

Preface

Six years after its inception at Kyoto University, Japan in 2006, the biennial series of the World Congress on Social Simulation (WCSS) has completed its first voyage round the world, including the second conference held at George Mason University, USA, in 2008 and the third held at Kassel University, Germany, in 2010. Each of the three major societies on computational social science, PAAA (Pan-Asian Association for Agent-based Approach in Social Systems Sciences), CSSSA (The Computational Social Science Society of the Americas) and ESSA (European Social Simulation Association), has contributed to organizing one of these three events in its region. In 2012, a new cycle has started. The ball has returned to Asia, and the fourth iteration of this series was held at National Chengchi University (NCCU) in Taipei, Taiwan.

WCSS is by far the largest academic event in computational social science (CSS), which is to study computationally the social phenomena as emergent properties of complex adaptive systems. WCSS, therefore, has served to motivate the interdisciplinary research among social scientists, computer scientists and physicists. By including two special satellite events, WCSS 2012 made this feature even more evident.

The first event was the *Turing Memorial Sessions*. Year 2012 was the centennial of the birth of Alan Turing (1912–1954), who is widely regarded as the father of computer science. A session on Turing’s Economics was organized by Vela Velupillai at the University of Trento to acknowledge the legacy of Alan Turing in computational social science.

The second event was the *First Asia-Pacific Econophysics Conference*. The interest of physicists in the social sciences has been growing over the last decade. Their studies on the social sciences have formed a research field, known as sociophysics or econophysics, which has many overlappings with computational social science. In some cases, CSS and sociophysics even share the same intellectual origins, such as John von Neumann’s cellular automata. Under the diligent coordination of Sai-Ping Li at the Institute of Physics, Academia Sinica, the first regional conference on econophysics was launched and held together with WCSS 2012.

WCSS 2012, with these two joint events, had a total of 130 papers, presented by the participants from 22 different countries, and turned out to be the largest and the most exciting congress in this series. This new milestone points to a promising future for computational social science, with the ever increasing interdisciplinary collaborations among social scientists, computer scientists and physicists.

The great success of WCSS 2012 should not be limited to the four conference days. The WCSS series has a tradition of publishing post-conference proceedings so that the progress made can be well documented as an important step in the development of the literature on CSS. We, therefore, invited all the authors of the papers which were duly presented at WCSS 2012 to resubmit their papers for the consideration of the post-conference publication. We received 46 submissions in response to our invitation. Each of the submissions was further reviewed by two anonymous referees, and, in the end, 21 papers were accepted and published in this proceedings. We classify these 21 chapters into six parts: *on-line communities and social media* (Part I), *economic and social networks* (Part II), *behavioral finance and macroeconomics* (Part III), *demographics, health care, linguistics, and sociology* (Part IV), *participatory modeling and simulation* (Part V), and *methodology* (Part VI).

On-Line Communities and Networks

One mainstay of the computational social science is the social interactions among agents. Two important related subjects in this regard are social network and internet. Internet is an engine for forming social networks; it provides tremendous inspirations for the development of the literature on social networks. In this volume, the advancement of computational social science along these two strands is illustrated by chapters in Parts I and II. The four chapters in Part I are devoted to different aspects of on-line communities and social media. The next three chapters in Part II are devoted to social or economic networks.

One form of social interactions is the generation of huge information flow and information exchange among agents, which is well manifested through the operation of many on-line communities and social media. Chapter 1 deals with the use of this huge information; in particular, it addresses the effect of on-line messages on investment behavior and financial market dynamics. Chapter 2 also deals with the use of information from on-line communities, but from a marketing perspective; it demonstrates the agent-based simulation of the interactions among bloggers, advertisers, and blog audience, and then evaluates the effectiveness of various affiliated marketing strategies. Through internet, the e-government attempts to provide citizens better public service. However, very much due to the habitual reasons, the adoption of this new service channel may be very slow, and people are still very much dependent on the conventional counter service. Chapter 3 develops an agent-based model to understand how micro-level individual preferences of public service channel lead to macro-level e-government service adoption phenomenon. Because

of their anonymity, many conversations appearing in on-line communities can be malicious and are intended to be in that way. Using an agent-based model, Chapter 4 addresses the impacts of the malicious messages or trolls on the development of an on-line community as well as the effective policies to cope with these malicious agents.

