

# **CPE/CSC 484: User-Centered Design and Development**


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# Chapter 10

## Identifying needs and establishing requirements



# Logistics

- ❖ **Senate appearance by the instructor**
  - ❖ during the first half of the lab period
- ❖ **Assignments**
  - ❖ A3 - Storyboards deadline Thu, May 3
- ❖ **Term Project**
  - ❖ mid-quarter project displays Thu, May 3
  - ❖ allocation of display stations
  - ❖ external visitors anticipated
    - ❖ don't reveal confidential information
      - ❖ e.g. names of collaboration partners

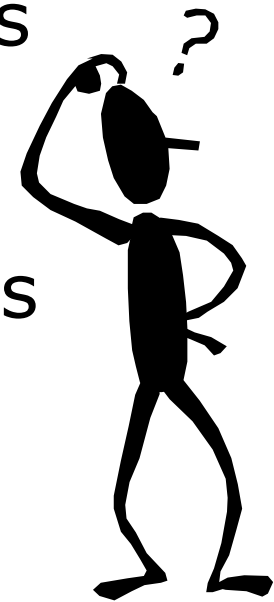
# Overview

- The importance of requirements
- Different types of requirements
- Data gathering for requirements
- Task descriptions: Scenarios

Use Cases

Essential use cases

- Task analysis: HTA



# What, how and why?

- What

Two aims:

1. Understand as much as possible about users, task, context
2. Produce a stable set of requirements

- How:

Data gathering activities

Data analysis activities

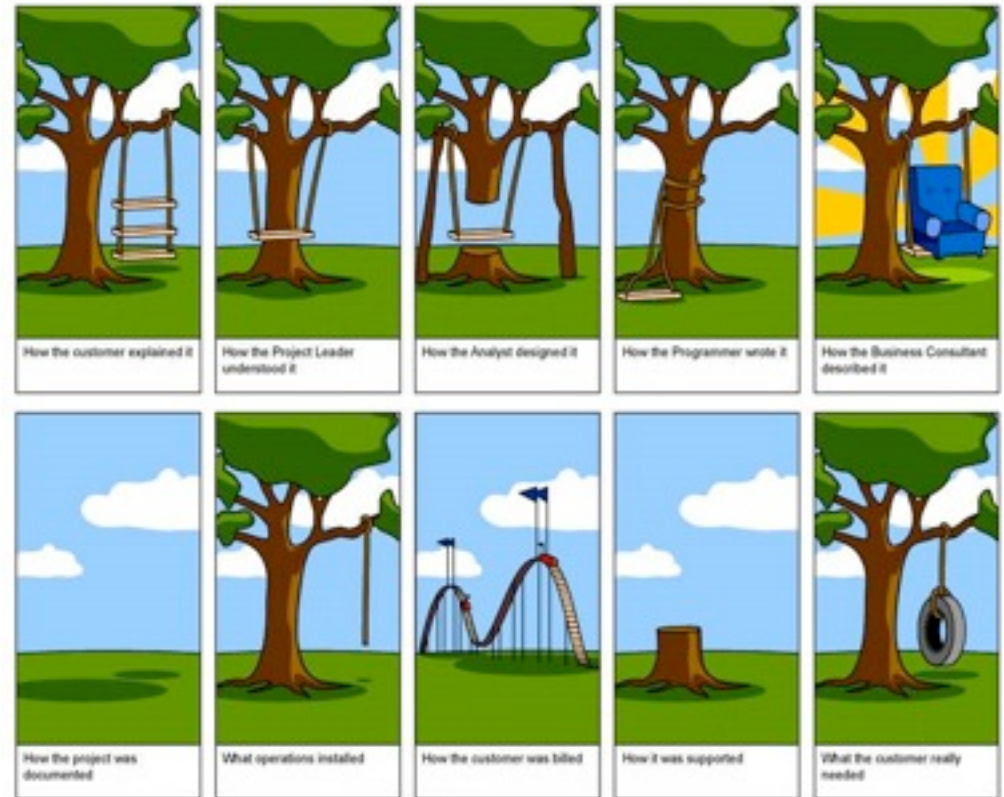
Expression as 'requirements'

All of this is iterative

# What, how and why?

- Why:

Requirements definition: the stage where failure occurs most commonly



Getting requirements right is crucial

# Volere shell

Requirement #: 75

Requirement Type: 9

Event/use case #: 6

Description: The product shall issue an alert if a weather station fails to transmit readings.

