

Modeling and Simulating Organizations

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Research Goals

Main Goals and sub-goals:

1. Model and Simulate operational Business Processes inside Organizations
 2. Enhance the AOR Simulation Language with Organizational constructs
- analyze existing organizational concepts from the AI area and extract a commonly agreed ontology of human organizations
 - improve the obtained metamodel with concepts originated from the social science fields
 - adapt the metamodel to the AOR simulation language
 - find solutions for the end-implementation languages such as: Java/JavaScript

Research Goals

Challenges:

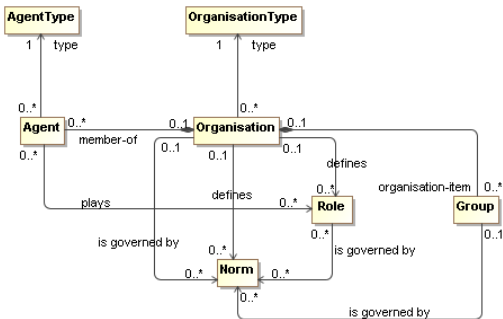
- decide on the commonly agreed organizational ontology of concepts: reduce the diverse concept etymologies under the same semantics
- synthesize the concept set needed for modeling institutions/organizations and NOT for modeling any manifestation of social forms
- consequently, we abstract away from:
 1. simple social groups without inner structure - Tuomela's "weak sense of organization"
 2. complex social forms - Searle's "social reality"

Current Knowledge of the Problem Domain

- different organization definitions and organization ontologies exist nowadays in the literature (sociology, political science, anthropology, psychology, economics, legal theory and marketing)
- we discuss in our paper computational organization theories such as: AGR, Gaia, Brain, OperA, Brahms, Aris, Tropos
- we analyze how approaches originating from/influences by social sciences define the *organizational* concepts

Computational Organization Theories - What is an Organization ?

Concept	AGR	Gaia2	Brain	OperA	Brahms	Aris	Tropos
Organization	x	x	—	x	—	x	—
Group	x	—	—	x	x	x	—
Position	—	—	—	—	—	—	x
Role	x	x	x	x	—	x	x
Human agents	—	—	—	x	x	x	x
Goal-oriented	—	x	—	x	x	x	x



Approaches influenced by Social Sciences - What is an Organization ?

Concept	EO	DOLCE	UFO	Searle	Luhmann
Organization	x	x	x	x	x
Group	x	x	x	x	x
Position	x	x	—	x	x
Role	—	x	x	x	—
Human agents	x	x	x	x	x
Goal-oriented	x	x	x	x	—

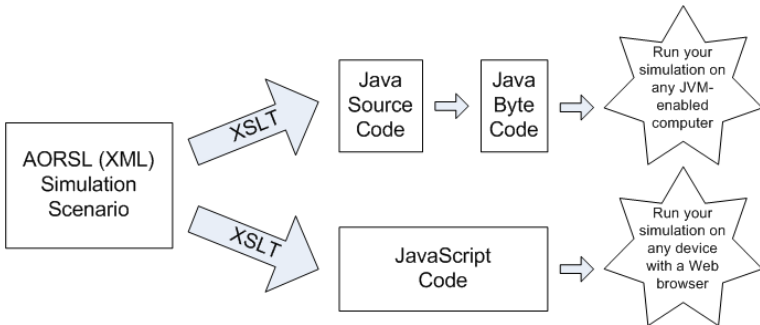
- a distinct class of constructs must be introduced and consequently referred as the class of social concepts
- some entity is a social concept only if it is classified by some normative layer
- the normative layer defines and regulates the social concepts
- the organization concept is a composite entity aggregating individual people belonging to the organization (human agents) but also its sub-unities (groups, organizations)
- the organization has functions or positions which aggregate roles
- individuals perform certain roles within organization by assuming positions defined by the organization

Generalities about ER/AOR Simulation Language

- it supports both basic DES models without agents, also called Entity-Relationship (ER) simulations, and complex agent-based simulation models with agents having (possibly distorted) perceptions and (possibly false) beliefs, called Agent-Object-Relationship (AOR) simulations;
- distinctive features of the ER/AOR Simulation framework are: (1) its high-level rule-based simulation language ER/AORSL; and (2) an abstract simulator architecture and execution model;
- both the behavior of the environment (its causality laws) and the behavior of agents are modeled with the help of rules, which support high-level declarative simulation modeling.

