Data Science Joint Education Program

INFO 102
Introduction to Information Systems

Information Systems Design

Information Systems Design
and
Socio-Technical Systems

Information Systems and People

- In this course we have introduced information systems with a brief overview of information systems design:
- The Wallace people are identified as an important component in information systems (however):
  - People are central to a successful information system
  - Therefore: people must form a central part in information systems design

Information Systems and People

- In considering information systems and people:
  - The traditional approach to information systems design is the:
    - *Hard Systems* Methodology (HSM)
    - This is the basic approach adopted by Wallace in the course textbook
  - The modern approach to information systems design is the:
    - *Soft Systems* Methodology (SSM)
  - The SSM is operates on similar principles to:
    - *Socio-Technical* information systems design (STSD)

Overview

- In this brief overview of information systems design we will:
  - Introduce the additional course content (not in the textbook)
    - Introduce information systems design
    - Introduce hard systems methodology and soft systems methodology
    - Introduce *socio-technical information systems design*
    - Introduce the C.O.A.T. and POM information systems design models using *rich pictures*
  - Set out ISD exercises

Information Systems Design

Information Systems Design

- We have considered many aspects of IS (taken from Wallace)
- The design aspect does not form part of Wallace
- The social aspects of IS are not fully addressed in Wallace
- In this lecture we will briefly consider:
  - How Wallace addresses IS and *apply it in design exercises*
  - IS *design methodologies* including *socio-technical* design
  - IS design and present the work in the form of '*rich pictures*'
- In the class sessions you will prepare IS design exercises
  - You will be required to present the results in a *5-minute presentation*

IS Design Methodologies

- Essentially two approaches to IS design:
  - Hard Systems Methodology (HSM)
  - Soft Systems Methodology (SSM)
- HSS focuses on:
  - Component technology
  - Management systems
- SSM extends the HSM:
  - While HSM recognizes the technology and management systems
  - SSM considers the agents (people and groups of people) in an organization

Socio-Technical Systems Design

- Socio-technical systems design (STSD) is an approach that considers:
  - Human, social, and organizational factors
- The outcomes from the use of STSD methods is a better understanding of:
  - How human, social, and organizational factors affect the ways in which work is done
  - Technical systems are designed and used
- While managers realize the importance of socio-technical design methods
  - Such methods are rarely used

Wallace

- The course textbook has as a focus HSM
  - SSM are not addressed
- While Wallace recognizes:
  - The organization
  - The technologies
  - People in organizations
- Wallace
  - Fails to deal with the importance of people in. organizations
  - Does not consider information systems design
  - Does not consider socio-technical systems

Information Systems Design

- IS are very individual (termed *domain specific*)
  - Every IS must be individually designed
- When designing an IS we must consider:
  - The organizational structure and plan
  - The *'goal'* of the IS (the *purposeful action* the IS must support)
  - The IS requirements specification
    - This applies to all design: web sites, database, computer programs, etc
  - The sources of data and information / knowledge
  - The socio-technical factors present within an organization
  - The application of disruptive technologies and innovations

Rich Pictures

Design with Rich Pictures

- Part of the soft systems methodology:
  - *Rich pictures* provide a mechanism for learning about complex or ill-defined problems by drawing detailed ("rich") representations of them
- Typically, *rich pictures*:
  - Follow no commonly agreed syntax
  - Are created using *symbols*, *sketches* or *"doodles"* and can contain as much (pictorial) information as is deemed necessary
  - The finished picture may be of value to other stakeholders in the problem being described since it is likely to capture many different facets of the situation
  - However: the real value of this technique is the way it forces the creator to think more deeply about the problem and understand it well enough to express it pictorially (a process known as action learning)

Design with Rich Pictures

- *Rich pictures*:
  - Are a diagrammatic way of relating your own experiences and perceptions to a given problem situation through the identification and linking of a series of concepts.
  - The creation of a rich picture provides a forum in which to think about a given situation. Rich pictures should concentrate on both the structure and the processes of a given situation.
  - Form part of the understanding process (not just a way of recording what you know of a given situation or creating a work of art)
  - The use of *metaphor* in *rich pictures* means that their interpretation by others may be difficult (this may not be important as it is the personal learning aspects that are important to this method)

SYSTEMS THINKING

Working Together to Create a Sustainable WORLD!

Peter Senge

"SYSTEM"

think of a family

Sometimes, Consistent outcomes that nobody wants... What's happening?

the HEALTH CARE CRISIS

the System:
- Too expensive
- not reliable
- Too little access

Why is our Attention focused HERE?

WHERE is the LEVERAGE in the System?

Healthy → NEED TREATMENT → IN TREATMENT

we think

it's this

Complex environmental, Social, psychological causes of illness

Attention

What are we paying attention to?

there's a larger system at work

Coca Cola... goal: reduce water use

WATER Scarcity

WWF "you use hundreds of liters for a liter of Coke" ...To grow the Sugar

The CEO water Mandate: learn how to manage water... Sources, uses

Political & Economic Chaos

Singapore KNOWS?
- recycled water
- See Sources
- SHARED STEWARDSHIP

WE ARE ALL PART of a LARGER SYSTEM

How do we SEE the System?

MANAGE the System?

Collaboration is the human face of Systems Thinking

OXFAM: the biggest threat to poor people in the world is climate change

Water

Disease

a SOCIAL, ECONOMIC, and ENVIRONMENTAL PROBLEM

- SEE the System we're a part of ... then ASK
- Where is the LEVERAGE?

