

What is Task Analysis?

Methods to analyze people's jobs:

- what people do
- what things they work with
- what they must know

Task Analysis as a Tool

- Design of a new human/machine system
- Evaluation of an existing system design

Goals of Task Analysis

- Description
- Diagnosis
- Prescription
- Prediction
- Explanation

Usage of Task Analysis

- Requirements and system design
- Human behaviour
- Detailed interface design
- Manuals

Three interacting components

- Task requirements
- Task environment
- Task behaviour
Destination among these three aspects of tasks is important for the process of task analysis
The process of task analysis

- Data collection
- Task description
- Task specific data required

Cognitive elements of task information are particularly difficult to obtain

Identify information for task analysis

- Decisions made in the execution of component sub-tasks
- Trigger conditions for sub-task execution
- Objective or goal of each sub-task
- Performance criteria for each sub-task
- Information required by each sub-task
- Knowledge employed in making decision
- Knowledge of system employed in performing sub-tasks

Identify information for task analysis

- Identification of component tasks
- Grouping of component task
- Commonalities and interrelationships between component tasks
- Important or priorities of component sub-tasks
- Sequencing of component sub-tasks

Approaches to task analysis

- Task decomposition
  - Splitting task into (ordered) subtasks
- Knowledge based techniques
  - What the user knows about the task and how it is organised
- Entity/object based analysis
  - Relationships between objects, actions and the people who perform them
- Lots of different notations/techniques

Task Decomposition

- Aims:
  - Describe the actions people do
  - Structure them within task sub-task hierarchy
  - Describe order of subtasks
- Variants:
  - Hierarchical Task Analysis (HTA)
  - Most common

Uses – requirements & design

- Requirements capture and systems design
  - Fitness focus from system to use
  - Suggests candidates for automation
  - Uncover user's conceptual model
- Detailed interface design
  - Taxonomies suggest menu layout
  - Object/action lists suggest interface objects
  - Task frequency guides default choices
  - Existing task sequences guide dialogue design
- NOTE. task analysis is never complete
  - Rigid task based design to inflexible system
Hierarchical Task Analysis

A task can be broken down into task components at a number of levels of description, with more detail of the task being revealed at each level

- Breaking the task down into elements
- Categorize task elements for different purpose

The HTA Analysis is able to

- Express the system’s goals more explicitly
- Identify appropriate features of the context with more precision
- Establish methods for accomplishing the overall goal

HTA and design

- Examining plant operation
- Allocation of function
- Job design
- Developing information requirements
- Interface design
- Developing job aids
- Developing training program
- Assessment

Stages of Conducting an HTA

- Consider the system’s goal
- Examine the task to attain these goal
- Judge current system performance satisfaction
- If not, seek to manipulate task components for satisfaction

Textual HTA description

Textual HTA description

Hierarchy description...

- 6. in order to clean the tenants
  1. get the vacuum cleaner out
  2. get the appropriate attachment
  3. clean the room
  4. clean the hall
  5. clean the bedroom
  6. get the dust bag
  7. put vacuum cleaner and attachments away

Plan 3: do 1 - 2 - 3 in that order, where the dust bag gets full do 4
Plan 3: do any of 1, 2 or 3 in any order depending on which room needs cleaning

N.B. only the plans denote order
### Generating the hierarchy

1. get list of tasks
2. group tasks into higher level tasks
3. decompose lowest level tasks further

**Stopping rules**
- How do we know when to stop?
- Is “empty the dust bag” simple enough?
- Purpose: expand only relevant tasks
- Motor actions: lowest sensible level

### Tasks as explanation

- imagine asking the user the question:
  - what are you doing now?
- for the same action the answer may be:
  - typing ctrl-B
  - making a word bold
  - emphasising a word
  - editing a document
  - writing a letter
  - preparing a legal case

### Diagrammatic HTA

1. get vacuum cleaner
2. fix carpet head
3. clean dining room
4. clean main bedroom
5. clean sitting room
6. put cleaner away

### Refining the description

**Task scenario using HTA**

1. in order to clean the house
2. get the appropriate attachment
3. clean the rooms
4. clean the living rooms
5. empty the dust bag
6. put vacuum cleaner and attachments away

