Preface

The main topic of this book is social simulation and modeling, aiming at agent-based applications, which naturally refers to the term interdisciplinarity since several disciplines are involved.

Social simulation has a dialectical relationship to Artificial Intelligence (AI), in general, and to Autonomous Agents and Multi-agent Systems (MAS), in particular. It is both an area for the application of methods, techniques and technologies of AI and MAS, as well as a source of inspiration for new theories, as it draws upon the theories, models and methods of the social sciences, such as anthropology, sociology, political science, economy, government, and management.

Social modeling and simulation is a difficult activity, mainly because its interdisciplinary character. This book brings new insights on the whole discipline, looking through its dangers, pitfalls, deceits and challenges.

The book presents some current discussions on agent-based social simulation and modeling, addressing theoretical, methodological, technical and instrumental issues concerning the area of social simulation, mainly based on AI and MAS technology, and focusing on applications, so offering different kinds of models and tools that can help the reader to face complex developments.

The book is divided into 3 sections. Section 1, “Current Discussions on Agent-Based Social Simulation and Modeling”, is a reflection on the tone of the book, by introducing the reader to the actual mission of Social Simulation, and the different challenges concerning the theme, such as morality aspects, the emergence issue, replication of models, the role of significance tests on simulation results, and large-scale problems and the effects of scale and topology.

Chapter 1, “Making Visible the Invisible Hand: The Mission of Social Simulation”, by Castelfranchi, brings a discussion about the mission of Social Simulation, showing that computer-based simulation should be considered a third scientific approach, to be added to the traditional inductive and deductive ones. The chapter remarks that Social Simulation provides the social sciences with a truly “experimental” method for the validation and adjustment of the models. In particular, it shows its importance for the specification of working architectures. The chapter stresses that agent-based social simulation provides the social sciences with “a generative approach”, and a synthetic, constructive approach – an operational approach.

Chapter 2, “On Agent Interactions Governed by Morality”, by Coelho, Costa, and Trigo, deals with agent moral behavior, following the classical view in Philosophy that defends character as a state concerned with choice, and able to direct the agent decision-making. The authors analyze the values regarding the
agent moral signature, showing that it may enhance the evaluation of agents, for example, on reputation and satisfaction, leading to a more consistent way for measuring agents’ popularity in organizations and social networks at large.

Chapter 3, “Scale and Topology Effects on Agent-Based Simulation: A Trust-Based Coalition Formation Case Study”, by Nardin, Rosset, and Sichman, provides an invariance analysis, considering scale and topology, of a model that incorporates the concepts of trust and coalition formation, in which agents are placed on a square lattice interacting locally with their neighbors and forming coalitions.

Chapter 4, “Exploring Emergence within Social Systems with Agent Based Models”, by Friesen, Gordon, and McLeod, analyses manifestations of emergence or apparent emergence in agent based social modeling and simulation, discussing the inherent challenges in building real world models and in defining, recognizing and validating emergence within these systems.

Chapter 5, “Usefulness of Agent-Based Simulation in Testing Collective Decision-Making Models”, by Lucas and Payne, discusses the importance of the specification and implementation of simulation assumptions and processes in the context of an agent-based model replication of a range of collective decision-making models (CDMM) that have been developed and established in political science.

Chapter 6, “Analysing Simulation Results Statistically: Does Significance Matter?”, by Troitzsch, discusses the question whether significance tests on simulation results are meaningful, and argues that it is the effect size much more than the existence of the effect that matters and that it is the description of the distribution function of the stochastic process incorporated in the simulation model which is important.

Chapter 7, “Large-Scale Social Simulation, Dealing with Complexity Challenges in High Performance Environments”, by Montañola-Sales, Rubio-Campillo, Casanovas-Garcia, Cela-Espín, and Kaplan-Marcusán, analyses the most relevant aspects to deal with large-scale agent-based simulations in social sciences and revises the developments to confront technological issues.