In addition to on-line community, the chapters in Part II study social networks in different forms. Financial networks have financial institutions as important parts of the net. Through the analysis of the flow of financial capital in these networks, one can have a basis to evaluate the security or vulnerability of the financial system. However, networks imply the interdependent relations among creditors and debtors. When networks get large and complex, these interdependent relations can generate cycling troubles that make a sound and unique evaluation of financial security difficult. In the context of payment systems, Chap. 5 gives a thorough analysis of this so-called indeterminacy problem, which has been long largely ignored in the literature.

Both Chaps. 6 and 7 are devotions to a long-standing issue in computational social science, namely, opinion dynamics. In opinion dynamics, the term social interactions means the processes of social influences or persuasiveness. The celebrated Schelling-Axelrod model of cultural dissemination [1, 9] and the political economic model of opinion dynamics proposed by Chen [3] are early examples in this direction. As shown in these pioneering studies, social network can play an important role in these processes since it defines neighborhoods and neighbors as well as the local majority and minority. Various behavioral rules articulating the interactions between the majority and the minority groups can have effects not only on the consensus formation but also on the evolution of social network topologies. In other words, social networks and opinion dynamics are co-evolving in the context of opinion dynamics, and these co-evolution processes are well demonstrated in these two chapters. Chapter 6 demonstrates this co-evolutionary process in the context of voter dynamics. Chapter 7 introduces the context-dependent social networks and demonstrates the co-evolutionary process with this augmentation.

Economics and Finance

Behavioral finance (Chaps. 8 and 9) has constantly been an interest of research for agent-based modelers, mainly because agent-based models endow us a great flexibility in dealing with a spectrum of behaviors in which the heterogeneity is beyond what the conventional analytical models can handle. Chapter 8 serves as a good example on this issue by addressing the consequences of traders' overconfidence in an agent-based financial market. Chapter 9 also uses an agent-based financial market model to justify the use of passive investment strategies when the assumption of efficient market hypothesis no longer holds.

Two chapters (Chaps. 10 and 11) on the agent-based macroeconomic models demonstrate the recent research ambition of economists to have a holistic picture of

the operation of the whole economy from individual firms and households, all the way up to the behavior of the aggregate economy. The development of the agent-based macroeconomic models allows us to conduct policy experiments in which the possible macroeconomic consequences emerge from the downward causation between policy and the populations of heterogeneous firms and households. The agent-based macroeconomic framework allows us to analyze the policy effects on the firms of different sizes (Chap. 10) and the effect of corporate tax rate on GDP under different characteristics (or operation specifications) of firms (Chap. 11).

Other Social Sciences

Part IV is the use of social simulation in other disciplines, including demographics (Chap. 12), health care and social work (Chap. 13), linguistics (Chap. 14), and social stratification (Chap. 15). Using the agent-based model to simulate marriages, fertility, and mortalities, Chap. 12 projects population demography in the UK from 1950 onward. Chapter 13 addresses an issue relating to health care policies and their collateral health effect. This issue is extremely important because the quality of the health care system and the incurred social costs are vital to modern aging societies. The authors set up an agent-based model to tackle this problem and make preliminary policy appraisals based on their simulation by simultaneously taking into account patients, patients' families, hospitals, social workers, and the government.

In Chap. 14, the linguistic evolution in communities of interacting agents is discussed in the frame work of agent-based social simulation. Linguistic development and the evolution of language are unsolved important problems. In this chapter, it is shown that various interesting phenomena have emerged under different control parameters, such as emergence of linguistic divergence by word mutation as well as transmission of language between generations. Distinct groups of agents that speak initially different languages, which are the sets of correspondence of an object to a word, converge to a common language group. An initially monolingual community splits to two or more groups of different languages. Chapter 15 explores the factors related to the emergence of social stratification structure.

