Advancing the Art of Simulation in the Social Sciences

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Abstract. Advancing the state of the art of simulation in the social sciences requires appreciating the unique value of simulation as a third way of doing science, in contrast to both induction and deduction. This essay offers advice for doing simulation research, focusing on the programming of a simulation model, analyzing the results and sharing the results with others. Replicating other people's simulations gets special emphasis, with examples of the procedures and difficulties involved in the process of replication. Finally, suggestions are offered for building of a community of social scientists who do simulation.

1 Simulation as a Young Field

Simulation is a young and rapidly growing field in the social sciences. As in most young fields, the promise is greater than the proven accomplishments. The purpose of this paper is to suggest what it will take for the field to become mature so that the potential contribution of simulation to the social sciences can be realized.

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2While simulation in the social sciences began over three decades ago (e.g., Cyert and March, 1963), only in the last ten years has the field begun to grow at a fast pace.

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One indication of the youth of the field is the extent to which published work in simulation is very widely dispersed. Consider these observations from the Social Science Citation Index of 1995.

1. There were 107 articles with "simulation" in the title. Clearly simulation is an important field. But these 107 articles were scattered among 74 different journals. Moreover, only five of the 74 journals had more than two of these articles. In fact, only one of these five, *Simulation and Gaming*, was primarily a social science journal. Among the 69 journals with just one or two articles with "simulation" in the title, were journals from virtually all disciplines of the social sciences, including economics, political science, psychology, sociology, anthropology and education. Searching by a key word in the title is bound to locate only a fraction of the articles using simulation, but the dispersion of these articles does demonstrate one of the great strengths as well as one of the great weaknesses of this young field. The strength of simulation is applicability in virtually all of the social sciences. The weakness of simulation is that it has little identity as a field in its own right.

2. To take another example, consider the articles published by the eighteen members of the program committee for this international conference. In 1995 they published twelve articles that were indexed by the Social Science Citation Index. These twelve articles were in eleven different journals, and the only journal overlap was two articles published by the same person. Thus no two members published in the same journal. While this dispersion shows how diverse the program committee really is, it also reinforces the earlier observation that simulation in the social sciences has no natural home.

3. As a final way of looking at the issue, consider citations to one of the classics of social science simulation, Thomas Schelling's *Micromotives and Macrobehavior* (1978). This book was cited 21 times in 1995, but these cites were dispersed among 19 journals. And neither of the journals with more than one citation were among the 74 journals that had "simulation" in the title of an article. Nor were either of these journals among the 11 journals where the program committee published.

In sum, works using social science simulation, works by social scientists interested in simulation, and works citing social science simulation are all very widely dispersed throughout the journals. There is not yet much concentration of articles in specialist journals, as there is in other interdisciplinary fields such as the theory of games or the study of China.

This essay is organized as follows. The next section discusses the variety of purposes that simulation can serve, giving special emphasis to the discovery of new principles and relationships. After this, advice is offered for how to do

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3 This excludes articles on gaming and education, and the use of simulation as a strictly statistical technique.

4 Three others were operations research journals, and the last was a journal of medical informatics.