Rationale: Failure to transmit readings might indicate that the weather station is faulty and needs maintenance, and that the data used to predict freezing roads may be incomplete.

Source: Road Engineers

Fit Criterion: For each weather station the product shall communicate to the user when the recorded number of each type of reading per hour is not within the manufacturer's specified range of the expected number of readings per hour.

Customer Satisfaction: 3

Customer Dissatisfaction: 5

Dependencies: None

Conflicts: None

Supporting Materials: Specification of Rosa Weather Station

History: Raised by GBS, 28 July 99

## Volere

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# Volere requirements template

## PROJECT DRIVERS

1. The Purpose of the Product
2. The Stakeholders

## PROJECT CONSTRAINTS

3. Mandated Constraints
4. Naming Conventions and Definitions
5. Relevant Facts and Assumptions

## FUNCTIONAL REQUIREMENTS

6. The Scope of the Work
7. Business Data Model and Data Dictionary
8. The Scope of the Product
9. Functional and Data Requirements

## NON-FUNCTIONAL REQUIREMENTS

10. Look and Feel Requirements
11. Usability and Humanity Requirements
12. Performance Requirements

13. Operational and Environmental Requirements

14. Maintainability and Support Requirements

15. Security Requirements

16. Cultural and Political Requirements

17. Legal Requirements

## PROJECT ISSUES

18. Open Issues

19. Off-the-Shelf Solutions

20. New Problems

21. Tasks

22. Migration to the New Product

23. Risks

24. Costs

25. User Documentation and Training

26. Waiting Room

27. Ideas for Solutions



# Establishing requirements

- What do users want? What do users 'need'?  
Requirements need clarification, refinement, completion, re-scoping  
Input: requirements document (maybe)  
Output: stable requirements
- Why 'establish'?  
Requirements arise from understanding users' needs  
Requirements can be justified & related to data

# Different kinds of requirements

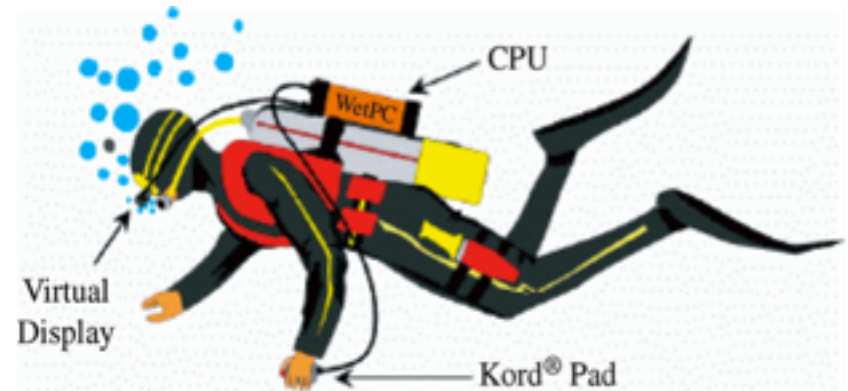
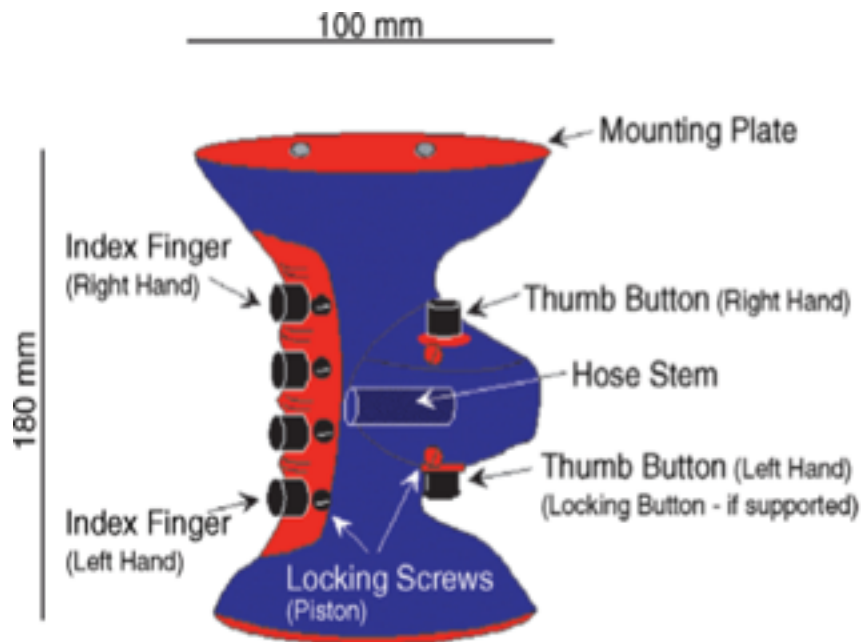
- Functional:
  - What the system should do
  - Historically the main focus of requirements activities
- (Non-functional: memory size, response time...)
- Data:
  - What kinds of data need to be stored?
  - How will they be stored (e.g. database)?

