# New Approaches to the Scientific Study of Religion

Volume 7

**Introduction to the Series**

This series presents new approaches to the scientific study of religion, moving from the first generation of studies that try to 'explain religion' towards a more critical effort to explore alternative paths in correspondence with this highly complex human and social feature. The series supports the development of new scientific models that advance our understanding of religious faith, emotions, symbols, rituals, meaning, and religions' anthropological and cultural dimensions, integrating them into more complex models.

Recent decades have witnessed a growing interest in the study of religious mind and behavior from new disciplinary fields, such as cognitive psychology, neuroscience and bio-evolutionary science. The amount of published research is impressive and has reached a level that now calls for evaluation and revision of current models and developments. This new series supports this fast-moving development, encouraging the publication of new books that move on from current research towards larger horizons and innovative ideas.
This series:

- Increases academic communication and exchange in this multi-disciplinary research area.
- Gives a new impetus to the science and religion dialogue.
- Opens up new avenues of encounter and discussion between more scientific and more humanistic traditions.

More information about this series at http://www.springer.com/series/15336

Saikou Y. Diallo • Wesley J. Wildman
F. LeRon Shults • Andreas Tolk
Editors

# Human Simulation: Perspectives, Insights, and Applications

Springer

*Editors*
Saikou Y. Diallo
Virginia Modeling Analysis
and Simulation Center
Old Dominion University
Norfolk, VA, USA

F. LeRon Shults
Institute for Global Development
and Social Planning
University of Agder
Kristiansand, Norway

Center for Modeling Social Systems
Kristiansand, Norway

Wesley J. Wildman
Boston University
Boston, MA, USA

Center for Mind and Culture
Boston, MA, USA

Andreas Tolk
The MITRE Corporation
Hampton, VA, USA

ISSN 2367-3494 ISSN 2367-3508 (electronic)
New Approaches to the Scientific Study of Religion
ISBN 978-3-030-17089-9 ISBN 978-3-030-17090-5 (eBook)
https://doi.org/10.1007/978-3-030-17090-5



This Springer imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

*To my wife Faby and my son Eja and to those who derive their happiness from serving others.*

Saikou Y. Diallo

*To the many humanities scholars who have taken risks, moved out of their comfort zones, built computational simulations with us, and in the process strengthened their love of humanities research.*

Wesley J. Wildman

*To the members of the Modeling Religion in Norway (MODRN) project.*

F. LeRon Shults

*To all researchers who dare to collaborate with colleagues from other disciplines to gain new insights to the hard problems of our world.*

Andreas Tolk

# Foreword

The study of human behavior emerged from the moment that humans developed the capacity for reflective thought. Historians of science have developed various versions of the trajectory that such thought has taken as well as its origins in the first reflective thinkers. Obviously, there is a very interesting long-term evolutionary story to tell about the conditions that contributed to that development, but I will not attempt that here. The particular trajectory that is relevant to this important book and one that fascinates me is the *short-term one that leads from theorizing about one form of human behavior, through empirical and experimental testing of hypotheses suggested by theorizing, to the development of conceptual modeling culminating in computer simulations*.

A case in point is the development of the cognitive science of religion (CSR). CSR began with various theoretical proposals about ritual in the context of action representation, agency detection, intuitive and reflective religious thought, teleological reasoning, and theological correctness, and then proceeded both to devise experimental studies and to collect ethnographic reports capable of confirming or disconfirming the hypotheses emerging from theorizing. The culmination of this process to date is the computational modeling and simulation now taking place and reported on in this volume.

This book, however, has wider aims than taking another step in the development of CSR, though it is interested in that as well. *Human Simulation* focuses its sights on nothing less than modeling many different kinds of human behavior. Readers interested in the human condition have a feast laid out before them to savor and consume. And the editors of the volume do not just cast you into the middle of the project but gently introduce you to the project of modeling and simulation making very clear its transdisciplinary approach. Furthermore, while they are excited about the promises of the project, they are also sharply aware of its limitations.

The subjects under investigation here capture our immediate attention: modeling the migration of humans from one place to another, large-scale social conflict, language learning, mobility constraints on refugee movements, the differences in cooperation between small and large groups, the evolutionary basis for CSR in

relationship to issues of morality, and even the ethical dilemmas of modeling leading to unwelcome and even devastating consequences.