Gets lots of People Working Together

YOUNG People and WOMEN are a force for Collaboration

South Africa a problem with collaboration ...Too individualistic

the Consultants helped

use collaboration

"It's us, we're causing the problem"

- Children are Natural Systems Thinkers
- Quality Conversations
- Collaboration

the KIDS get Systems

BETTER HEALTH, BETTER QUALITY, LOWER COST

We can only get all THREE?

Distinguishing High vs. Low LEVERAGE?

SHORT TERM vs. LONG TERM

attractive, but low leverage: the Symptomatic Solution

Pressure for Short Term RESULTS

A BIG PROBLEM in HIGHLY POLITICAL ISSUES

SHIFTING THE BORDEN Archetype

B= Balancing Loop

R= Reinforcing Loop

Symptomatic Solution (B)

DELAY

Problem Symptom (B)

(R) SIDE EFFECT

Fundamental Solution

DELAY

We are NATURAL SYSTEMS THINKERS!

- the most insidious symptomatic Solutions are the most effective ones
- Symptomatic fixes don't deal with Underlying causes!
- Fundamental Solutions Take Longer... they're often Higher Risk
- Side Effects either Make things worse or cause whole new problems

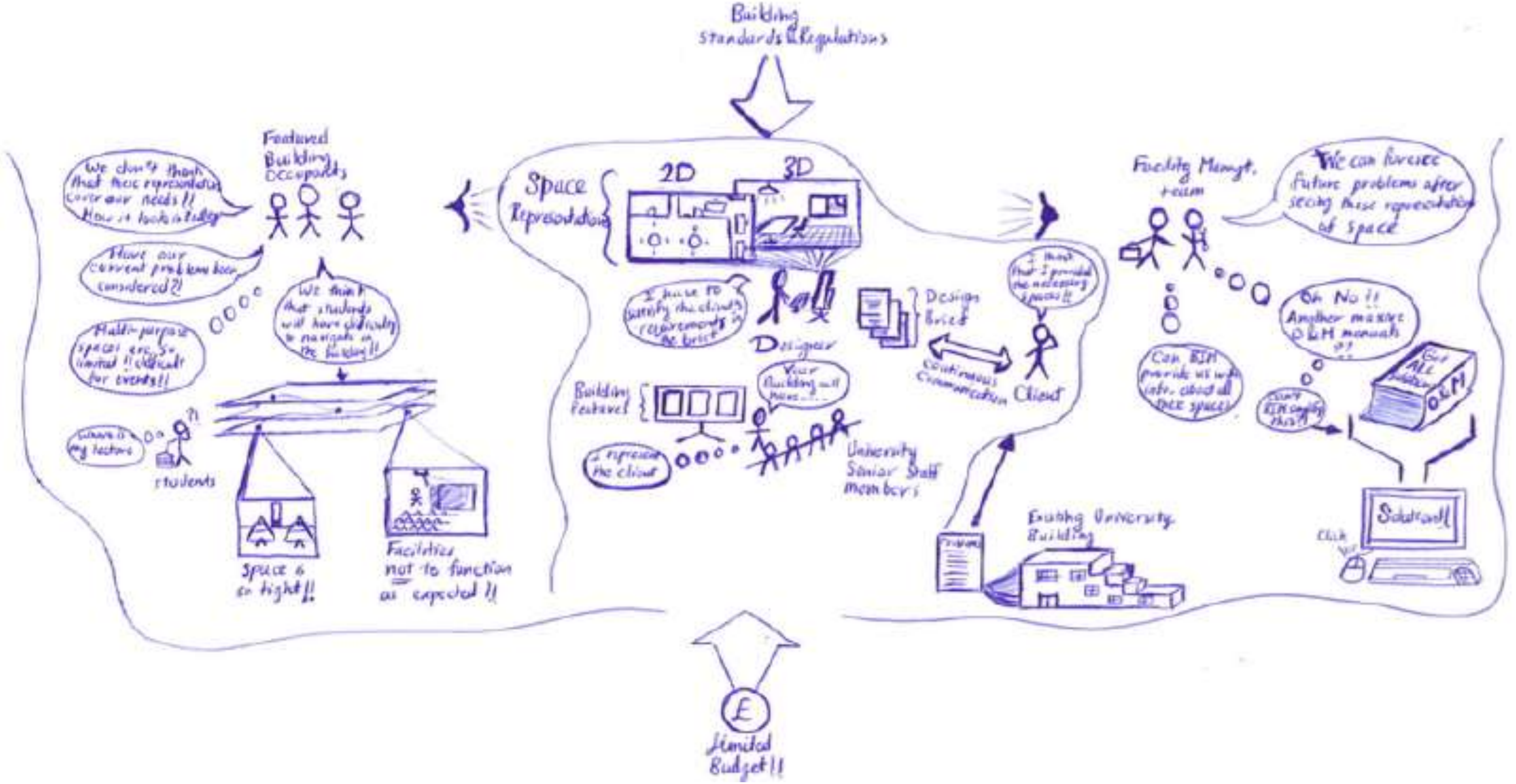
Why are Systems so RIGID?