# Different kinds of requirements

Environment or context of use:

- physical: dusty? noisy? vibration? light? heat? humidity? .... (e.g. OMS insects, ATM)
- social: sharing of files, of displays, in paper, across great distances, work individually, privacy for clients
- organisational: hierarchy, IT department's attitude and remit, user support, communications structure and infrastructure, availability of training

# An extreme example



# Different kinds of requirements

- Users: Who are they?
  - Characteristics: ability, background, attitude to computers
  - System use: novice, expert, casual, frequent
  - Novice: step-by-step (prompted), constrained, clear information
  - Expert: flexibility, access/power
  - Frequent: short cuts
  - Casual/infrequent: clear instructions, e.g. menu paths

# What are the users' capabilities?

Humans vary in many dimensions:

- size of hands may affect the size and positioning of input buttons
- motor abilities may affect the suitability of certain input and output devices
- height if designing a physical kiosk
- strength - a child's toy requires little strength to operate, but greater strength to change batteries
- disabilities (e.g. sight, hearing, dexterity)



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# Kinds of requirements

What factors (environmental, user, usability) would affect the following systems?

- Self-service filling and payment system for a petrol (gas) station
- On-board ship data analysis system for geologists searching for oil
- Fashion clothes website

# Personas

- Capture user characteristics
- Not real people, but synthesised from real user characteristics
- Should not be idealised
- Bring them to life with a name, characteristics, goals, personal background
- Develop multiple personas



# Personas

**BACKGROUND**

- 15, Female
- Ongoing Private Education
- Ambitious
- Comfortable using technology to communicate

**MOTIVATIONS**

- Keeping in touch with her network
- Fashion/street cred
- Keeping up with peers.

**FRUSTRATIONS**

- Sad people trying to be 'friends' on Facebook
- Having to be in bed @ 11pm
- Being swamped in friends updates
- Missing important status updates

## Ginnie

Receives private tutoring in Maths and English as these are not her strong subjects. Enjoys playing for the school's 2nd teams for netball and Lacrosse and is good at art.

She loves recording her favourite shows: ER and San Valley High on Sky+ and spends some of her time on her Laptop that Daddy bought her watching videos on YouTube, downloading music, keeping up to date with her friends on Facebook and chatting via MS IM to her cousin who is at University in Leeds.

She loves Ugg boots and Abercrombie & Fitch and uses the Internet to shop and find the cheapest prices.