Both the excitement and the wariness that come from something new are reflected in the outline of the book. We are introduced both to the promises and limitations of computer modeling and its transdisciplinary nature. We learn from simulationists and modelers. We are even given examples of humanities scholars and social scientists describing in their own words how they learned to be reasonably comfortable in acquiring, understanding, and applying such knowledge to their own subjects of interest. In other words, the book gives us much to contemplate no matter what our starting point happens to be.

My own interests have focused on competence theorizing and the evolutionary processes that provide the conditions for the development of competencies such as ritual competence. Competence theorizing in general considers particular human abilities or capacities whose development is triggered by exposure to external stimuli. One way of discovering the structure of such capacities is to present experimental subjects with scenarios that call on them to make a judgment. This is a process that can be simulated. The first step would be to construct a chart of every stage in this process. For example, a subject is postulated to possess implicit and perhaps even unconscious knowledge of a ritual act and will be able to distinguish between legitimate and illegitimate examples, or the ones that fit with a ritual system and the ones that do not. The challenge lies in simulating the relationship between the conceptual scheme and the action representation system in relation to certain universal principles. I never got around to designing a computer model of this process, but Justin Lane and colleagues have taken a close look at it (see Lane et al. in this volume) and have shown how modeling some aspects of this process can lead to new insights. This book is full of such discoveries.

Researchers in the natural and social sciences will, no doubt, be pleased by the essays in this book and recognize its value and cherish its insights. Scholars in the Humanities, too, should be aware of the benefits that modeling can contribute to developing a deeper and more precise understanding of their subject matter and point them to connections that they might have suspected but had never been able to demonstrate and articulate in a principled way. When the sciences and the humanities cooperate rather than skirmish, our knowledge of human behavior is enriched rather than impoverished. And the world just might be a better place for us all.

Institute of Cognition and Culture
Queen's University
Belfast, Belfast, UK

E. Thomas Lawson

# Preface

The social problems we face in our time arise within complex adaptive social systems. These social systems share many of the features of non-linear dynamical systems in mathematics, including sensitive dependence and long-term unpredictability. They have other spectacular features as well, including causal obscurity such that well-intentioned interventions could ultimately produce systemic deterioration. The problems seem intractable because the network of societies in which they arise is exquisitely complex. Monodisciplinary approaches to these problems generate vital insights but whether and how these cohere with insights from other stakeholder disciplines is typically unknown. Unfortunately, the disciplinary structure of contemporary research universities inhibits the kind of multidisciplinary inquiry that could investigate that issue. Traditional policy methods struggle to project the impact of policy proposals because the intended effects can be accompanied by a slew of unintended consequences, like chaotic eddies on the edge of aircraft wings that increase drag and drive up fuel costs.

These complex societies are wondrous human creations, despite the attendant problems. Our species is less violent, more creative, freer, healthier, and better informed about the world than ever before. So the solution can't be reversion to the simpler societies of former centuries. Rather, we have to figure out how to solve the problems of our time, which are potentially deadly on an unprecedented scale, in a way that responds to the reality of complex adaptive social systems.

Enter human simulation. This phrase has been used to describe the process of building humanoid robots but that's not the focus of this volume. We're talking about virtual human beings in artificial societies, growing and learning, deciding and acting in their virtual surroundings. This type of simulation is a bit like a computer game except the aim is accuracy rather than entertainment. We use a virtual complex system to model a real-world complex system. By grounding the computational simulation in solid knowledge about human cognition and behavior, and through validating emergent aspects of the virtual system against emergent features of real-world social systems, we gain confidence in the simulation's causal architecture: the virtual system behaves like the real-world system because the causal properties of the two systems are similar. This provides a platform for virtual

experimentation. We can run back projections to evaluate how well the experimental platform performs. We can try out policy proposals to predict their effects, including formerly unforeseeable side effects.

