Artefacts in Agent-Oriented Software Engineering

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Outline

• Agents & Artefacts
• SODA+artefacts
• SODA+zoom
• Zooming Artefacts
• Conclusions and Future Work
Introduction

• Agents never live alone
  ➢ they coexist with other agents in a MAS
  ➢ within an *environment* where they act and interact

• The agent abstraction alone is not enough to fully model the environment

• The environmental entities are not agents

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Artefacts

• Artefacts take the form of objects or tools that agents *share and use* to
  ➢ support their activities
  ➢ achieve their objectives

• Artefacts are explicitly designed to provide some *functions* which guide their use.

• An artefact can have *responsibilities*
Example

• Coordination Artefacts
  ➢ govern social activities
  ➢ enable and mediate agent interaction
  ➢ mediate the interaction between individual agents and their environment
  ➢ capture, express and embody the parts of the environment that support agents’ activities

Features & Classification

• An artefact exposes:
  ➢ usage interface
  ➢ operating instructions
  ➢ function description

• Other interesting artefact features are:
  ➢ inspectability
  ➢ malleability
  ➢ linkability

• A possible classification
  ➢ individual artefact
  ➢ social artefact
  ➢ resource artefact
Agents & Artefacts

- Artefacts constitute the basic building block both for
  - MAS analysis/modelling
  - MAS development

- Agents & Artefacts can be assumed as two fundamental abstractions for modelling MAS structure
  - agents speaking with other agents
  - agents using artefacts in order to achieve their objectives

The New Meta-model

- Agents & Artefacts lead to new ontological meta-model for MASs

- Artefacts allow to
  - model the environment as a first-class entity
  - engineer the space of interaction among agents
    (not only mere conversations between agents, but complex agent interaction patterns)
  - enrich MAS design with social/organisational structure, topological models, as well as (complex) security models
New Meta-model in AOSE

• AOSE methodologies should then enable and promote the design of artefacts

• However, no known agent-oriented methodology adopts agents and artefacts as its basic abstractions

• As a consequence, we choose to extend an existing agent-oriented methodology (SODA) with the notion of artefact

Artefacted SODA

• SODA concentrates on inter-agent issues, like the engineering of societies and infrastructure

• The SODA analysis phase is based on three models:
  ➢ the role model
  ➢ the resource model
  ➢ the interaction model

• The SODA design phase is also based on three models:
  ➢ the agent model
  ➢ the society model
  ➢ the environment model
Model Relation

Analysis

Role Table

<table>
<thead>
<tr>
<th>Role</th>
<th>Task</th>
<th>Interaction Protocols</th>
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</thead>
<tbody>
<tr>
<td>name</td>
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Group Table

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<tr>
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<th>Social Task</th>
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Resource Table

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Interaction Protocols Table

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Interaction Rules Table

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Design

Agent Table

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<th>Role</th>
<th>Individual Artefact</th>
<th>Interaction Protocols</th>
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Society Table

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Environment Table

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Zooming SODA

- Goal: scaling with the complexity of task description by introducing a simple layering principle into the models of the analysis phase (role, resources, interaction models).

- Each layer contains a description of the models at a given abstraction level

- The models of the design phase become layered indirectly, since they map the layers described in the analysis phase
Zooming: The Idea

- Individual Task IT
- Role R
- Agent A
- Layer L
- Layer L+1
- Social Task ST
- Group G
- Social Role SR
- Society S
- Agent A
- Agent A

Zooming Artefacts

- Artefacts have a relevant impact on any AOSE methodology
- The notion of artefact itself is affected by the principles of the methodology where it is introduced.
- This is evident when applying zooming principle to artefacts.
Zooming Artefacts: an Example

Conclusions

• We investigate the impact of assuming a new ontological meta-model in AOSE: Agents & Artefacts

• We extend SODA with the concept of artefacts:
  ➢ artefacts have a relevant impact on SODA
  ➢ the SODA principle has an impact on artefacts too

• Artefacts seem to fit well with SODA models
Future Work

- Understanding the implications of the new meta-model in terms of the fundamental agent-oriented abstractions.
- Developing suitable design tools for modelling systems with SODA
- Forthcoming in SODA+zoom:
  - the topological model
  - the organisational model