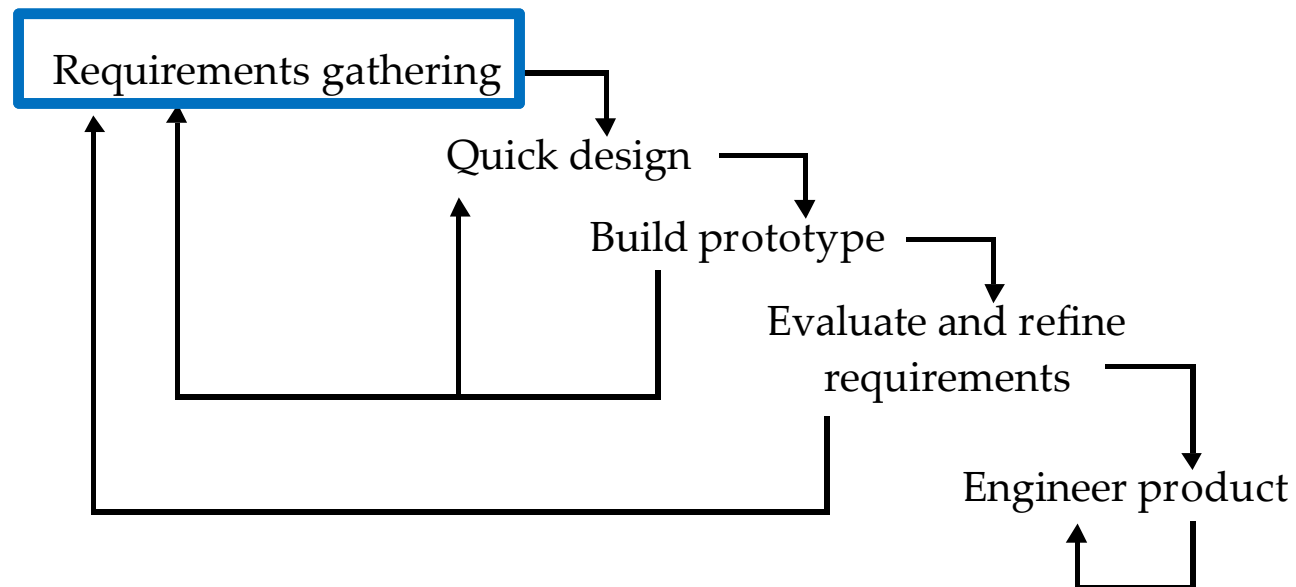# Interaction Design

Requirements Analysis

This Lecture

- Requirements analysis

- A number of approaches for gathering requirements:
  - Socio-technical models
    1. CUSTOM Stakeholder Analysis
    2. Requirements Development

  - Soft Systems Methodology (SSM)

Interaction Design

- **Iterative user-centered design and development**

Requirements

- In order to get a good design we must first understand the requirements
  - Who are the users?
  - What do users want?
  - What do users need?

- The requirements arise from understanding users' needs
  - Establishing what exactly is needed
  - Identifying what exactly the system should accomplish

How the customer explained it
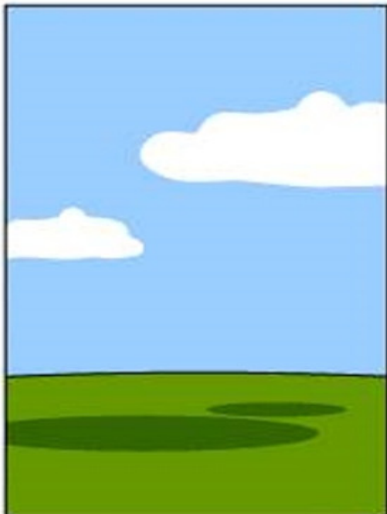
How the Project Leader understood it