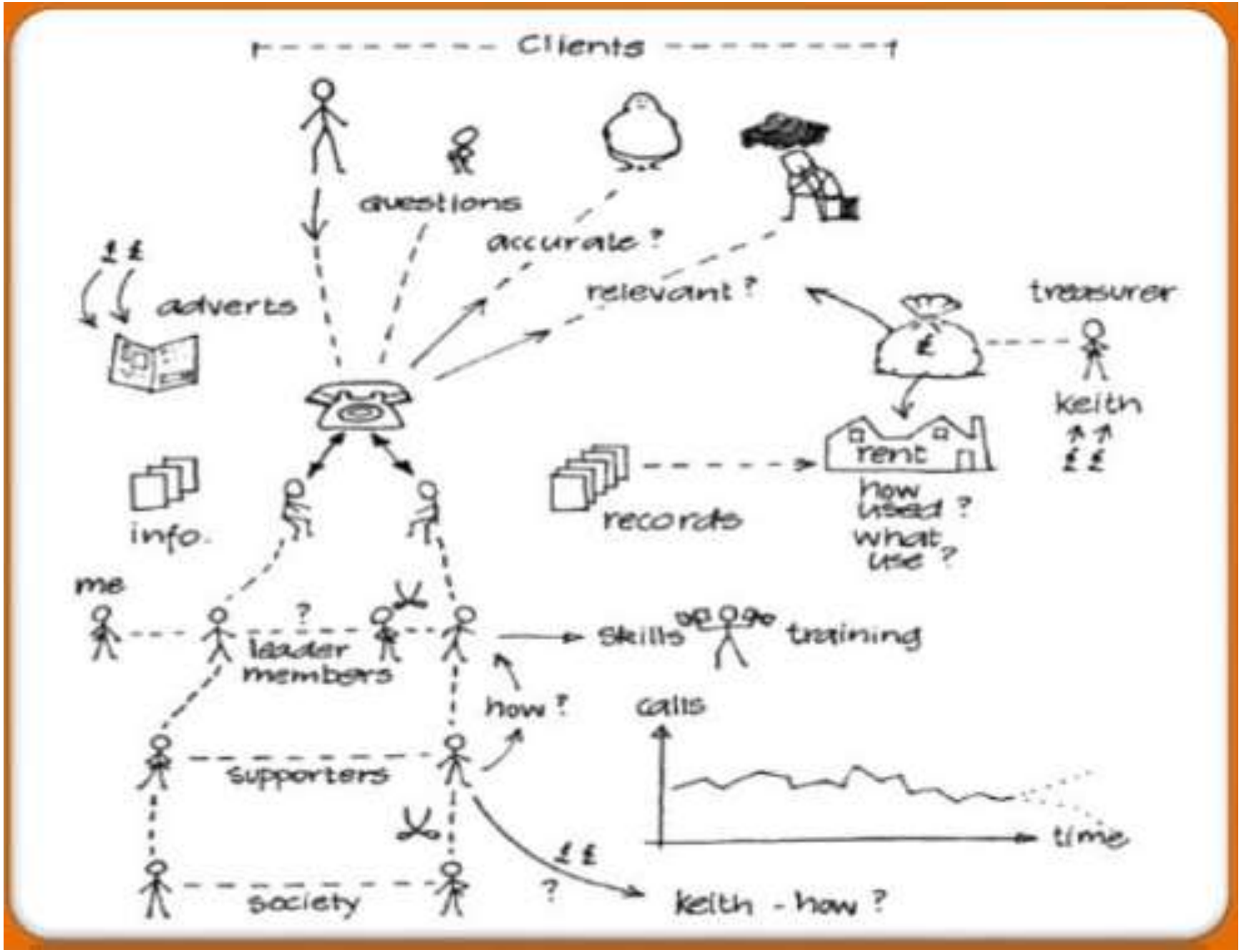
MENTAL MODELS

RECOGNIZING Patterns?

focus on the PATTERN, not on the details

What's YOUR STORY?


Building Standards & Regulations
Featured Building Occupants
We don't think that these representation cover our needs!! How it looks in reality
Have our current problems been considered?!
Multi-purpose spaces are so limited !! difficult for events!!
We think that students will have difficulty to navigate in the building!!
Where is my lecture
students
Space is so tight!!
Facilities not to function as expected !!
Space Representation
2D
3D
I have to satisfy the client's requirements in the brief
Designer
Design Brief
Continuous Communication
I think that I provided the necessary spaces!!
Client
Building Features
Your building will have...
I represent the client
University Senior Staff members
Existing University Building
Facility Mangt. team
We can foresee future problems after seeing these representation of space
Oh No!! Another massive O&M manuals ??
Can BIM provide us with info. about all these spaces
O&M
Solution!!
Click
Limited Budget!!


Clients
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members
skills
training
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supporters
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society
keith - how?