*"I want to easily hook up with my friends whilst watching TV"*



**CAPLIN**



# Data gathering for requirements

## Interviews:

- Props, e.g. sample scenarios of use, prototypes, can be used in interviews
- Good for exploring issues
- But are time consuming and may be infeasible to visit everyone

## Focus groups:

- Group interviews
- Good at gaining a consensus view and/or highlighting areas of conflict
- But can be dominated by individuals

# Data gathering for requirements

## Questionnaires:

- Often used in conjunction with other techniques
- Can give quantitative or qualitative data
- Good for answering specific questions from a large, dispersed group of people

## Researching similar products:

- Good for prompting requirements

# Data gathering for requirements

## Direct observation:

- Gain insights into stakeholders' tasks
- Good for understanding the nature and context of the tasks
- But, it requires time and commitment from a member of the design team, and  
it can result in a huge amount of data

## Indirect observation:

- Not often used in requirements activity
- Good for logging current tasks

# Data gathering for requirements

## Studying documentation:

- Procedures and rules are often written down in manuals
- Good source of data about the steps involved in an activity, and any regulations governing a task
- Not to be used in isolation
- Good for understanding legislation, and getting background information
- No stakeholder time, which is a limiting factor on the other techniques

# Some examples

## Diary and interview



Need						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
12am-3am	3am-6am	6am-12pm	12pm-3pm	3pm-6pm	6pm-12pm	12pm-3pm
You needed: <input type="checkbox"/> Info. <input checked="" type="checkbox"/> Assist. <input type="checkbox"/> Other						
What did you need? <u>to know if</u> <u>Stroller could be used on</u> <u>Don Valley trail</u>						
Why did you need it? <u>wanted to</u> <u>take baby stroller on trail</u> <u>but it just be use - low</u>						
Where were you? <u>at home</u>						
What were you doing? <u>planning a trip</u>						
When did you need it? <u>5-10 days</u>						
What I needed was very important.						
<input type="checkbox"/> Family	<input type="checkbox"/> Friends	<input type="checkbox"/> Neighbors	<input type="checkbox"/> Acquaintances	<input type="checkbox"/> Strangers		

Share						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
12am-3am	3am-6am	6am-12pm	12pm-3pm	3pm-6pm	6pm-12pm	12pm-3pm
What did you want to share? <u>Photo</u> <u>of pop art on sale</u> <u>at Dominion - 1/20</u>						
Why did you want to share it? <u>bc</u> <u>lots of people like</u> <u>pop art &amp; art sale</u>						
Where were you? <u>Dorland King</u> <u>Harbour</u>						
What were you doing? <u>shopping</u>						
I want to share the information with:						
<input type="checkbox"/> People around me		<input type="checkbox"/> People who visit this location		<input checked="" type="checkbox"/> People elsewhere		
Other _____						



## Cultural probes

# Contextual Inquiry

- An approach to ethnographic study where user is expert, designer is apprentice
- A form of interview, but
  - at users' workplace (workstation)
  - 2 to 3 hours long
- Four main principles:
  - Context: see workplace & what happens
  - Partnership: user and developer collaborate
  - Interpretation: observations interpreted by user and developer together
  - Focus: project focus to understand what to look

# Problems with data gathering (1)

- Identifying and involving stakeholders: users, managers, developers, customer reps?, union reps?, shareholders?
- Involving stakeholders: workshops, interviews, workplace studies, co-opt stakeholders onto the development team
- 'Real' users, not managers: traditionally a problem in software engineering, but better now



# Problems with data gathering (2)

- Requirements management: version control, ownership
- Communication between parties:
  - within development team
  - with customer/user
  - between users... different parts of an organisation use different terminology
- Domain knowledge distributed and implicit:
  - difficult to dig up and understand
  - knowledge articulation: how do you walk?
- Availability of key people

# Problems with data gathering (3)

- Political problems within the organisation
- Dominance of certain stakeholders
- Economic and business environment changes
- Balancing functional and usability demands

