Chapter VIII
Multi-Agent Systems Research and Social Science Theory Building

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ABSTRACT

This chapter describes the possible relationship between multi-agent systems research and social science research, more particularly sociology. It gives examples of the consequences and possibilities of these relationships, and describes some of the important issues and concepts in each of these areas. It finally points out some future directions for a bi-directional relationship between the social sciences and multi-agent systems research which hopefully will help researchers in both research areas, as well as researchers in management and organization theory.

INTRODUCTION

In the early 1980s, Newell (1982) defined the concept of Agent within computer science in his presidential speech as the first AAAI president, and agents and multi-agent systems have since been an area of interest for computer science students and researchers alike. The late seventies and early eighties of the 20th century are the early years of agent research, still searching for direction and a fitting name. From distributed artificial intelligence, coordinated distributed problem solving, and multi-agent systems (MAS), it is the latter name (and corresponding view on these systems) that survived, even if we in most MAS applications can see the distributed problem-solving paradigm (which had its focus on developing special-purpose systems to solve complex real-world problems).

Already in the early days of multi-agent systems research there have been attempts to and cries for the use of social science theories and concepts (Bond & Gasser, 1988; Conte & Gilbert, 1995; Verhagen & Smit, 1996). As for the social science, there the use of agent-based simulation models (or individual-based models) has been heralded as an instrument to conduct

social experiments using artificial societies not viable in human societies (Axelrod, 1997; Verhagen & Smit, 1997; Brent & Thompson, 1999; Lansing, 2002; Macy & Willer, 2002; Sawyer, 2003, 2004). Multi-agent systems can be seen as a development at least partly based on artificial intelligence, thus this is even a claim within the agent society in the same sense that AI was claimed to be "the" instrument for developing and testing theories of cognition (Simon, 1970). Time will tell if MAS will have more impact than AI has had and if it is indeed possible to build "artificial humans."

In the remainder of this chapter I will focus upon the relation between MAS research and the social sciences, present some recent work on integrating frameworks that might help to overcome some of the difficulties in combining these research areas, and finally present some remaining problems.

MULTI-AGENT SYSTEMS RESEARCH AND THE SOCIAL SCIENCES

The relationship between these two research areas can take three different forms:

1. **The social sciences inform or help MAS research:** The social sciences are used in two different ways in the development of theories and models of multi-agent systems. The first way of use is the "borrowing" of concepts developed in the social sciences, such as coordination, organization, convention, norm, trust, and so on in multi-agent systems research. A second way is to contrast agent theory with social theory, based on the distinctions between artificial systems and humans. For example, humans cannot be programmed such that they never violate a norm or always cooperate, but artificial systems can.
2. **MAS research informs or helps the social sciences:** According to Castelfranchi (1998, 2000), agent theory should also produce theories, models, and experimental, conceptual, and theoretical new instruments, which can be used to revise and develop the social sciences. He summarizes this point by stating that agent theory—and the related area of artificial intelligence—is not just an engineering discipline, but it is also a science and thus should develop theories, concepts, and methods of its own. I will give an overview of MAS research for social scientists, with a focus on MAS-based simulation studies, since I presume these to be the main product of interest in this category for social scientists.
3. **The social sciences and MAS research have a bi-directional relationship:** Bi-directional research can be obtained via multidisciplinary researchers or multidisciplinary research teams. The tight cooperation between MAS research questions and social science is a complicating factor, but may produce interesting and better grounded results for both areas. Few projects have a focus on both relations. A prime example of such work is the different projects within the German Socionics research effort (Malsch, 1998; Kron, 2002; Köhler, Rölke, Moldt, Valk, von Lüde, Langer, et al., 2003; Fischer, Florian, & Malsch, 2005).

The next three sections will describe each of these relationships in more detail.

SOCIAL SCIENCES THEORIES AND CONCEPTS AS AN INPUT TO MAS RESEARCH

Here I will focus mainly upon theories and frameworks from sociology. I will present a