Participatory Modeling

Participatory modeling generally refers to modeling with the involvement of human subjects. While social simulation in most cases only involves artificial agents (software agents), many cases have shown that the participation of human agents can be critical and valuable. There are different purposes of involving human agents in agent-based modeling, and each of the three chapters in Part V illustrates one possible way to involve human agents in social simulation. First of all, one can

use agent-based models to replicate the results of human-subject experiments; in fact, one of the origins of social simulation in economics is the attempt to replicate what was observed in human-subject experiments [5]. Based on that replicability, agent-based modeling goes beyond the limit of human-subject experiments. The agent-based modeling of Swedish Lottery (the lowest unique bid auction) in Chap. 16 is a case in point.

Secondly, one can use the agent-based model as a bridge to facilitate the communication among different stakeholders. In a complex system, each individual stakeholder may have limited capacity to comprehend the consequences of his any possible actions. The chain of the responses to his action can be so long and complex that is beyond what any single person can perceive. However, through agent-based models, very much as in a gaming situation, it is easier to simulate “if I do this and you do that” and see its full effect, including the possibly unintended consequence. Then, on the basis of these simulations, one can decide what could be the feasible solutions acceptable for all stakeholders.

Of course, to do so, one has to first build up an agent-based model that all stakeholders in a real system acknowledge that the model is really “them”. This will trigger a close communication between modelers and stakeholders, and through this communication, missing fine details can be brought back and arbitrary behavioral assumptions of stakeholders can be avoided. In other words, participatory modeling provides us with another way to validate the model. Sean Boyle referred to this agent-based modeling approach as the *mirror function* [2, 4], but this novel idea has not been often seen in the practice of agent-based modeling; Chaps. 17 and 18 are two exceptional illustrations of this kind of participatory modeling.

Methodology

The last part of the book is devoted to the methodological aspect of agent-based modeling. It covers two issues: one is validation, and the other is model comparison. The validation issue has been long discussed in the literature of agent-based modeling. Depending on the data availability and the scale of the model, it can be implemented with different granulations. Calibration and validation have been used quite intensively in agent-based economic and financial models [6]. In this kind of calibration and validation, the agent-based model is considered to be a parametric statistical model. By calibrating or estimating these parameters, the modelers attempt to use the agent-based model to generate the data or observations which are most similar to the real data with respect to one or a few given metrics. In Chap. 19, the authors attempt to calibrate an agent-based model of web news consumption by using genetic algorithms in search of the optimal set of parameters in a large parametric space. It shows that depending on the metric applied to measure the error one may come up with different calibrated models.

Chapter 20 is an agent-based model of agricultural societies in East Africa. It concerns the household decisions on farming, herding, and labor activities in

response to the surrounding environment. Chapter 20 presents a different style of calibration from Chap. 19's. It does not formally define the model as a parametric statistical model, neither does it use the aggregate data to fine-tune the behavioral parameters at the very micro level. Instead, the validation is done at the very bottom level of the model using the anthropological data almost at the same micro level, while the emergent aggregate phenomena are further examined with aggregate data. This work shows the use of field study in empirical-based, agent-based modeling [8].

The last chapter of the book deals with the model-to-model analysis. This issue has drawn a lot of attentions among agent-based modelers. There were even special issues edited for this subject [7]. However, because of the difficulties indicated in this chapter, the full-fledged implementation of the model-to-model analysis is rarely seen and has not become a practice by most modelers. For example, there are large sets of agent-based financial markets, macroeconomic models, and even the electricity markets as illustrated in the chapter, but there is almost no model-to-model analysis being done in these areas. Hence, given a full plethora of models, it leaves the robustness of policy recommendations unchecked. This final chapter gives some suggestions to make progresses in this direction possible.

The editors of this book, with great pleasure, now formally announce the presentation of these 21 inspirational high-quality chapters to all interested readers in CSS and invite them to keep their wonders of CSS alive by traveling along its exciting research frontier, drawn collectively by these respectable 51 contributors.

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