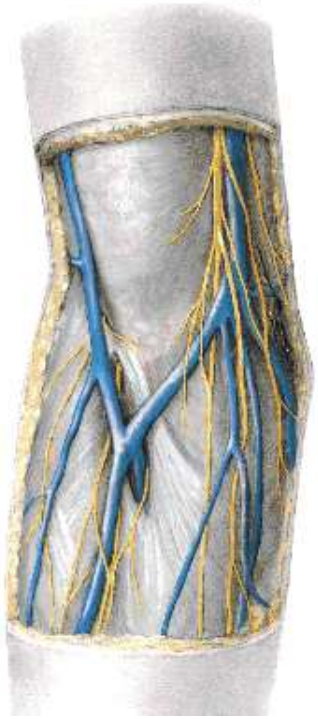
Design with Rich Pictures

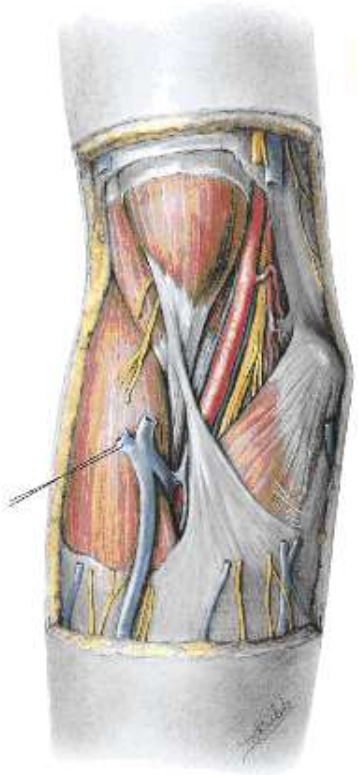
- It is also possible to produce rich pictures as part of a group:
  - By having everybody contribute to a rich picture they can be used to help develop a shared understanding of a given situation.
- Mind maps are often considered to be rich pictures:
  - But since these tend to be mainly text-based and do dictate a degree of formality with respect to their structure clear distinctions can be drawn
- Generally, the two notations serve different purposes (for example, in the field of systems engineering).

Mind Maps

- A *mind map* is a diagram used to visually organize information
- A mind map is hierarchical and shows relationships among pieces of the whole
  - It is often created around a single concept, drawn as an image in the center of a blank page, to which associated representations of ideas such as images, words and parts of words are added.
  - Major ideas are connected directly to the central concept, and other ideas branch out from those major ideas.

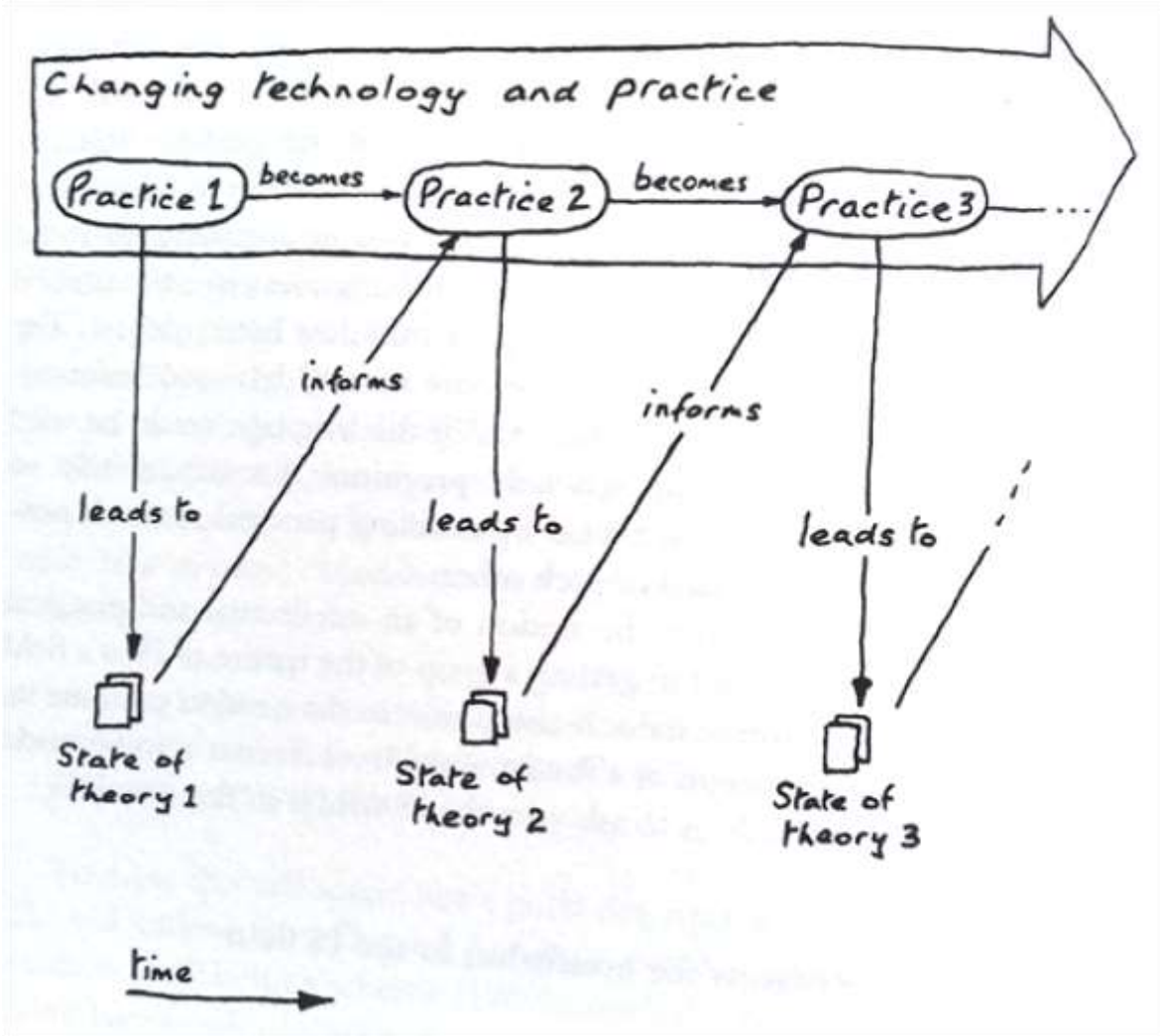
- Cubital Fossa
  - from medial to lateral contain
    1. Median nerve
    2. Brachial artery
    3. Tendon of Biceps
    4. Radial nerve
    5. Radial nerve deep branch
  - in its superficial facia
    - cephalic vein
    - Basilic Vein
    - medial cubital vein
      - superficial to the bicipital aponeurosis
      - separates it from the brachial artery
      - Protect it during intravenous injections
      - and blood transfusions
  - Skin depression
  - Triangular Shape
  - in front of elbow
  - Clinical aspects
    - BP measurements — for stethoscope
    - palpate for the brachial pulse
    - used for venous access (phlebotomy)
  - Cubital tunnel
    - channel
    - allows the Ulnar nerve
    - to travel over the elbow
    - Cubital Tunnel Syndrome — Chronic compression
  - Borders
    - medially — Pronator teres
    - Leterally — Brachioradialis and supinator
    - Base — Line between Epicondyles
    - superficial boundary
      - Skin
      - deep fascia
      - bicipital aponeurosis — grace of God / protect contents of the fossa
    - deep boundary (floor) — Brachioradialis and supinator