AOR Simulation Language ... a MDA Approach

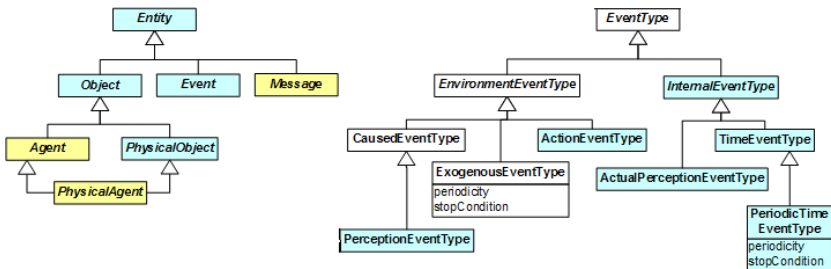
- the simulation scenario is expressed with the help of the XML-based ER/AOR Simulation Language



Agent-based DES: Agent Object Relationship (AOR)

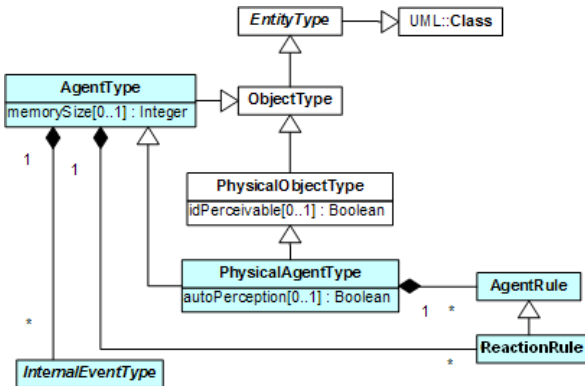
An agent type is defined by means of:

- a set of (objective) properties;
- a set of (subjective) self-belief properties as well as an optional set of (subjective) belief entity types;
- a set of agent rules, which define the agent's reactive behavior in response to perception events (and internal time events).



AOR - Simple Agent Concepts

- The organizational constructs are introduced by means of an abstract syntax which represents an extension of the below AOR simulation language meta-model:

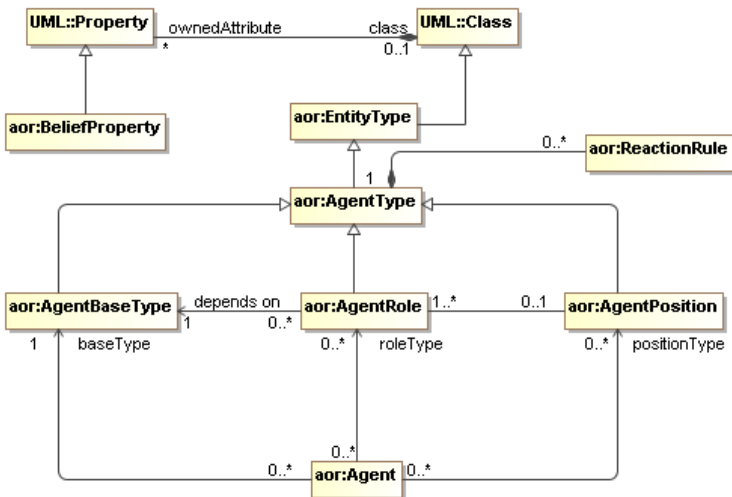


AOR - How do we define an Agent ?

An agent is defined by means of the following types:

- AgentBaseType - defines the fundamental characteristics of the agents and also provides the identity criterion for its instances.
- AgentPosition - defines the common characteristics of the agent positions existing inside of the Organisation, therefore it must be understood as a concept type. An agent position aggregates at least one agent role. When a position corresponds to exactly one role the position equates with that particular role.
- AgentRole - defines common characteristics of the roles existing inside of the institution, therefore it must be understood as a concept type. Roles are constitutive elements of any social institution. They are temporal. They are constrained by a dependency with their base type.