How the Analyst designed it
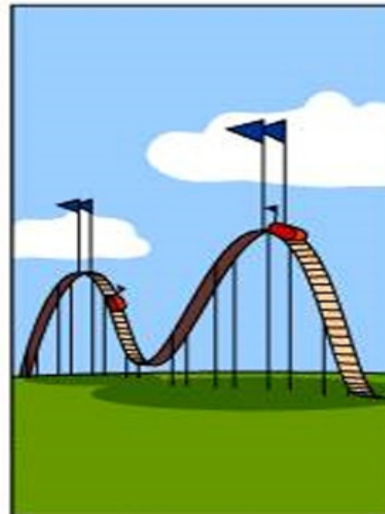
How the Programmer wrote it
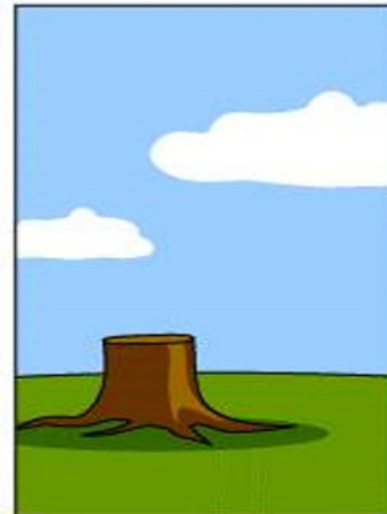
How the Business Consultant described it

How the project was documented

What operations installed

How the customer was billed

How it was supported
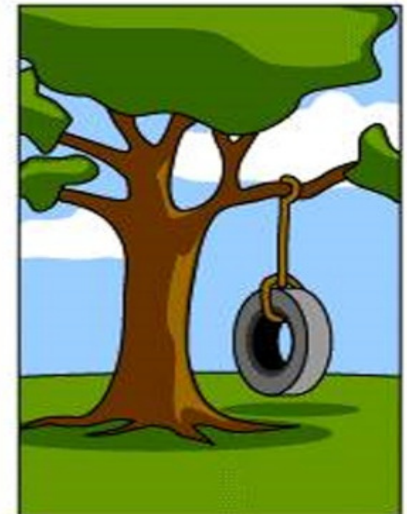
What the customer really needed

Requirements Analysis

Why?

- Things can go wrong:
  - Customers can explain their needs ambiguously
  - Designers can understand the customers' wishes wrongly
  - Programmers can implement something that was not asked for
  - …

- Most importantly:
  - Defining requirements is where failure most often occurs
  - Failure at this stage is expensive and time-consuming to fix
    - Getting requirements right is <u>crucial</u>

Requirements Analysis: What?

- Requirement ≡ Statement about what and how a future software or product should perform

- Aims:
    - Identifying Needs: Understand as much as possible about users, task, context
    - Establishing Requirements: Produce a stable set of requirements

- Activities:
    - Data gathering activities
    - Data analysis activities   **The process is iterative !**
    - Defining the requirements

Kinds of Requirements

- **Functional requirements** – what the system should do

- **Non-functional requirements** – what are the constraints on the system / development
    - data requirements
    - environmental requirements
    - user characteristics
    - usability goals and user experience goals

Non-functional Requirements

- Data requirements
  - ✓ Where is the data coming from?
  - ✓ What kinds of data need to be stored?
  - ✓ How will they be stored (e.g. database)?
  - ✓ How long the data must persist?
  - ✓ How accurate the stored data must be?
  - ✓ Which data representations are needed?

Non-functional Requirements

- Environmental requirements
  - ✓ physical characteristics: cold, crowded, dirty?
  - ✓ social characteristics: collaborative?
  - ✓ organisational characteristics: person vs. enterprise?
  - ✓ technical characteristics: compatibility requirements?

Non-functional Requirements

- User characteristics
  - ✓ ICT-related abilities and skills
  - ✓ age, nationality, education
  - ✓ physical and mental disabilities
  - ✓ preferences

Non-functional Requirements

- Usability goals and user experience goals
  - ✓ usability goals:
    effectiveness, efficiency, safety, utility, learnability, memorability
  - ✓ experience goals:
    enjoyable, entertaining, aesthetically pleasing, motivating