# Some basic guidelines

- Focus on identifying the stakeholders' needs
- Involve all the stakeholder groups
- Involve more than one representative from each stakeholder group
- Use a combination of data gathering techniques

# Some basic guidelines

- Support the process with props such as prototypes and task descriptions
- Run a pilot session
- You will need to compromise on the data you collect and the analysis to be done, but before you can make sensible compromises, you need to know what you'd *really* like
- Consider carefully how to record the data

# Data interpretation and analysis

- Start soon after data gathering session
- Initial interpretation before deeper analysis
- Different approaches emphasize different elements e.g. class diagrams for object-oriented systems, entity-relationship diagrams for data intensive systems

# Task descriptions

- Scenarios
  - an informal narrative story, simple, 'natural', personal, not generalisable
- Use cases
  - assume interaction with a system
  - assume detailed understanding of the interaction
- Essential use cases
  - abstract away from the details
  - does not have the same assumptions as use cases

# Example: Travel Organizer

- Scenario
- Use Case
- Alternative Courses
- Use Case Diagram

# Scenario for travel organizer

"The Thomson family enjoy outdoor activities and want to try their hand at sailing this year. There are four family members: Sky (10 years old), Eamonn (15 years old), Claire (35), and Will (40). One evening after dinner they decide to start exploring the possibilities. They all gather around the travel organizer and enter their initial set of requirements – a sailing trip for four novices in the Mediterranean. The console is designed so that all members of the family can interact easily and comfortably with it. The system's initial suggestion is a flotilla, where several crews (with various levels of experience) sail together on separate boats. Sky and Eamonn aren't very happy at the idea of going on vacation with a group of other people, even though the Thomsons would have their own boat. The travel organizer shows them descriptions of flotillas from other children their ages and they are all very positive, so eventually, everyone agrees to explore flotilla opportunities. Will confirms this recommendation and asks for detailed options. As it's getting late, he asks for the details to be printed so everyone can consider them tomorrow. The travel organizer prints out a summary of the different options available."



# Use case for travel organizer

1. The system displays options for investigating visa and vaccination requirements.
2. The user chooses the option to find out about visa requirements.
3. The system prompts user for the name of the destination country.
4. The user enters the country's name.
5. The system checks that the country is valid.
6. The system prompts the user for her nationality.
7. The user enters her nationality.
8. The system checks the visa requirements of the entered country for a passport holder of her nationality.
9. The system displays the visa requirements.
10. The system displays the option to print out the visa requirements.

# Alternative courses for travel organizer

Some alternative courses:

6. If the country name is invalid:

6.1 The system displays an error message.

6.2 The system returns to step 3.

8. If the nationality is invalid:

8.1 The system displays an error message.

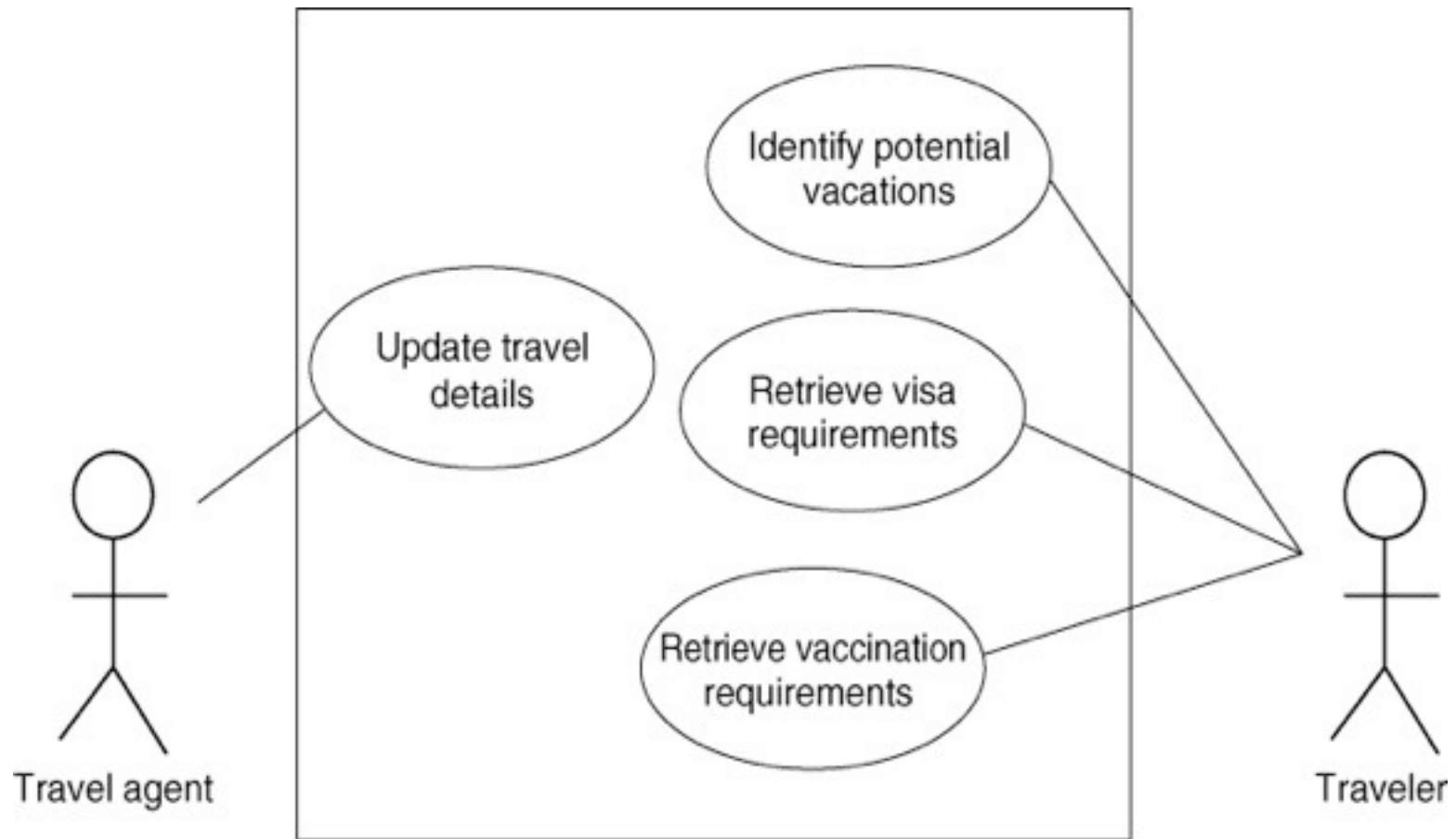
8.2 The system returns to step 6.

9. If no information about visa requirements is found:

9.1 The system displays a suitable message.

9.2 The system returns to step 1.

# Example use case diagram for travel organizer



# Example essential use case for travel organizer

retrieveVisa

## USER INTENTION

find visa requirements

supply required information

obtain copy of visa info

choose suitable format

## SYSTEM RESPONSIBILITY

request destination and  
nationality

obtain appropriate visa info

offer info in different formats

provide info in chosen format

# Task analysis

- Task descriptions are often used to envision new systems or devices
- Task analysis is used mainly to investigate an existing situation
- It is important not to focus on superficial activities
  - What are people trying to achieve?
  - Why are they trying to achieve it?
  - How are they going about it?
- Many techniques, the most popular is Hierarchical Task Analysis (HTA)

