Modeling Social Behavior: Mathematical and Agent-Based Models of Social Dynamics and Cultural Evolution. By Paul E. Smaldino. Princeton: Princeton University Press, 2023. Pp. xvii, 341. $150.00, cloth; $60.00, paper; $60.00, e-book. ISBN 978–0–691–22413–8, cloth; 978–0–691–22414–5, pbk.; 978–0–691–22415–2, e-book. (*JEL* C61, C63, C70)

This is an interesting, well-constructed book on the application of agent-based models to study various complex social systems. As such, the book is intended to provide advanced undergraduate or graduate students with a thorough introduction to agent-based models as a tool kit for social studies. To this end, the book relies on a widely adopted software package for agent-based models; NetLogo codes for all the models studied in the book are available and referenced in detail when necessary. This makes it possible for the reader to advance in the study of agent-based models without too much coding skill and experience. While the book reads fundamentally as a textbook, it covers enough material in enough depth to represent an interesting introduction to the literature on social dynamics and cultural evolution, so that it could be profitably read by a social scientist looking for a port of entry into these topics.

After two methodological chapters—the first on why mathematical models are useful and how they should be interpreted and the second on how NetLogo works and what it does—the book is structured by topics of application. The list is rich, varied, and fundamentally fascinating. It contains segregation, contagion, opinion dynamics, cooperation, coordination, Bayesian inference in science, and networks. Each one of the chapters enters first in some depth into the relevant mathematical model and then maps it into an agent-based simulation system where agents move as particles on a geographical space and act following a prespecified rule of thumb. The book ends with a chapter taking stock of what the reader has learned and giving indications about how to turn this into the ability to do novel research.

The contagion chapter, for instance, introduces general compartmental models in epidemiology and then delves into the basic susceptible–infected (SI) model used in the social sciences to study the spread of ideas, beliefs, innovations, and so on. In agent-based mapping, agents move quasi-randomly in space and any susceptible agents have a given probability of getting infected when meeting with an infected agent. By the end of the chapter the analysis is extended to the susceptible–infected–recovered (SIR) model, and the reader has the opportunity of simulating comparative dynamics exercises on the spread of a realistic health epidemic, studying, for example, the effect on nonpharmacological interventions like restrictions on the movements of the agents. The chapter on cooperation studies instead the evolutionary dynamics

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of agents playing the prisoner's dilemma. In fact, the chapter introduces first a general model of evolution—including, for instance, replicator dynamics—before accompanying the reader into the game-theoretic structure of the problem. The evolutionary dynamics are then studied in an environment specifically designed to map interestingly into an agent-based model structure, where, in each period, each agent plays a given strategy with all the agents positioned in a neighborhood of given size and the replication dynamics act on the aggregate payoff of these plays for each agent.

The book is very successful in its aim of introducing the reader to agent-based models, bringing him/her to develop the theoretical skills necessary to apply them to interesting problems. It is less successful, however, as an introduction to the broader study of social dynamics and cultural evolution. Agent-based models are widely used in the social sciences, in sociology, political science, and economics, as well as in anthropology, demography, and epidemiology. Their limitation is that agents move and act as particles, without any rational (or less-than-rational) choice, without any forward-looking calculus, and independent of the specifics of the environment they find themselves in. The severity of this limitation obviously depends on the problem at hand. Given the problem, the intellectual—or even ideological—priors of the (discipline of the) researcher also contribute to evaluating the explanatory power of agent-based models: generally, economists, more than other social scientists, tend to consider rational (or less-than-rational) choice and some forward-looking behavior as fundamental dimensions of models dealing with most socioeconomic phenomena.

One does not have to align with the priors of economists, however, to agree that in several contexts agents make choices depending on the environment they face and on their beliefs about either future expected change in the environment itself or about the future actions of other agents with whom they are and will be interacting. This is indeed the case for several—indeed arguably all—the topics studied in the book. In the contagion case, for instance, local interaction models with rational choice have proven to be greatly successful in the understanding the role of, for example, peer effects as a determining factor of various socioeconomic phenomena like crime activity and risky behavioral practices (smoking, drinking, practicing unsafe sex, and so on). An introductory treatment of social dynamics cannot avoid referring to this literature—if for no other reason than to be alert the reader to its existence; see Blume et al. (2011) and Glaeser and Scheinkman (2000) for surveys. Another fundamental role of forward-

looking rationality in the general context of contagion and epidemics consists in modeling the contact rate in SI and SIR models as determined by the choices of agents acting on their beliefs about the future spread of the epidemics. Failure to do so has arguably contributed to the gross overestimation of COVID deaths early in the pandemic, for instance, by Ferguson et al. (2020).

In the case of cooperation, the issue with lack of choice and beliefs in the models studied in the book is even much more problematic. Game theory has developed, since its beginning in the early 1900s, in terms of equilibrium. The prisoner's dilemma has normally been studied in the context of repeated games and in this context has produced a wealth of folk theorems that identify—in different specific context in terms of the structure of information of the agents and the form of their interaction—conditions for cooperation to arise at equilibrium. All this is completely missing in the book, which only refers to evolutionary dynamics. This is not to say that the evolutionary approaches to strategic interactions are not of interest, of course. But the reader should know that they are only a (possibly marginal) component of game theory in the social sciences.

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Alberto Bisin
New York University