Example: Underwater Computing

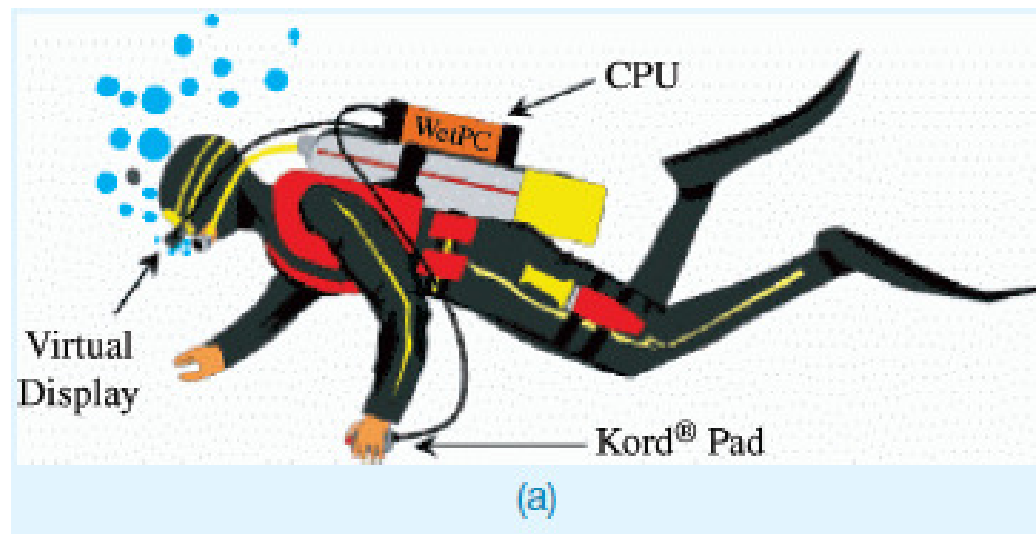**Figure 10.2** (a) The components of WetPC's underwater computer.

Source: Reproduced by permission of WetPC Pty Ltd. http://www.wetpc.com.au/WetPC.

Example: Underwater Computing
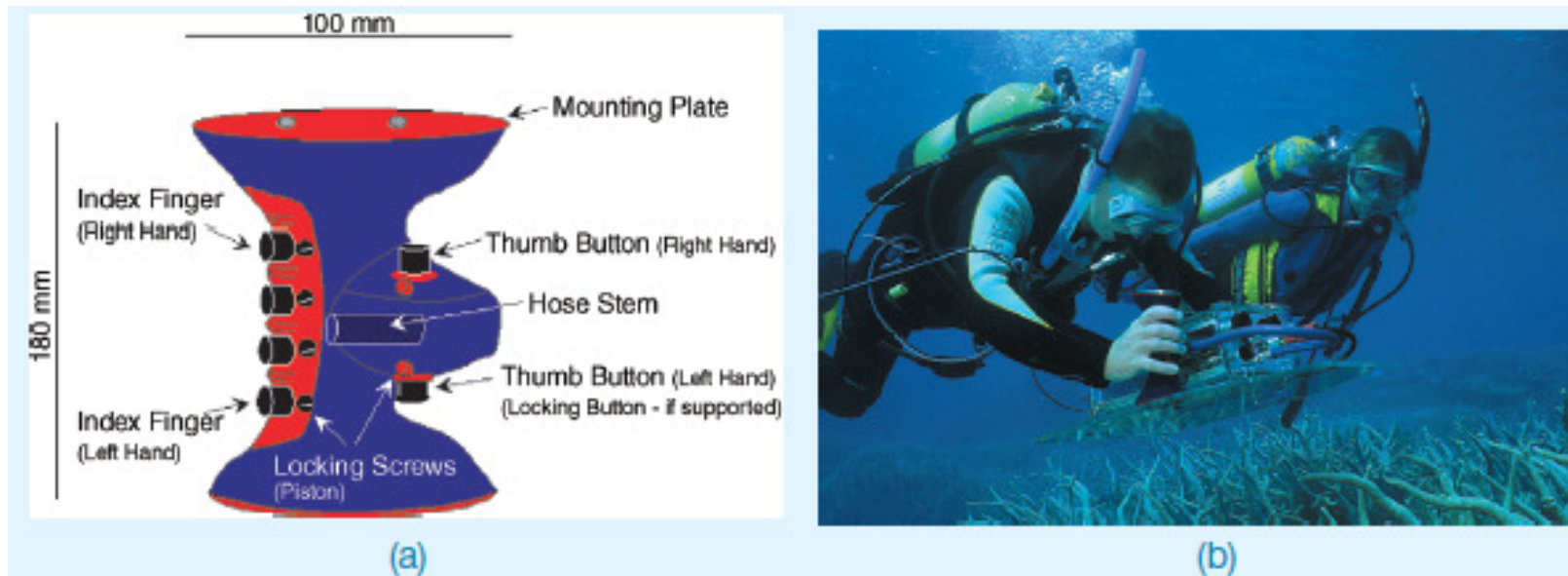
Figure 10.3 (a) The KordGrip interface and (b) the KordGrip in use underwater

Source: (a) Reproduced by permission of WetPC Pty Ltd (b) Reproduced by permission of the Australian Institute of Marine Science.