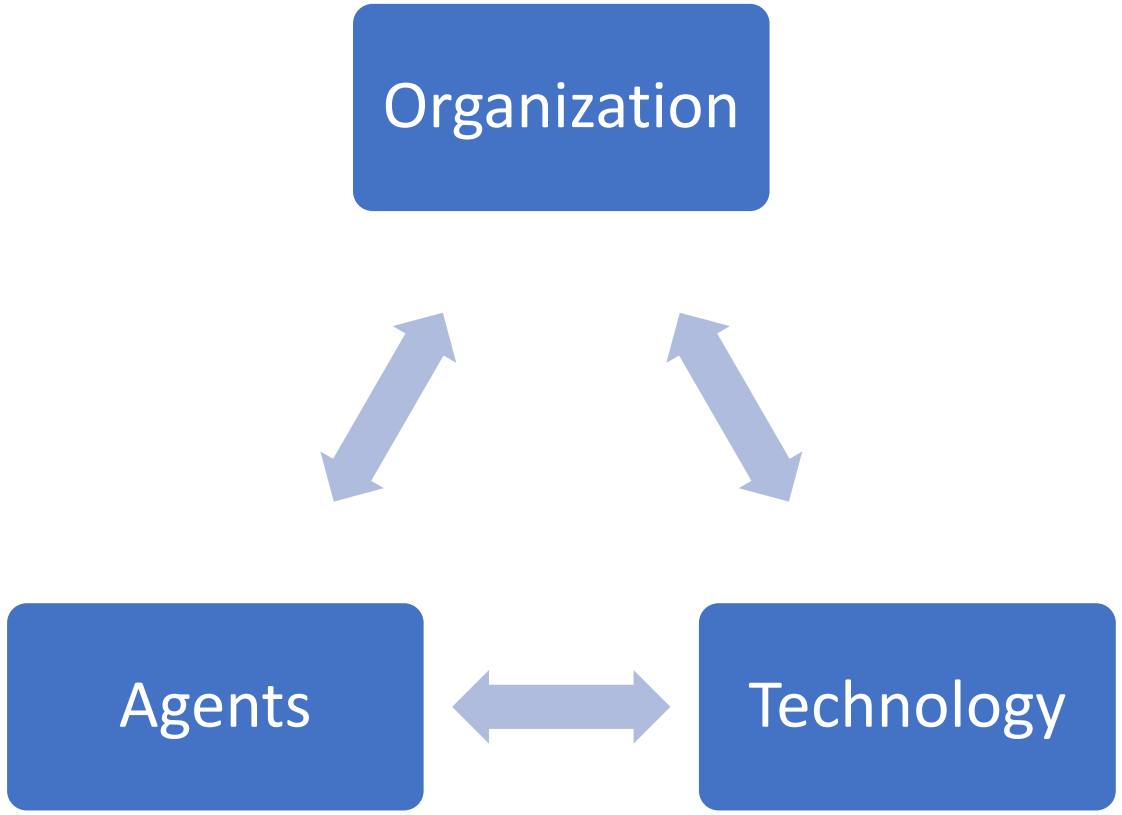


Information Systems Design Theory

Information Systems: Theory and Practice

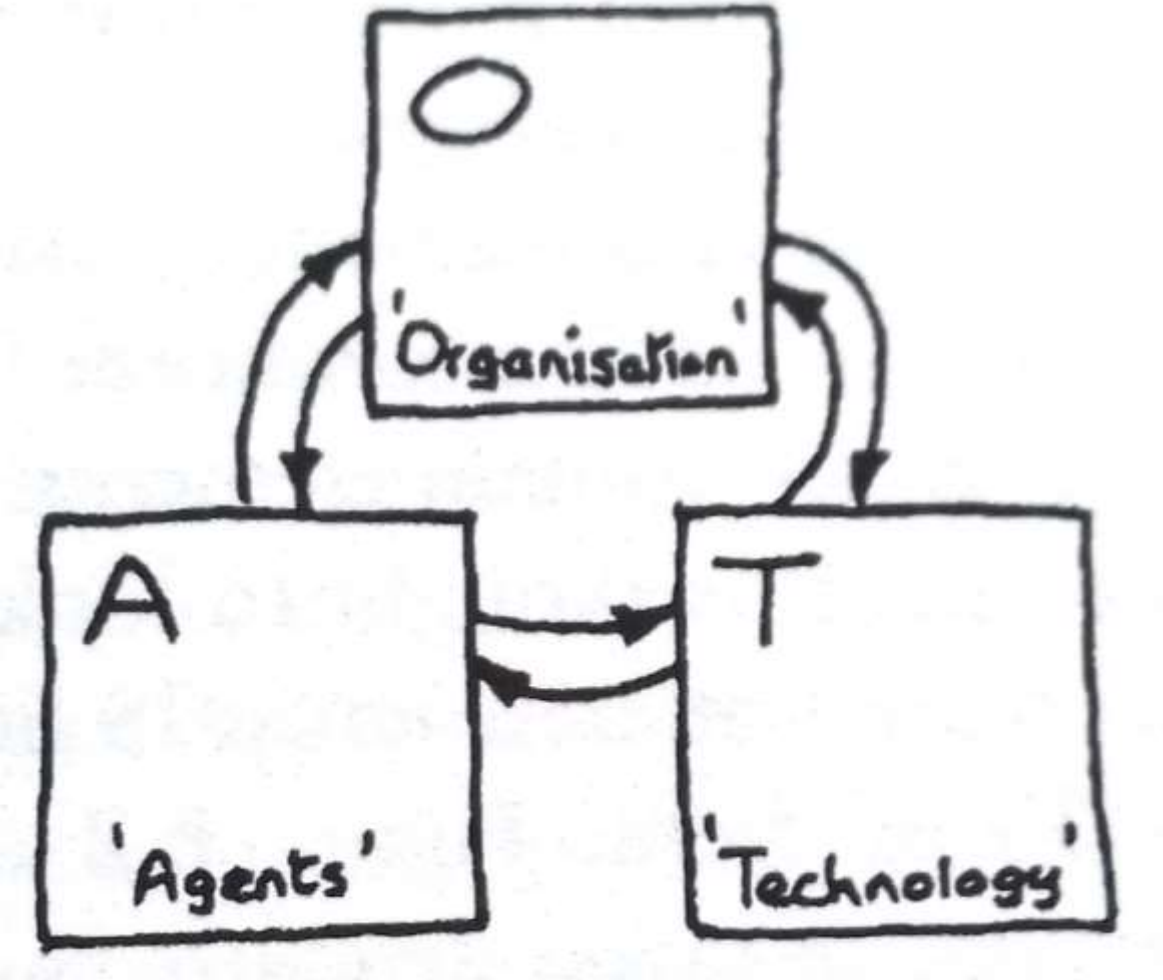


Information Systems: Elements and Interactions



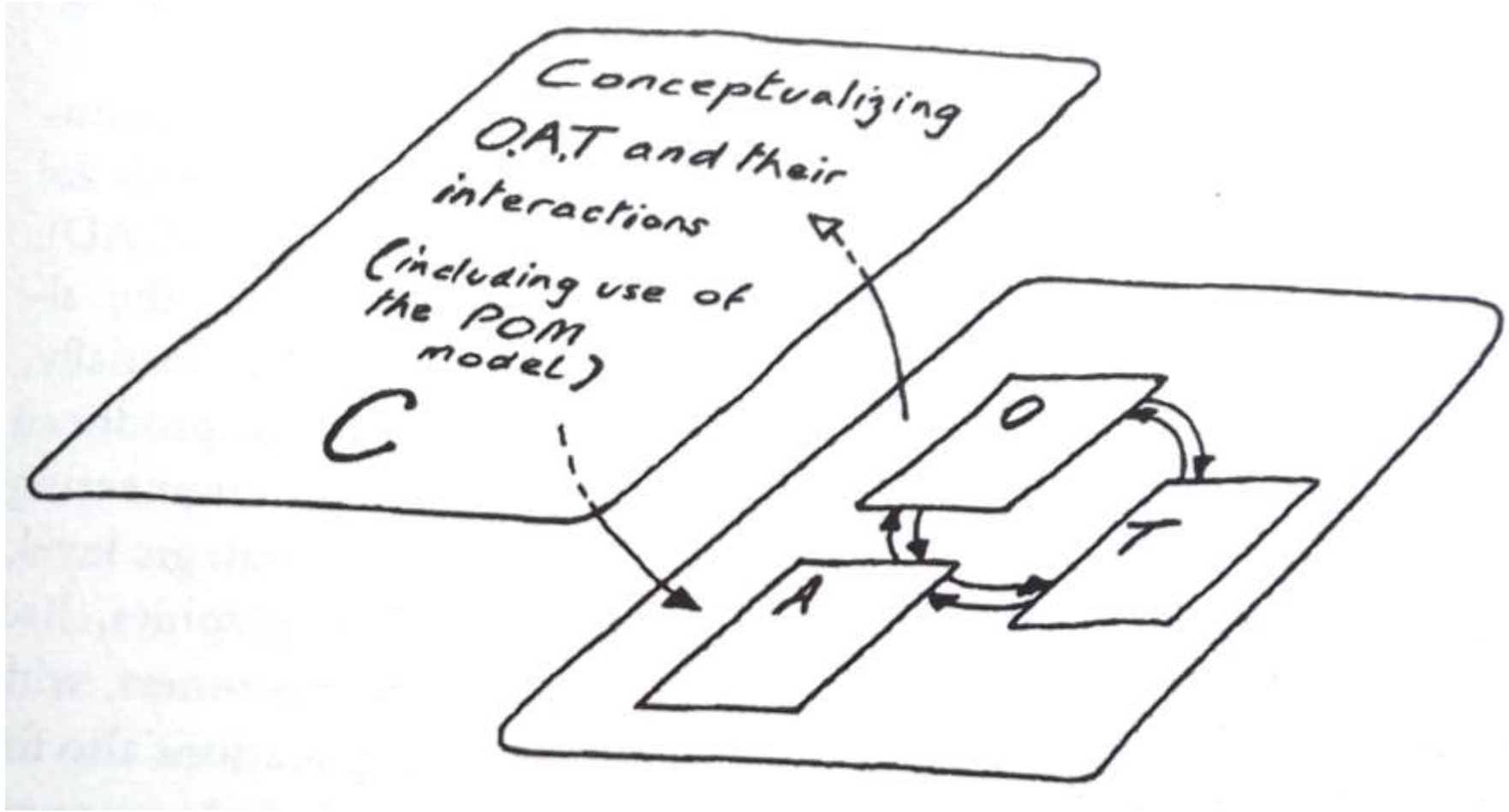
- There are three components (elements) that combine to create an information system:
  - The *organization*
  - The *agents* (people or groups of people
  - The *technologies*
    - Established technologies
    - Disruptive technologies