### Types of plan

- **-prepared sequence**
  - 1.1 then 1.2 then 1.3
- **optional tasks**
  - if the pot is full
- **wait for events**
  - when kettle boils 1.4
- **cycles**
  - do 5.1 5.2 while there are still empty cups
- **time-sharing**
  - do 1 at the same time ...
- **discretionary**
  - do any of 3.1, 3.2 or 3.3 in any order
- **mixture**
  - most plans involve several of the above
Knowledge Based Analyses

Focus on:
- Objects – used in task
- Actions – performed
- Taxonomies – represent levels of abstraction

Objects – used in task
- Vera's Veggies – a market gardening firm

Knowledge-Based Example

- Objects:
  - steering
  - engine
  - direct
  - lights
  - wash/wipe

- Composite objects:
  - lights
  - steering
  - wash/ wipe

Task Description Hierarchy

Three types of branch point in taxonomy:
- XOR – normal taxonomy
  - object in one and only one branch
- AND – object must be in both multiple classifications
- OR – weakest case
  - can be in one, many or none

Abstraction and cuts

- After producing detailed taxonomy ‘cut’ to yield abstract view
  - That is, ignore lower level nodes
  - e.g. cutting above shape and below dining, plate becomes:
    - kitchen item/function/preparation,dining/
  - This is a term in Knowledge Representation Grammar (KRG)
  - These can be more complex:
    - e.g. ‘beating in a mixing bowl’ becomes:
      - kitchen job(preparation) using a kitchen item/function/preparation/

Entity-Relationship Techniques

Focus on objects, actions and their relationships

Similar to knowledge-based analysis, but …
- includes non-computer entities
- emphasises domain understanding not implementation

Running example
- ‘Vera’s Veggies’ – a market gardening firm
  - owner/manager: Vera Bradshaw
  - employee: Sam Gummage and Tony Peroon
  - various tools including a tractor ‘Fergie’
  - two fields and a glasshouse
  - new computer controlled irrigation system

Concrete objects:
- simple things: spade, plough, glasshouse

Actors:
- human actors: Vera, Sam, Tony, the customers
  - what about the irrigation controller?

Composite objects:
- sets: the team = Vera, Sam, Tony
- tuples: tractor may be < Fergie, plough >

Objects
Attributes

To the objects add attributes:

Object: Pump3 simple – irrigation pump
Attributes:
- status: on/off/faulty
- capacity: 100 litres/minute

N.B. need not be computationally complete

Actions

List actions and associate with each:

agent – who performs the action
patient – which is changed by the action
instrument – used to perform action

examples:
- Sam (agent) planted (action) the leeks (patient)
- Tony dug the field with the spade (instrument)

Uses – manuals & documentation

Information and Data Collection

- Documentation
- Observation
- Interviews
- Initial analysis
- Sorting and classification

Methods for data collection

- Activity (raw or coded) plus time
- Time study: raw event/time record.
- Process charts – how material and people are moving
- Gantt charts – graphical description of activities in time
- Link charts – sequences of eye fixations

Methods

- Observation
- Questionnaires
- Interviews
- Specific techniques to answer questions
- Rating scales
Uses for task information

- System design/evaluation
- Training design/evaluation
- Interface design/evaluation
- Job/team design
- Personnel selection
- System reliability analysis

How to carry out your project work - Part II

- Identify the task
- Background of the project
- Aim
- Method description
- Result analysis
- Discussion
- Conclusion
- Future work

Analysis the results

- Statistic analysis
  - Average ±St.D.
  - Percentage
- Qualitative data analysis
  - Do not need to give detail results of each subject, only those interesting findings
- Use tables and figures, easy to understand

Discussion

- Explain your results
- Generalize your results, imply for new design? Any recommendations?
- What kind of mistakes and errors you made during the project and what you have learned from it.
- Suggestion for the improvement of the design

Conclusion

- Main findings
- Main experiences

Keep it short !!!!!

Future work

- What shall be done in the future?
Differences between abstract and conclusion?