Focus on the User!

- Focus on the user and their non-functional requirements rather than concentrating solely on functional requirements

- If users do not find a system acceptable they will not use it
  - Extensive redesign
  - User retraining e.g. call-centres
  - Costing large amounts of time and money

Requirements Analysis: How?

- Several approaches that help us gather the requirements

  - Socio-technical models
    1. CUSTOM Stakeholder Analysis
    2. Requirements development

  - Soft Systems Methodology (SSM)

Socio-technical Analysis

Socio-technical Analysis

- Concerned with technical, social, organizational and human aspects of design

    - Technology is not developed in isolation but as part of a wider organizational environment

    - It is important to consider social and technical issues side by side
        - so that human issues are not overruled by technical considerations

Socio-technical Models

- These models consider the context into which the system will be introduced and used

  1. CUSTOM Stakeholder Analysis
     - **Identify** your stakeholders

  2. Requirements Development
     - **Understand** your stakeholders

CUSTOM Model

CUSTOM Model

- A socio-technical methodology designed to be practical to use in small organizations

  - Concentrates on identifying:
    - Who will be involved with the new system
    - What their requirements are (not just functional requirements)
    - Organisational structure

Further Reading:
- Alan Dix, Human-Computer Interaction, Pearson Education, 2004 - Chapter 13, page 458:
  https://books.google.co.uk/books?id=luQxui8GHDcC

Stakeholders

- Anyone who is affected by the success or the failure of the system

- In an organisational setting, it is not simply the end-user who is affected by the introduction of new technology

- So understanding the stakeholders is key to establishing the right set of requirements
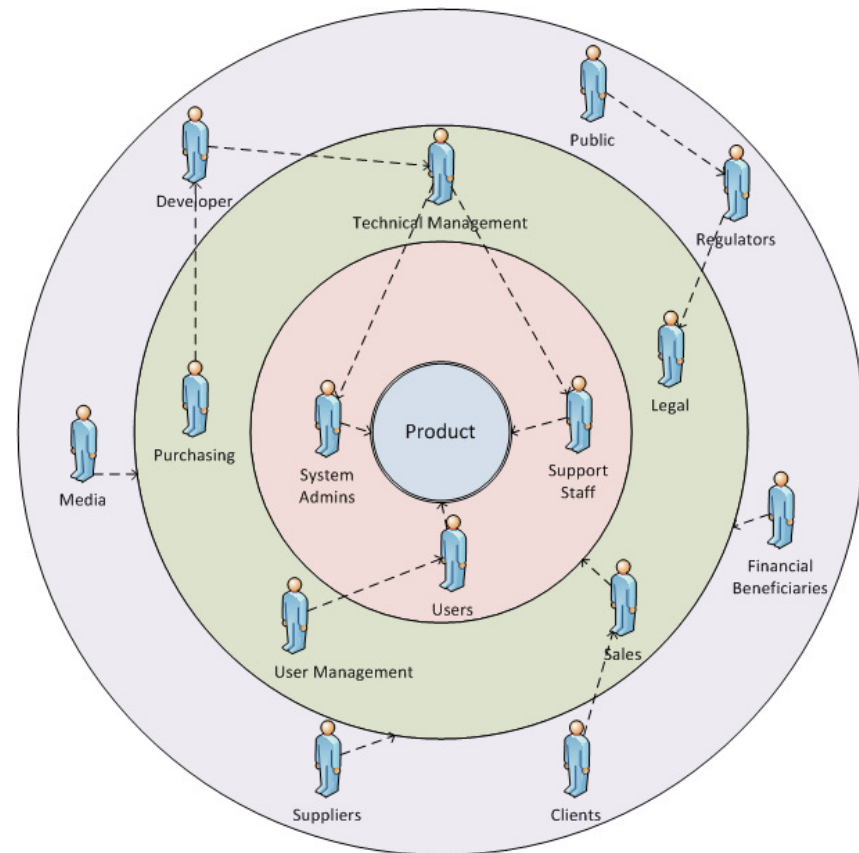
Who Are the Stakeholders?

