Why models and modeling?

- Real life phenomena are **complex** thus difficult to describe just using text
- Models can be used to **understand** them
- Models are also tools for **planning**

→ Modeling has to be **goal driven**
Model characteristics

What do all these models have in common?

- **Representation** of real life phenomena
- Do not depict all but only **relevant aspects**
- **Replace** certain subjects for a certain amount of time in a limited manner
  (Stachowiak, 1973)

→ Models are usually only useful for a **certain period of time**
Model characteristics
What do all these models have in common?

• Do not only represent but may also be used to form reality.

• Models are not self-explanatory. Additional context is required to understand them.

• Models are the result of a construction process done by a modeler.
Organization

individual [1...n]

mental model of structure

A: perceiving and reflecting on structure

B: articulating and negotiating

C: contributing to the developing of structure

model - externally represented structure

reality - perceptible structure
Coordination Theory
Malone and Crowston (1990)

- **Processes:** Means for Coordination

- Which are the *elements* of Processes / Coordination?
  - Actors
  - Activities
  - Interdependencies (between resources)

- Elements of all modeling notations

- Need to coordinate: Development of common notation
Coordination Theory
Malone and Crowston (1990)

• Definition:
  • Relating goals, activities and actors to each other AND
  • Managing interdependencies

• Interdependencies between activities can be analysed by common / shared entities (objects)
Interdependencies between activities:

Results

• Activities may have **similar** or **conflicting** results
### Interdependencies between activities: Results

- Activities may have **similar** or **conflicting** results

<table>
<thead>
<tr>
<th>Kind of interdependency</th>
<th>Coordination mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar result</td>
<td>Identify and stop redundant work: Merge activities or choose one</td>
</tr>
<tr>
<td>Overlapping results</td>
<td>Negotiate common results</td>
</tr>
<tr>
<td>Conflicting results</td>
<td>Choice of one activity / task</td>
</tr>
</tbody>
</table>
Interdependencies between activities: Input

- Activities may need the same input
Interdependencies between activities: Input

• Activities may need the **same input**

<table>
<thead>
<tr>
<th>Kind of interdependency</th>
<th>Coordination mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sharable resource</td>
<td>• Make conflicts transparent</td>
</tr>
<tr>
<td>• Non-sharable resource</td>
<td>• Plan use of resources</td>
</tr>
<tr>
<td>• Non-reusable resource</td>
<td>• Choose one activity</td>
</tr>
</tbody>
</table>
Interdependencies between activities: Input

- The **result** of one activity can be the **input** for another activity
### Interdependencies between activities: Input

- **The result** of one activity can be the input for another activity

<table>
<thead>
<tr>
<th>Kind of interdependency</th>
<th>Coordination mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible</td>
<td>Fix sequence</td>
</tr>
<tr>
<td></td>
<td>Ensure usability of output</td>
</tr>
<tr>
<td></td>
<td>Control resource flow</td>
</tr>
<tr>
<td>Incompatible</td>
<td>Re-structuring of activities</td>
</tr>
<tr>
<td></td>
<td>Adding conflict-resolving activity</td>
</tr>
</tbody>
</table>
Specifics of visual modeling notations

- Consist of **elements** (visual shapes) and **relations** (connections between them)
- A **syntax** describes how these elements may be interconnected with each other
- A **semantic** describes their meaning in relation to real life phenomena

Some modeling notations contain **multiple diagram types** (e.g. UML)
Elements of modeling notations

- Organizational structure
  - Roles (e.g. engineer, project manager)
  - Rights and responsibilities
- Functions
  - Workflow
  - Executed by roles or systems
  - Same granularity as other functions
- Information
  - Data and containers (artifacts)
- Resources
  - In- and Out-put for (Sub-)processes
- Control
  - Branches and conditions
Typical challenges of modeling

• **Creating a model:** How to start, how to go on?

• **Appropriate abstraction:** What to include, what to leave out in a model?

• **Representing real life:** How to translate real life phenomena into modeling notation?

• **Choosing modeling notation and tools:** What is appropriate for whom / for which purpose?
Modeling: How to do it?
Freund and Götzer (2008)

- Decide which elements / perspectives of modeling should be used
- Gather information about process and its context
- Use reference models
- Choose a suitable modeling notation
- Analyse processes
  - Existing processes
  - Requirements for new processes
Choice of a modeling notation

• **Goal** of a modeling project

There is **no modeling notation** that fits everywhere.
Choice of a modeling notation

Additional criteria

• **Purpose / goal**
  • Development, analysis, communication, ...

• **Target group(s)**
  • End user, technicians, management, ...

• **Experience** with notations / notations in use

• **Extent of notation / aspects to be modeled**

• **Phase of process management**
  • Documentation, analysis, formalization
Choice of a modeling notation
Freund and Götzer (2008)

• **Syntactical** correctness / quality
  • Is there a meta model for verification? Is it required?

• **Semantic** correctness / quality
  • Can all relevant aspects be represented?

• **Economic** efficiency
  • Effort of modeling, maintenance, usage?

• **Clarity**
  • Can the model be understood? By whom?
Understanding models (or not…)
Reijers et al. (2007)

- If T is executed for a case, can U be executed for the same case?
- Can T, M and 0 all be executed for the same case?
Choice of a modeling notation

Degrees of abstraction and complexity

• **Simple** metaphors
  - e.g. activities and sequences
  - Coarse analyses, communication, overview

• **Formal** models
  - From simple to more complex
  - Analysis and design of processes

• **Programmatical** models
  - Technical orientation
  - Automation