Visual Enhancements of Enterprise Models

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Motivation

Knowledge Management

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Focus

Information Overflow

Visualisation – Enterprise Modelling

Enterprise Modelling

Information Visualisation

Knowledge Visualisation

IT-Outsourcing

Flexibilität

Besseres Service (Service Desk, 3rd Level Support)

Start
Examples of Enterprise Models

Basic Concepts of Enterprise Models

We see enterprise models as:

An IT-based management approach to represent organisational knowledge in the form of (graphical) models that are based either on a user-defined or standardised schema.

Requirements for enterprise modelling techniques:

- Definition of a **modelling language** (including syntax, semantics, notation)
- Definition of a **procedure model** for applying the modelling language
Specification of Modelling Languages

Two state-of-the-art approaches:
• Ontologies
• Meta-models

Common properties:
• Specification of basic entities and their attributes of an application domain.
• Specification of the relations between these entities.
• Availability of internationally aligned standards for both approaches (e.g. OWL/RDFS, MOF)

Possible distinguishing feature:
• Degree of abstraction from the real world

Meta-Model vs. Ontology

Abstraction

low

high

Ontology

Meta-Model
Foundations of Visualisation of Enterprise Models

By reverting to the field of visual language theory and benefiting from the similarities to meta-model/ontology concepts:

- State $S$ of an application domain $AD$ for a visual language, described by objects $O$, attributes $A$ and relationships $R^n$:
  \[ S = \{O, A, R^n\} \]
- Visual language $VL$ composed of a set of visual sentences $VS$. Vocabulary $V$ of VS composed of a set $P$ of visual primitives with visual dimensions $D$, and a set of visual relations $V^n$:
  \[ V = \{P, D, V^n\} \]
- Possible visual dimensions according to (Bertin, 1982): Position (X,Y for 2D), Size, Brightness, Texture, Colour, Orientation, Shape
- Specification of the semantics of $VL$ by mapping e.g.:
  \[ O \leftrightarrow P, A \leftrightarrow D \text{ and } R^n \leftrightarrow V^n \]

Application to Business Process Modelling I

- Application domain Business Process Modelling $BP$ is described by one start object $S$, at least one or more activities $AC$, zero or more decisions $DEC$, zero or more start points of parallel flows $SPAR$, zero or more unions of parallel flows $EPAR$, exactly one end object $E$ and successor relations $SR^n$ between the objects:
  \[ BP = \{S^1, AC^*, DEC^*, SPAR^*, EPAR^*, E^1, SR^n\} \]
  All objects have a name as an attribute, activities have a range of attributes such as costs, duration, actors, input and output documents etc.
Application to Business Process Modelling II

• A graph-based Visual Language for Business Processes consisting of six primitives $SYM_{1,6}$, one relation $ARR$ and an actual set $SET$ of the visual dimensions* size $\psi$, brightness $\lambda$, texture $\tau$, colour $\chi$, orientation $\omega$, and shape $\sigma$ for the primitives and the relation

$$VL^{ADONIS} = \{SYM_1, SYM_2, \ldots, SYM_6, SET, ARR\}$$

$$SET (P \cdot V) = \{\psi, \lambda, \tau, \chi, \omega, \sigma\}$$

*Position dimension left out as determined by graph layout

Application to Business Process Modelling III

• Semantic Mapping between $BP$ and $VL^{ADONIS}$ then takes place as follows:

$$S \leftrightarrow SYM_1, AC \leftrightarrow SYM_2, DEC \leftrightarrow SYM_3, SPAR \leftrightarrow SYM_4, EPAR \leftrightarrow SYM_5, E \leftrightarrow SYM_6, SRn \leftrightarrow ARR$$

• Except for the name the attributes of the AC elements are not mapped to the visual attributes
Example of a Business Process in \( VL^{ADONIS} \)

Application to Business Process Modelling IV

- Central question: Can the remaining attributes be used for additional visualisation purposes?
- Path of analysis:
  - Which attributes are concerned in \( BP \) and \( VL^{ADONIS} \)?
  - Does a change in a \( SET \) result in a change of the semantics?
    \[
    SET_a(SYM6) \neq SET_b(SYM6) \\
    \rightarrow SYM6_a \neq SYM6_b \\
    \rightarrow \{E \leftrightarrow SYM6_a\} \neq \{E \leftrightarrow SYM6_b\}
    \]

- **Hypothesis 1:** Not all types of changes in a \( SET \) directly lead to a change in the semantic mapping.
- **Hypothesis 2:** Semantic mapping is influenced by context.
- **Hypothesis 3:** There is one dominant dimension in the visual language so that other dimensions can be used to code additional information.
Analysis of $V^{ADONIS}$

- Influence of visual dimensions on distinctiveness:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Relevant for Distinction in ADONIS</th>
<th>Number of Elements affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>☑️</td>
<td>0</td>
</tr>
<tr>
<td>Brightness</td>
<td>☑️</td>
<td>0</td>
</tr>
<tr>
<td>Texture</td>
<td>☑️</td>
<td>0</td>
</tr>
<tr>
<td>Colour</td>
<td>☑️</td>
<td>0</td>
</tr>
<tr>
<td>Orientation</td>
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<td>3</td>
</tr>
<tr>
<td>Shape</td>
<td>☑️</td>
<td>3</td>
</tr>
</tbody>
</table>

Examples of Visual Model Enhancements I

Colour-coded business process model:

- Start
- Activity A
- Decision
- Activity B
- Activity C

Cost estimator:低成本 10.000000
Examples of Visual Model Enhancements I

Size-coded business process model:

Thank you for your attention!

Questions, Discussion
Selected References for the Presentation

• SequoiaView http://www.win.tue.nl/sequoiaview/