- Not as obvious as you think:

- those who interact directly with the product

- those who manage direct users

- those who receive output from the product

- those who make the purchasing decision

- those who use competitor's products

Stakeholders

- People who would in some way be involved with the new system

- Categories of users (Eason, 1987):
  - **Primary** – the people who will use the system (frequent, hands-on)
  - **Secondary** – people who produce input for the system, or receive output from the system, but may not directly use it (occasional or via someone else)
  - **Tertiary** – people who are affected by the system's introduction, or will influence its purchase, but are neither primary nor secondary stakeholders
  - **Facilitating** – the people involved in the system's design, development, and maintenance.

Stakeholders: Illustration

- An example onion diagram

Stakeholders: Example

A restaurant introducing waiter tablets and automated billing system

Who are the stakeholders?

Stakeholders: Example

- A restaurant introducing waiter pads and automated billing system
  - **Primary** – the people who will use the system
    - e.g. the waiters in a restaurant.
  - **Secondary** – people who produce input for the system, or receive output from the system, but do not directly use it
    - e.g. the restaurant goers who are presented with a bill produced by the system at the end of their meal.
  - **Tertiary** – people who are touched by the success or failure of the system, but are neither primary nor secondary stakeholders
    - e.g. the owner of the restaurant chain.
  - **Facilitating** – the people involved in the system's design, development, and maintenance.

Requirements Development

Requirements Development

- Once the stakeholders have been identified their characteristics are analysed to develop user centred requirements for the system

Requirements Development

- Analysis in terms of the following aspects:
  - Aims
  - Sources of satisfaction
  - Knowledge and skills
  - Attitudes to work
  - Work-group attributes
  - Nature of activities
  - Responsibility
  - Working conditions

Aims

- What does the stakeholder have to achieve, and how is success measured?

- Example
  - *Waiters have to ensure diners are served at appropriate times and are happy with the level of service (not too intense or too disinterested)*
  - One way to measure a waiter's success may be the size of their tip

Job Satisfaction

- What are the stakeholder's sources of job satisfaction?
- What are the sources of dissatisfaction and stress?

- Example
  - For a waiter this may be the pleasure of serving food and providing a pleasant eating atmosphere.
  - They may be stressed by angry customers or a large number of customers to keep happy at the same time.

Knowledge and Skills

- What knowledge and skills does the stakeholder have?

- Example
  - *A chef has extensive knowledge of cooking which the waiters may not*

Work Attitude

- What is the stakeholder's attitude towards work and computer technology?

- Example
  - The owner of a chain of restaurants may be a technophile whilst a chef may be a technophobe
  - This may well cause conflict in the introduction of new technology

Work-group Attributes

- Are there any work-group attributes that will affect the acceptability of the product to the stakeholder?

- Example
  - Is there something about people who become waiters that will affect how well they accept the product?

Features of Activity

- What are the characteristics of the stakeholder's task in terms of frequency, fragmentation, and choice of actions?

- Example
  - *A busy waiter will typically have to perform many fragmented tasks with high frequency in order to keep the diners happy*

Responsibilities

- Does the stakeholder have to consider any particular issues relating to responsibility, security, or privacy?

- Example
  - Waiters may need to be discreet with regular diners who dine each night with a different partner,
  - and may need to ensure that credit card payments are dealt with securely

Work Conditions

- What are the typical conditions in which the stakeholder is working?

- Example
  - The chef of the restaurant typically works in a hot and dangerous environment
  - The owner of the chain of restaurants may work in a conventional office environment.