AOR - Agent Types

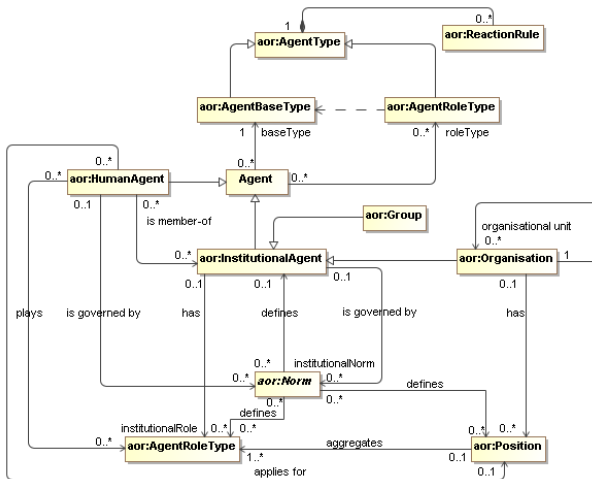


AOR - Agents as Social Forms

We distinguish between:

- institutions represented by the *InstitutionalAgent* concept such as: the institution of English language
- organizations and their sub-unities represented by the *Organization* concept such as: universities and their organization units: senat, faculties, presidential body etc.
- simple forms of institutions such as groups of friends (Tuomela's sense of weak organisation)
- people represented by the concept *HumanAgent* such as: persons or individuals
- other kinds of artificial agents represented by the *Agent* such as: computers or trees

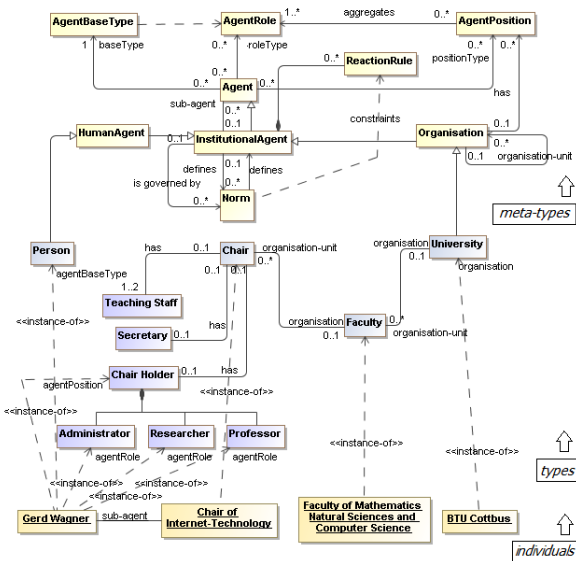
AOR Organizational concepts



University - An Organization Case Study

- we choose to model an academic environment and the concept of University is the first choice to reach
- BTU Cottbus is an example which successfully can instantiate such an organization structure
- we focus on describing only the positions and their associated roles inside of a faculty chair
- we briefly represent the organization structure together with its official positions and aggregated roles in terms of concepts defined by the AOR simulation language and with the help of the UML class diagram which comprises:
- meta-types (elements of the AOR simulation language) displayed on the top of the diagram
- organizational concept types (blue colored)
- individuals (instances of the organizational concept types) displayed on the bottom of the diagram: BTU Cottbus etc.

University - an Organization Case Study



Conclusions and Future Works

- we described a proposal for enhancing the AOR simulation language with organizational constructs
- the presented approach is limited to some default normative behavior exposed at the level of agent/role types: the duty to react to some triggering events and the duty to perform some actions

Future Works:

- defining a normative layer for the proposed organization structure :
- what kind of norms do we need ? (e.g. constitutive norms and regulative norms)
- how does the normative layer constraint the behavior of the organization and of its members?
- how do we adapt the envisioned norm ontology to our AOR simulation language?

QUESTIONS ?

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Thank you for your attention!



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