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Actor Based Spatial Modelling using Multi-Agent Systems (id = @4408.0)

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Abstract

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Actor Based Spatial Modelling using Multi-Agent Systems

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Spatial planning is aimed to change the organisation of a spatial environment to meet the demands of society. Demands of society continuously change as the result of changes in this society itself but also as a result of change in the spatial environment.

As space becomes a limited resource the spatial environment is expected to fulfil multiple functions. Multiple actors compete for the same resources. This results in a increasing pressure on rural areas. The rural areas need to be attractive for recreation, need to fulfil their production function an need to provide the space necessary to meet the claims of expanding urban areas.

At the same time we observe a shift from planning based upon

primarily hierarchical principles (agency oriented planning) towards actor oriented and participatory types of planning.

To produce adequate (in terms of acceptable and sustainable) spatial plans, planners need to have insight into effect that their plans have on the spatial environment and society. Tools that support an "ex ante" evaluation of spatial plans are therefor a basic requirement for a planner. There is a clear need for a kind of artificial environment in which policy can be developed and tested in order to cope with the above described complexity of modern spatial planning.

In this paper we investigate the relation between spatial planning and a Multi-Agent Simulation (MAS) approach. Our main goal is to explore Multi-Agent Systems for their use to understand the effects of individual actor based decision making on the organisation of the spatial environment. The premise is that MAS offers concepts and techniques to handle the complexity beyond that of the capabilities offered by conventional simulation techniques. MAS supports inference of knowledge of and insight into the effects of desires and demands of individual actors upon the organisation of space and vice-versa.

Furthermore this paper points out the relation between spatial planning and MAS using four embedded levels: the level of the social and spatial systems, the level of the social spatial organisation, the level of the planning processes and the level of the individual cognitive systems. Based upon this analysis of spatial planning we propose a intentional model for individual actor based spatial planning.

Next we proposed a multi-agent simulation (MAS) that implements this intentional model. The MAS is loosely based upon a BDI architecture which captures beliefs, desires, values and preferences of an individual actor and relates it to processes described in the intentional model.

The proposed MAS enables simple (rule based) reasoning over individual beliefs and desires based upon sets of values known to all agents or sets of values that are specific to an individual agent.

We implemented the model using a combination of JAVA, SWARM and the expert system JESS. We demonstrate the model by applying it on a

study area in the Netherlands to simulate urbanisation. The MAS enables us to monitor the development of individual and global preferences, the number of conflicts that arise between actors and the result of the mutual decision making process and urban development according to individual actors.

The results shows clearly the potential of Multi-Agent System as an explorative tool to get insight in the complexity of the spatial planning process and especially the role of the interaction between and decision making of individual agents involved in a spatial planning process.

Results

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