Soft Systems Methodology (SSM)

Soft-Systems Methodology

- A broader view than socio-technical approaches
  - Considering the organisation as a whole

- The stakeholders and technology are components of the larger context

- Learning and appreciation of the problem situation between a group of stakeholders rather than set out to solve a pre-defined problem

Soft Systems Methodology (SSM)

- Means to understanding the organisational context:

  1. Rich Picture
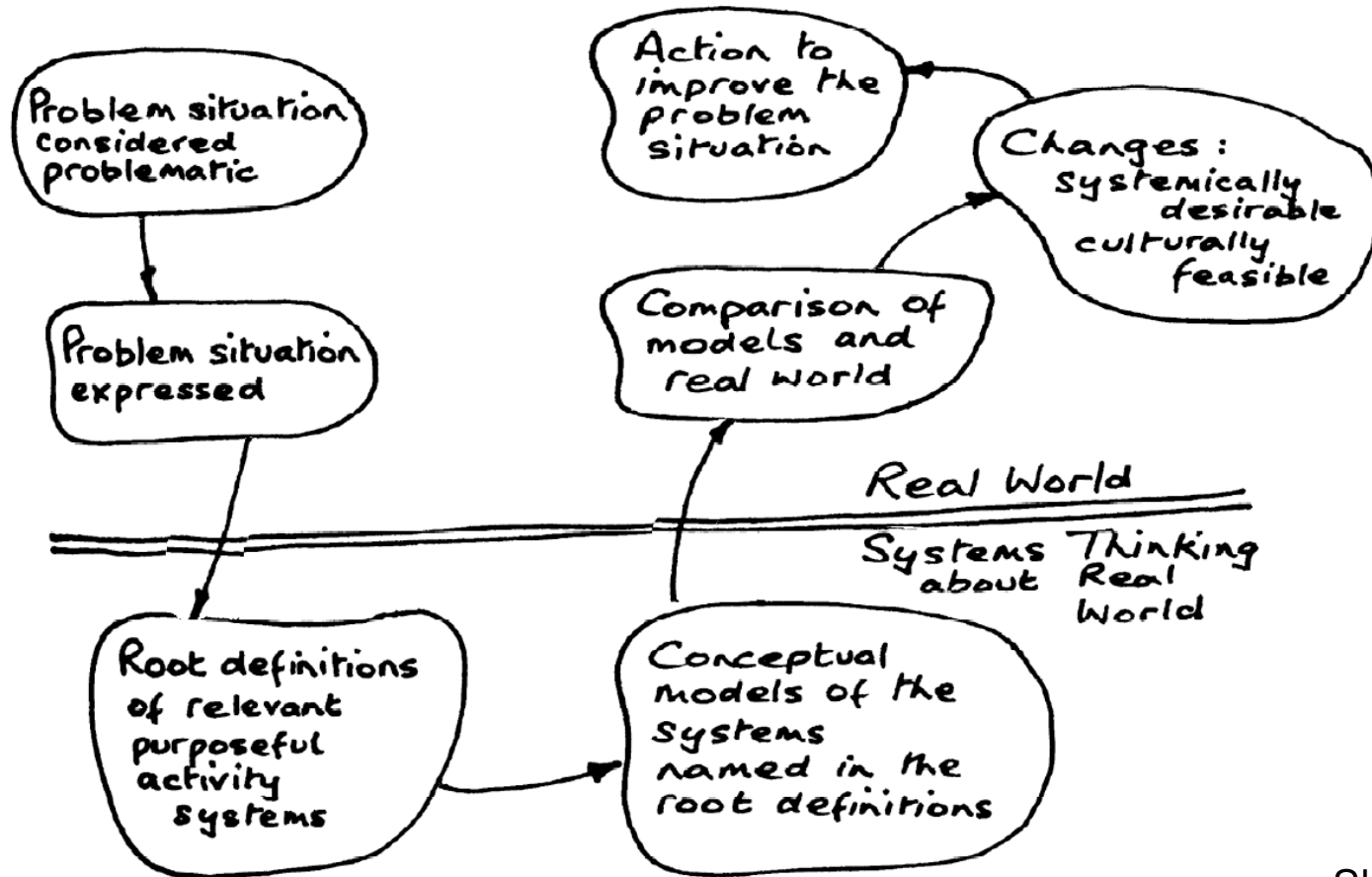 2. Root Definitions
  3. Conceptual model

Further Reading:
- Peter Checkland, Soft Systems Methodology: A Thirty Year Retrospective, Systems Research and Behavioral Science Syst. Res. 17, S11–S58 (2000).
- Soft Systems Methodology in Action, by Peter Checkland & Jim Scholes, John Wiley & Sons, 1990.

