Chapter XV
Data Gathering to Build and Validate Small-Scale Social Models for Simulation

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ABSTRACT

This chapter discusses two different approaches that gather empirical data and link them to modeling and simulations with agent-based systems: experimental economics which built reproducible settings and quantitatively defined indicators, and companion modeling which accompanies observed social groups when they negotiate over renewable resource issues. Both developed techniques have different epistemological posture which lead them to promote diverse data comparison and model validation. They both have small limitation. The chapter wishes to put forward that, although both approaches have different goals, some evolutions in research protocol could enhance qualities of both. Some of these evolutions have already started to be used by researchers.

MODELING AND THE SEARCH FOR REALISM

Social simulation using multi-agent paradigm (sometimes called *agent-based simulation* or *simulation with agents*) has developed quickly in the last fifteen years. The tool offers numerous new possibilities to represent rationality and structures of interaction, to take into account for heterogeneity in rationality and perception (Kirman, 1997; Bousquet, Cambier, Mullon, Morand, Quensière, & Pavè, 1993) or social relations (Moss & Edmonds, 2005; Rouchier, 2004), and test a variety of learning models for agents with procedural rationality (Simon, 1969).

The discipline of social simulation with agents started from two distinct communities at least. One was the economics community, with regular seminars at the Santa Fe Institute called "Economics as an Evolving Complex System" (Anderson, Arrow, & Pines, 1988). Another branch was started in Europe with the book *Artificial Societies* (Gilbert & Conte, 1994).

The first developments were quite close to artificial life (Langton, 1991). Researchers were trying to build credible global behavior from local actions, and were qualitatively inspired by social facts. For example, some would deal with emergence of hierarchies based on hypothesis by archaeologists (Doran et al., 1995), and would study which parameters have an influence on the existence and stability of the emerging phenomena. They were producing global behaviors that resemble the type of general structures that can be observed in society, and it was an important first step to be able to "grow artificial society" (Epstein & Axtell, 1992). Hence, most simulations of complexity were used as "black boxes" (Simon, 1969): the influence of the changes of parameters would be studied in relation with some global observation parameters, without following necessarily step-by-step processes to understand the internal mechanisms. There was no strong request for validation at that time, and all representations put in a model as well as evaluation processes relied on the expertise of the researcher. The issue of realistically understanding the influence of the numerous parameters of these complex systems, however, became more and more central (Gilbert & Abbott, 2005; Edmonds et al., 2003), and implied the apparition of new methods for building and validating models.

Nowadays, it has become a norm to assess results with actually comparable data and to build the hypotheses themselves by offering some empirical facts to justify for the model construction. Diverse sets of data can be used—from surveys to observations in real settings, and a large number of applications have searched for the right use of empirical data in the building of models (Moss & Edmonds, 2005). In this chapter, we focus on two trends that explore the representation of small-scale interaction settings with multi-agent simulations, caring about both protocols to gather data and assess the results of their assumptions on rationality, and involve human subjects in the process.

Some researchers want to perform quantitative validation for their simulations, and try to use their models to establish positive scientific results. The method of statistical comparison with outside world data is very often used (Moss & Edmonds, 2005). In the context of experimental economics, it is possible to acquire a lot of very precise behavioral data on microbehavior in the context of well-defined choice. A systematic comparison of artificial and real agents' behavior is, for some, a good way to assess the validity of the cognitive models they build for agents. A Popperian approach can be identified in these protocols, where scientists position themselves as outside observers of a social system on which they can draw objective refutable theories.

Others, at the opposite end of the validation approach, question the need to switch from qualitative validation to quantitative validation and look for scientific methods where the validation would not be abstracted from the social use they assign to social sciences. The second approach presented here is called companion modeling (some recent papers also refer to the stakeholder approach) and is rather embedded in an instrumentalist epistemology (Zammito, 2004), referring to the Duhem-Quine thesis. Followers are conscious of the fact that their hypotheses about rationality and structure of systems are social construct (Berger & Luckman, 1969), and instead of confining the use of the model to an analytic situation, they use it as a device for communication among those very actors who have been mimicked in the system.

Both approaches have different goals and invented settings that are suited to their general understanding of knowledge of society. We present here those two protocols, which define a rather high methodological standard for validation of simulation models. They have two

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