Chapter 10
Beyond Citizen Participation in Planning: Multi-Agent Systems for Complex Decision-Making

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ABSTRACT

The new complexity of planning knowledge implies innovation of planning methods, in both substance and procedure. The development of multi-agent cognitive processes, particularly when the agents are diverse and dynamically associated to their interaction arenas, may have manifold implications. In particular, interesting aspects are scale problems of distributed interaction, continuous feedback on problem setting, language and representation (formal, informal, hybrid, etc.) differences among agents (Bousquet, Le Page, 2004). In this concern, an increasing number of experiences on multi-agent interactions are today located within the processes of spatial and environmental planning. Yet, the upcoming presence of different human agents often acting au pairé with artificial agents in a social physical environment (see, e.g., with sensors or data-mining routines) often suggests the use of hybrid MAS-based approaches (Al-Kodmany, 2002; Ron, 2005). In this framework, the chapter will scan experiences on the setting up of cooperative multi-agent systems, in order to investigate the potentials of that approach on the interaction of agents in planning processes, beyond participatory planning as such. This investigation will reflect on agent roles, behaviours, actions in planning processes themselves. Also, an attempt will be carried out to put down formal representation of supporting architectures for interaction and decision making.

INTRODUCTION

The increasing orientation of spatial planning toward the so-called ‘environmental sustainability’ has brought new agents into the process of plan development. Environmental laws and norms, increasingly widespread in different Countries, legitimate a large social participation in planning debates. For example, the diffusion of environmental impact assessment and strategic assessment regulations in Europe, during the 1990s and 2000s, has generated a wide arena of discussion and also an
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important occasion for the development of new technologies.

Different social groups enter both technical and political debates on the two opposite faces of the environmental context. They contribute to the setting up of spatial plans and projects, but meanwhile they are able to delay or speed up them even wrongfully, in the attempt of defending their stakes, considered as absolute principles (Forester, 1999).

A space of mediation and negotiation is continuously created in confrontations and conflicts, and it is managed by mediators or negotiators. They play a role rather similar to the so-called ‘intermediate agents’ of the multi-agent distributed computer science, who are essential in the coordination of such complex task organizations (Ferber, 1999).

To date, the theory and the practice about these planning ‘multi-agencies’ is not able to clear up some theoretical and practical problems that look significant. First, the democratic or oligarchic or even aristocratic basis of multi-agencies (commonsense vs. expert agents, for example; Fischer, 2000) is not clear in its process of building and legitimization, and is open to numerous theorems or cases of impossibility (Arrow, 1963; Owen, 1995). Further, the cooperative compromise approach to solutions is ‘logically’ inappropriate to phenomena that are external to the disputing agents. Finally, the System Theory’s postulate on the ‘super-sum of parts’ seems not always and not clearly affirmative in knowledge domains (Kalman, 1969). These are only few examples of the major problems that planning multi-agencies have to face.

But plans are technical and ‘political’ exercises per se, in that they are both constructions of action optimization over time and ‘social’ organizations toward action, therefore requiring coordination and consensus. As a matter of facts, plans can be also individual constructions, as occurring when for example they are drawn out by a business manager. However, even individual plans may involve multiple agents, because they are typically built upon informational materials developed by other agents (Ferber, 1999).

In general, a large complexity comes out in planning knowledge and exercises, implying innovation of planning methods, in both substance and procedure. The development of multi-agent cognitive processes, particularly when the agents are diverse and dynamically associated to their interaction arenas, may have manifold implications.

In particular, interesting aspects are scale problems in distributed interaction, continuous feedback on problem setting, language and representation (formal, informal, hybrid, etc.) differences among agents (Bousquet & Le Page, 2004).

In this concern, an increasing number of experiences on multi-agent interactions are today located within processes of spatial and environmental planning. Case studies have not been deliberately set up using formalized and/or predefined multi-agent-system layouts, as described, i.e., by Ferber (1999) or Wooldridge (2002). Basically, the need for the involvement of a number of different agents during the planning process induced issues of gathering and exchanging complex knowledge, representing structured concepts, supporting different formal/informal languages, structuring complex problems, allowing synchronous and/or asynchronous communication. Therefore, a multi-agent approach and supporting system (MAS) emerged in a bottom-up fashion, driven by the needs of the activities being carried out.

Yet, the upcoming presence of different human agents often acting _au pair_ with artificial agents in a social physical environment (e.g., with sensors or data-mining routines) often suggests the use of hybrid MAS-based approaches (Al-Kodmany, 2002; Ron, 2005). However, such approaches have not been formalized properly to date, due to both the lack of time allowed by grants associated to projects - mostly target-oriented - and to a research attitude toward the improvement, rather than the formalization of methodologies during that little time available.

In this framework, the chapter will scan some experiences on the setting up of cooperative multi-agent systems, in order to investigate the