Practical Examples:
- http://www.bobwilliams.co.nz/Systems_Resources_files/ssm.pdf
- http://www.jespersimonsen.dk/Downloads/SSM-IntroductionJS.pdf

Soft Systems Methodology

Soft Systems Methodology

- **Rich picture** provides a detailed description of the problem situation

- **Root definitions** of the system - stakeholder perceptions

- **Conceptual model** is constructed with details of what the system has to do to meet the root definitions

Rich Picture

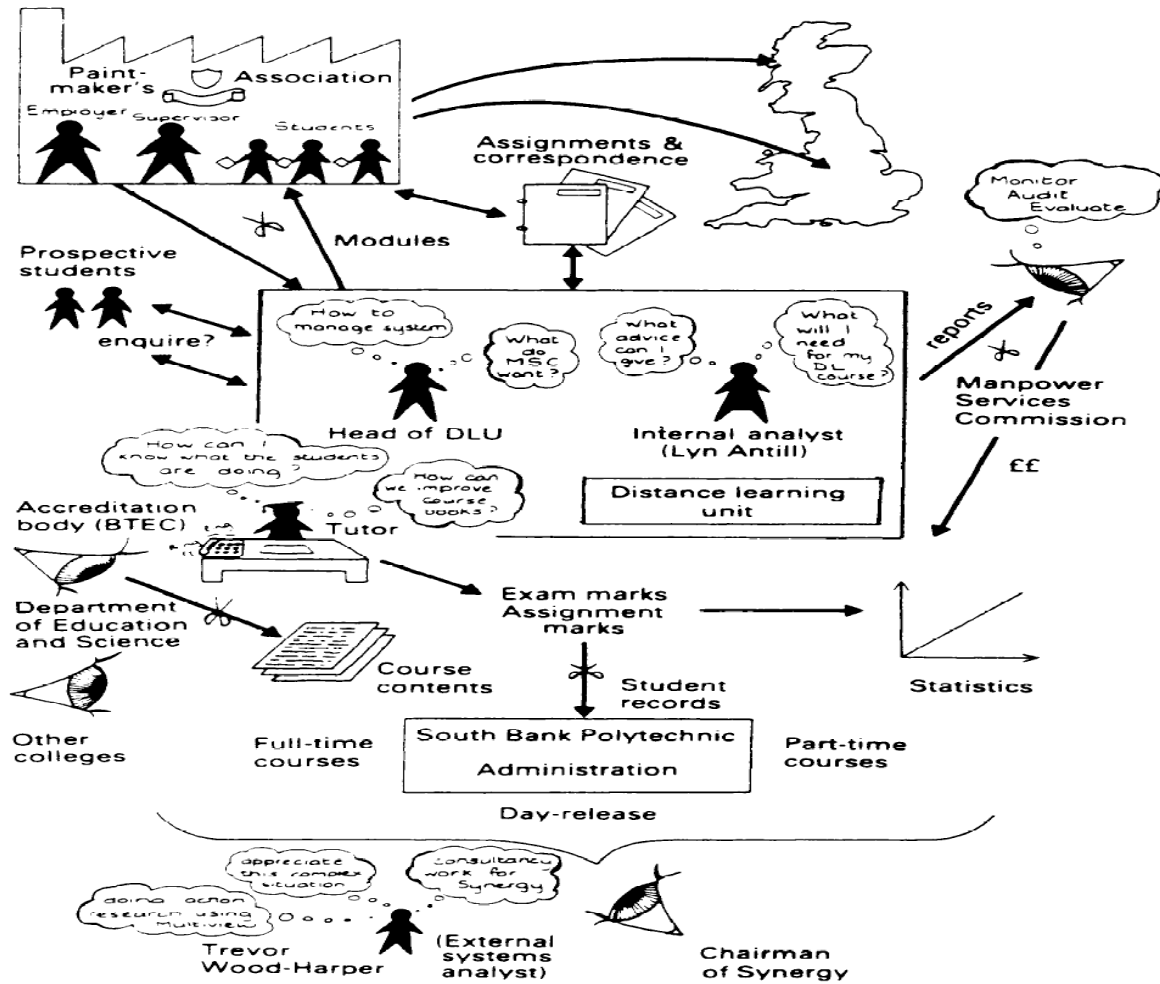Provides a detailed description of the problem situation

- Who are the stakeholders?
- What groups do they work in?
- What tasks do they perform?