The Interacting Elements of the POM Model



- The elements whose interactions enact the *Process of Organisation Meanings* (POM) are:
  - The *organization*
  - The *agents*
  - The *technologies*
- The *interactions* are modelled in the POM model

The C.O.A.T. Model

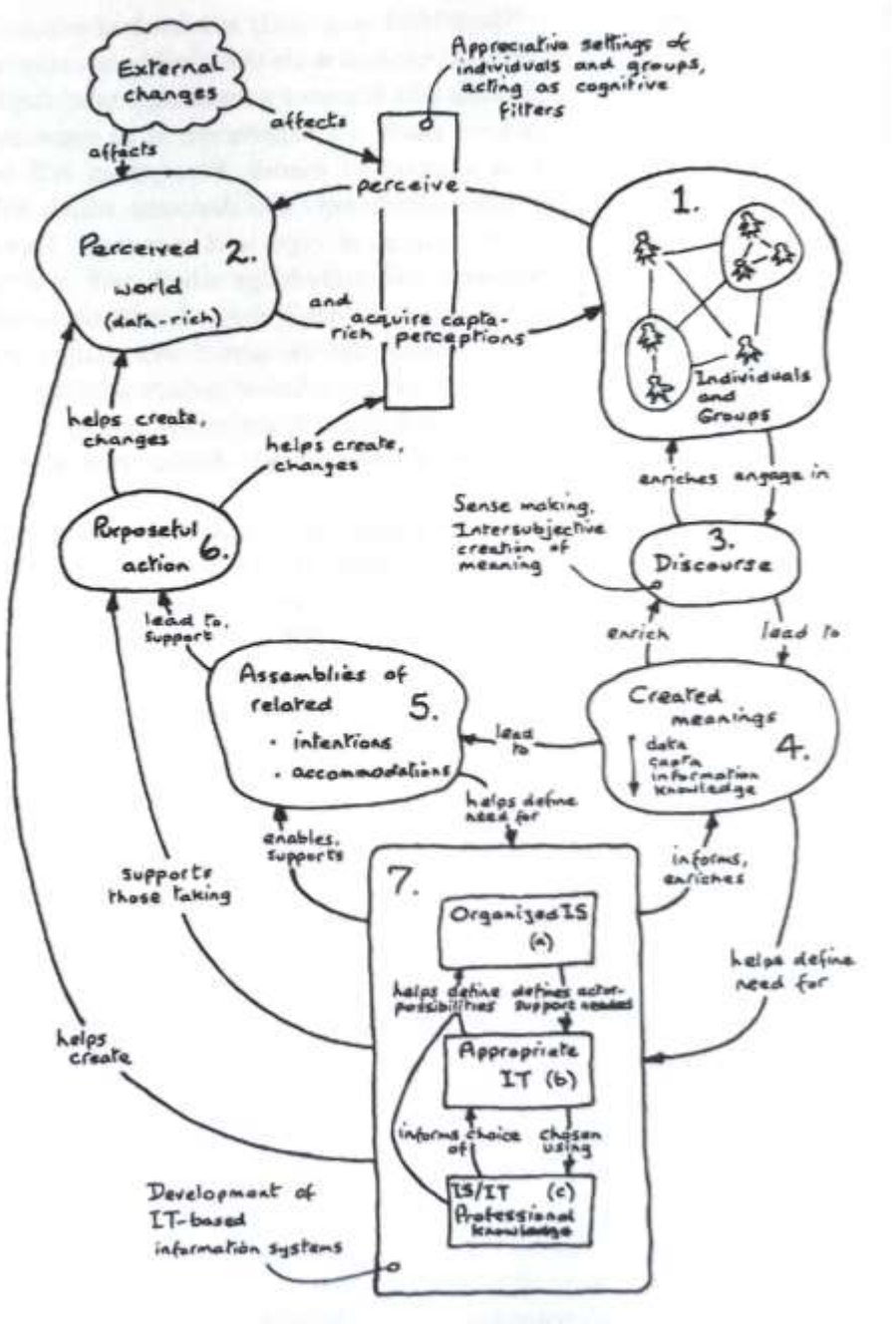


The C.O.A.T. model

- Conceptualizing the O.A.T. interactions
- Including using the POM model

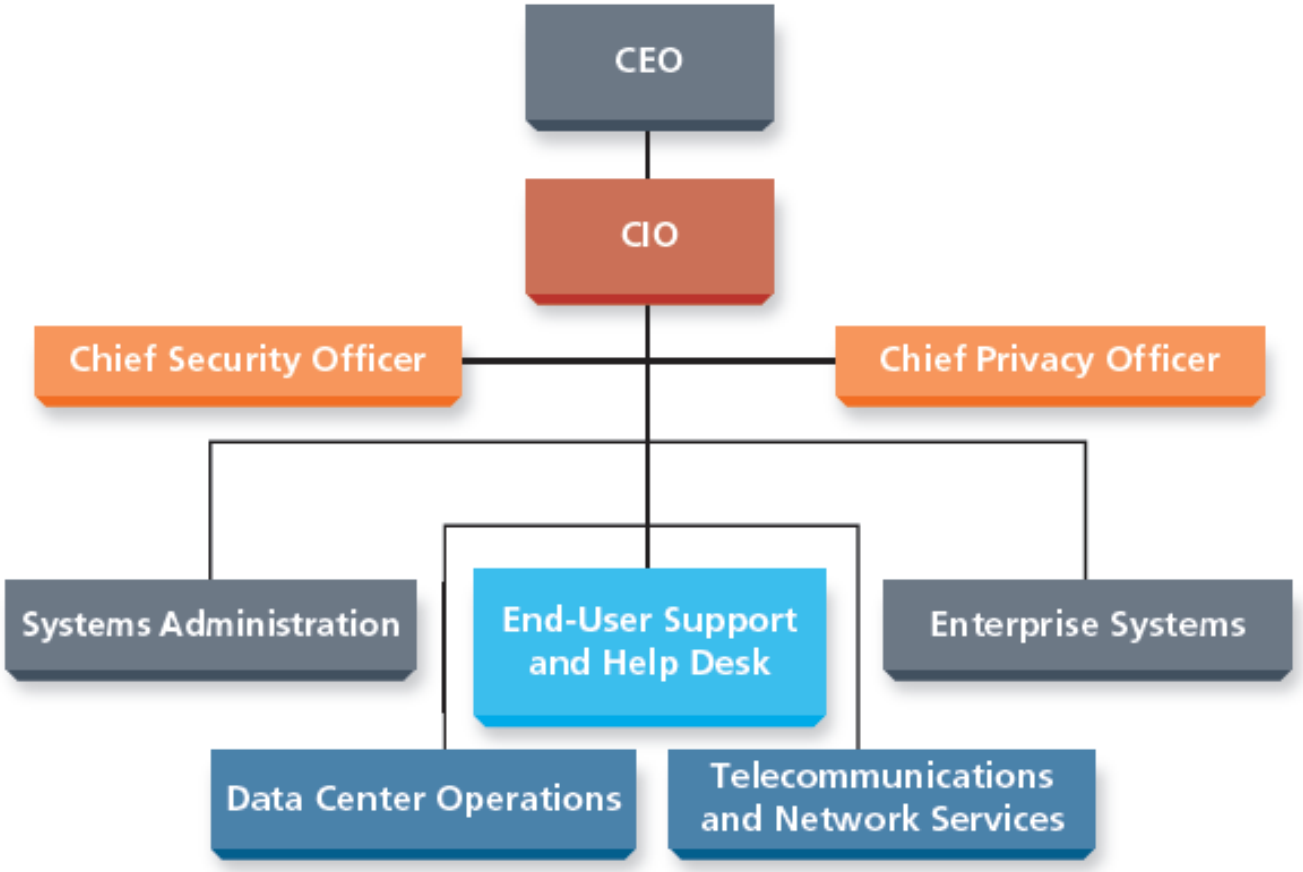
The POM Model

- The *Process for Organization Meanings* (POM) model
  - The *'organizational'* form of the model of the *social process* in which *'meanings'* are established
  - 'Meanings' lead to support for people (or groups pf people) undertaking *'purposeful'* action



A Typical Organisational Structure

- The model shows:
  - A prototypical hierarchical structure for an organisation
  - The focus of this model is the IT department and the relationship to:
    - The CEO and the CIO
    - The internal relationships between the departments and functions are shown



Information System Design Exercises

Design Exercise Overview

- Consider the organization and the socio-technical factors in the following types of organization:
  - A commercial organization designing and selling technology products
  - A university with multiple faculties and schools in multiple locations
  - A non-profit organization (a charity) providing emergency relief in disaster zones globally
  - A social-network organization (platform) with huge membership

Exercise Tasks

- Identify a typical organisational *structure and plan*
- Identify the ‘goal’ of the IS (the *purposeful action* the IS must support)