Section 2, “Research on Agent-Based Models for Social Simulation”, provides a look on some new agent-based models for social simulation that constitute the focus of some current research in the theme, such as social networks, economic experiments, policy diffusion, and electricity market.

Chapter 8, “Playing with Ambiguity: An Agent-Based Model of Vague Beliefs in Games”, by Georgalos, discusses the way that three distinct fields, decision theory, game theory and computer science, can be successfully combined in order to optimally design economic experiments, using agent-based simulation methods.

Chapter 9, “From Meso Decision to Macro Results: An Agent-Based Approach for Policy Diffusion”, by Luyet, aims at developing a simple computational model based on a theoretical model of policy diffusion that helps to explain the emergence of diffusion in a complex system.

Chapter 10, “Multi-Agent Economically Motivated Decision-Making”, by Trigo, describes the most relevant aspects of a simulation tool that provides (human and virtual) producer-consumer agents an interactive and real-time game-like environment where they can explore (long-term and short-term) strategic behavior and experience the effects of social influence in their decision-making processes. The game-like environment is focused on the simulation of electricity markets.

Chapter 11, “A Unified Framework for Traditional and Agent-Based Social Network Modeling”, by Franchi, and Tomaiuolo, presents a unified conceptual framework to express both novel agent-based and
traditional social network models. This conceptual framework is essentially a meta-model that acts as a template for other models. To support the meta-model, Franchi and Tomaiuolo also introduce a different kind of agent-based modeling tool for developing social network models.

Chapter 12, “Social Space in Simulation Models”, by Nunes and Antunes, discusses the role of social relation structure in opinion dynamics and consensus formation. The chapter presents an agent-based model that defines social relations as multiple concomitant social networks and explores multiple interaction games in this structural set-up. The authors discuss the influence of complex social network topologies where actors interact in multiple distinct networks.

Section 3, “Developing Reliable Interdisciplinary Applications of Agent-based Social Simulation and Modeling”, is the core of the book, presenting applications in different fields, such as an incentive for scientific production, energy usage in households, tax evasion risk, geographical clustering of firms, social production and management processes, and emergence of financial crisis.


Chapter 14, “Agent-Based Simulation of Electric Energy Consumers: A NetLogo Tool”, by Mota, Santos, Dimuro, Rosa and Botelho, discusses the energy usage in households, proposing a MAS-based simulating tool, implemented in NetLogo.

Chapter 15, “Agents’ Risk Relations in a Strategic Tax Reporting”, by Magessi and Antunes, analyses and discusses the behavior of taxpayers and its relation with risk, when they act strategically, by replicating the three main conceptual functions of the brain, when agents do their strategic options, concerning tax evasion risk task.


Chapter 17, “Towards a Multi-Agent-Based Tool for the Analysis of the Social Production and Management Processes in a Urban Ecosystem: An Approach Based on the Integration of Organizational, Regulatory, Communication and Physical Artifacts in the JaCaMo Framework”, by Santos, Fredes Rodrigues, Donâncio Rodrigues, Adamatti, Pereira Dimuro, Dimuro, and De Manuel Jerez, addresses the development of a MAS-based tool for the simulation of the social production and management processes observed in urban ecosystems, adopting as case study the social vegetable garden project conducted at the San Jerónimo Park (Seville, Spain). The authors discuss the use of JaCaMo framework, presenting the adopted multi-dimensional based methodology consisted by the integration of artifacts.

Chapter 18, “Building ABMs to Control the Emergence of Crisis Analyzing Agent’s Behaviors”, by Arciero, Picillo, Solomon, and Terna, apply agent-based modeling and simulation to the financial crisis analysis, adopting a simplified implementation of the SWARM protocol, based on Python, and presenting the Swarm-Like Agent Protocol in Python (SLAPP).
Finally, we attempted to provide a comprehensive and integrated view of the current discussions and investigations on agent-based social simulation and modeling, from a conceptual point of view to the development of models and applications, with an interdisciplinary character.

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