Develop the rich picture using:

- Interviews with people in the organisation
- Observations of their work practices
- Interactive approaches such as workshops

Rich **Picture**: Example

The Distance Learning situation
(Wood-Harper et al., 1985)

Root Definitions

- Move the focus of analysis from the real-world situation to the development of **definitions** of what stakeholders perceive to be the activities taking place in the organisation
  - These definitions are referred to as *root definitions* of the system
  - There may be several different root definitions – representing different stakeholders' perspectives

- These need to be reconciled at a later stage

Root Definitions

C A T W O E : to list the perspectives of a situation that must be considered

- **Clients** – people who benefit or accept output from the system
- **Actors** – stakeholders who perform activities in the system
- **Transformations** – what changes the system performs on things in the environment
- **World view** – how the system is perceived by a client
- **Owner** – who the system belongs to, and who can allow changes in the system
- **Environment** – what factors influence the system

Conceptual Model

- The most important part of the root definitions are the transformations
  - These are used in the conceptual model
  - They are used to define what is **achieved**, and how it is achieved

- Achievements are usually modelled hierarchically listing core relevant activities, to provide different levels of detail
  - Writing down the activities to carry out the transformations

Conceptual Model

- Conceptual model is used to identify differences between:
  - The real-world situation
  - Model of how the stakeholders perceive the system

- Different conceptual models represent different viewpoints
  - Can be used as the basis of a debate
  - Can be used to inform change and/ or development of appropriate systems

- The key outcome of the whole SSM approach is for designers to have a better understanding of the **context** in which developed systems are to be placed

SSM: Restaurant Example

- Rich picture
  - Situation: Order taking and payment process in the restaurant
    - Express this situation in all its richness

- Root definitions
  - Holon: Increasing customer satisfaction

- Conceptual model(s)

CATWOE: Restaurant Example

- **Clients** – people who benefit or accept output from the system
  - e.g. the clients may be the diners who benefit from the restaurant nutritionally and receive output from the system by way of a bill.

- **Actors** – stakeholders who perform activities in the system
  - e.g. the waiters and chefs in the restaurant.

- **Transformations** – what changes the system performs on things in the environment
  - e.g. a system which produces bills in a restaurant transforms diners' requests for food (conveyed by the waiters) into bills by the end of the meal.

CATWOE: Restaurant Example

- **World view** – how the system is perceived by a client
  - e.g. a waiter may perceive the current billing system as problematic as it does not help them to efficiently maintain the bills for multiple diners.

- **Owner** – who the system belongs to, and who can allow changes in the system
  - e.g. the owner of the restaurant chain owns the billing system.

- **Environment** – what factors influence the system
  - e.g. a restaurant has to abide by certain health and safety standards.

Conceptual Model: Restaurant Example

- The overall achievement of serving a diner includes the following core activities:
  - successfully finding out what the diner wants
  - serving them
  - clearing the table
  - ensuring that the food is paid for

- Achieving payment for the food involves several sub-achievements:
  - producing the bill
  - collecting the money
  - possibly producing a receipt

SSM: Restaurant Example

- Rich picture
  - Situation: Order taking and payment process in the restaurant
    - Express this situation in all its richness

- Root definitions
  - Holon: Increasing customer satisfaction

- Possible Solution/Development of an appropriate system
  - Waiter pads that speed up order taking, improve efficiency and reduce mistakes and complaints

Lecture Summary

Summary

- We need to understand the user requirements to design effective and suitable systems

- Otherwise we will need to redesign systems
  - Or rely on training

- Costly mistakes can be avoided by understanding the work situation

- Several approaches can be used for gathering requirements:
  - Socio-technical models
    1. CUSTOM Stakeholder Analysis
    2. Requirements Development
  - Soft Systems Methodology (SSM)

TODO

- Meet and greet your team! ☺

- Get ready for the practical sessions
  - Download/read the relevant PDF file on Moodle

- Check out various weather apps that are around

- Go through the description of Task 1
  - Choose and identify your stakeholders

Study Material & Reading

- BOOK: Preece, J., Rogers, Y. and Sharp, H. **Interaction Design**.

Chapter: What is Interaction Design?
Chapter: Establishing Requirements