# Hierarchical Task Analysis

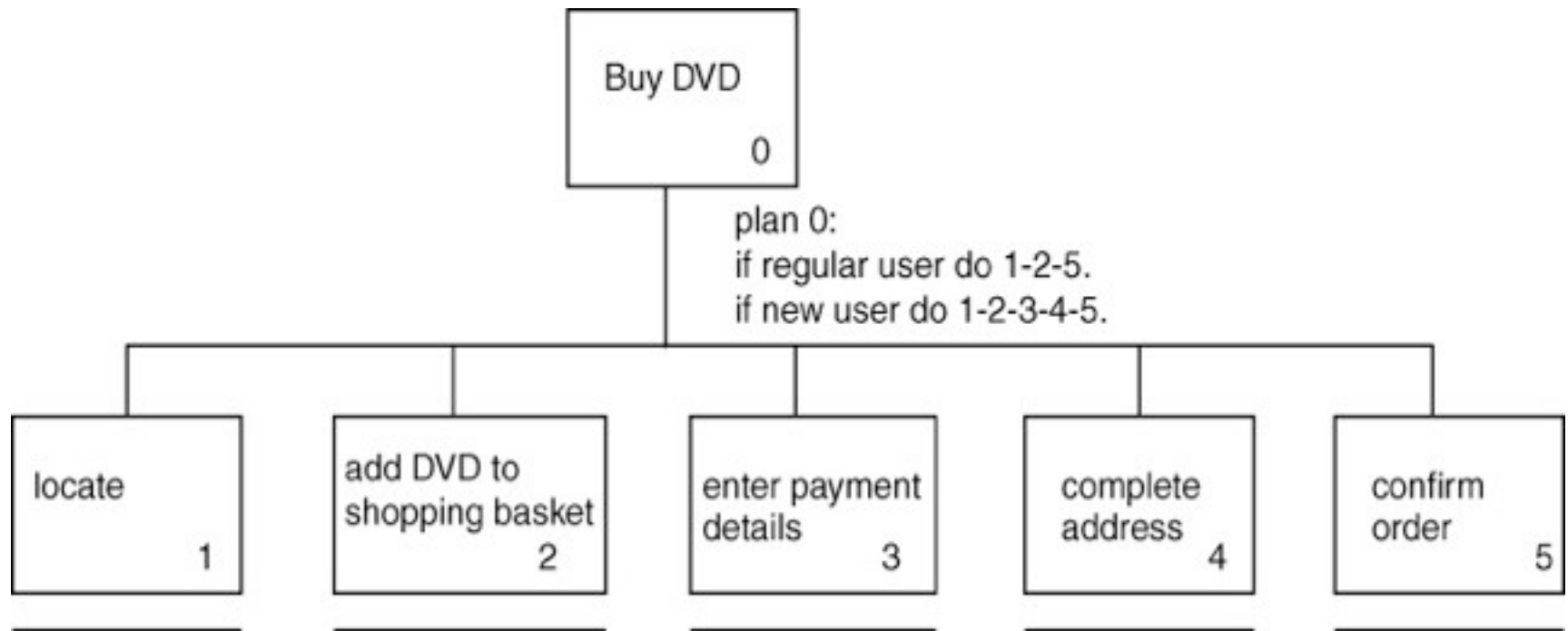
- Involves breaking a task down into subtasks, then sub-sub-tasks and so on. These are grouped as plans which specify how the tasks might be performed in practice
- HTA focuses on physical and observable actions, and includes looking at actions not related to software or an interaction device
- Start with a user goal which is examined and the main tasks for achieving it are identified
- Tasks are sub-divided into sub-tasks

# Example Hierarchical Task Analysis

- 0. In order to buy a DVD
  - 1. locate DVD
  - 2. add DVD to shopping basket
  - 3. enter payment details
  - 4. complete address
  - 5. confirm order

plan 0:        If regular user do 1-2-5.  
                 If new user do 1-2-3-4-5.

# Example Hierarchical Task Analysis (graphical)





# Summary

- Getting requirements right is crucial
- There are different kinds of requirement, each is significant for interaction design
- The most commonly-used techniques for data gathering are: questionnaires, interviews, focus groups, direct observation, studying documentation and researching similar products
- Scenarios, use cases and essential use cases can be used to articulate existing and envisioned work practices.
- Task analysis techniques such as HTA help to investigate existing systems and practices