- Identify the IS *requirements specification and list*:
  - The sources of data and information / knowledge
  - The socio-technical factors which must be represented in the IS design
  - The application and affects (social and technological) of disruptive technologies and innovations
- Draw rich pictures to provide:
  - An understanding of the relationships that exist in the organisations and use the rich pictures to promote *action learning*

Exercise Output

- The result of your investigations will be:
  - An organizational structure plan (for each type of organization)
  - The purposeful action (goal) of each type of organization
  - The requirements specification for each IS
  - A list of data / knowledge required
  - Rich pictures showing the social interactions (the C.O.A.T. and POM models)
  - The technologies required to support the IS and the ‘goal’

Exercise Output

- The result of your investigations will be:
  - The structure plan will be in a conceptual model tree format
  - The requirements specification will be in a written list
  - The social and technology design will be in the form of a ‘rich picture’
- You are required to:
  - *Prepare* and *submit* the IS design exercises
  - Present the results in a *5-minute presentation*
  - All the exercises will be carried out in the class sessions

Writing Requirements

- The IS design will not require computerised systems to *prepare* and *submit* the exercises (to be completed in class sessions)
- You will need:
  - Pens
  - Pencils
  - Rubbers (rich pictures develop and are created with many changes)
  - Plain A4 paper to:
    - Prepare the lists
    - Draw the rich pictures