Human simulation is not a substitute for traditional policy analysis and debate. On the contrary, human beings must always take responsibility for proposed solutions to the problems we create for ourselves, and avoid becoming overly dependent on technologies we don't fully understand. Unfortunately, we are prone to rely on technologies that seem to deliver easy answers and thereby reduce cognitive load. But easy answers are not always good answers and the history of technology is littered with instances of technological fixes that went nightmarishly wrong, from asbestos to thalidomide. Thus, the role of human simulation in policy analysis should probably be confined to generating insights capable of directing attention to unnoticed aspects of a proposed solution or exploring promising new ideas.

=======

The world of computational modeling and simulation (M&S) is very large. These techniques are routinely used in a host of design and testing applications because it is cheaper, easier, and safer to find and fix problems before the factory or bridge or distribution network or airplane wing have been built. As M&S techniques grew in sophistication and advancing technology rendered more complex simulations computationally tractable, people began using these technologies to study society. Social simulation was born. The disciplinary partners for social simulation have tended to be sociologists and the applications have typically been the kind of human interactions and systems that sociologists study. The rise of artificial intelligence gave birth to another branch of M&S: the building of virtual minds. These technologies are used in driverless cars and robotics, and their main disciplinary partners have tended to be cognitive psychology and neuroscience.

Human simulation combines social simulation and artificial intelligence technologies to yield artificial societies in which cognitively and behaviorally complex agents interact. In this case, the applications tend to be in the domains of problem-oriented policy analysis or fundamental research into complex human phenomena such as the kinds of themes taken up in this volume. But what are the relevant partner disciplines? Obviously the social sciences, psychological sciences, and brain sciences are heavily involved due to the disciplinary heritage of human simulation just sketched. But the phenomena being studied also call for humanities disciplines from history to philosophy, from cultural anthropology to international relations, and from religious studies to analysis of ancient texts. This is *unprecedented*.

The humanities are on the back foot in most research universities. The sciences bring in the research funding, the inventions, and the notoriety on which universities thrive as institutions. The patient labors of humanities scholars building subtle and sophisticated interpretations of complex subject matters lack the ideal optics, especially in a social-media world, and the humanities disciplines are suffering as a result. It doesn't help that many humanities scholars feel sidelined and

unappreciated and don't practice explaining their research to a wider audience the way scientists have to do. This defines the much discussed, well-known, so-called crisis of the humanities.

Human simulation is a game changer for the humanities. For most applications of human simulation, the humanities disciplines are literally *indispensable*. We need the subtle and sophisticated interpretations of humanities scholars to make simulations relevant: they are critical for validating design, for evaluating accuracy, and for making sense of results. So far from being sidelined, the humanities disciplines are the heart and soul of human simulation, functioning as equal partners with the human sciences. Here we have a solution to the crisis of the humanities – indeed, the best kind of solution: humanities scholars should demonstrate the value of their work by engaging scientists and showing how humanities insights make a difference. Human simulation is exactly the right venue for that kind of aggressively multidisciplinary work.

=======

The organizations represented by the editors of this volume – the Virginia Modeling, Analysis, and Simulation Center, the Center for Mind and Culture, and the Center for Modeling Social Systems – are heavily invested in human simulation. We collaborate intensively, and this volume is one of the many fruits of that collaboration. When we first conceived of this volume, we imagined the fun we could have by initiating humanities and other scholars unfamiliar with M&S into the wonders of human simulation. We did have fun and we are enormously grateful to those who responded to our invitation to build models with us. We asked them in their chapters not merely to describe the model they built but also to explain to readers what their experience of working with computational engineers to build a model was like for them.

We could think of no better way to get our message across. Human simulation is a method tailor-made for our time. It facilitates multidisciplinary engagement across the humanities and sciences, supports conceptual analysis and historical investigation of key theories in the humanities about aspects of human life, and gives us tools to tackle pressing social problems.

Consider religion as an example. Though scientific approaches to religion now form the larger part of the literature in the academic study of religion, traditionally that field has been housed in the humanities. The Field Mapping Project of the Center for Mind and Culture has run co-authorship network analyses that demonstrate clearly what some have suspected: the two sides of the academic study of religion are almost completely isolated from one another. This means that the scientific work is not benefitting from the interpretative excellence of the humanities and that humanities work is failing to engage the theoretically most generative resources in the field.

Here is where human simulation comes in. Applying human-simulation methods to the study of religious phenomena requires the humanities and the scientific approaches to combine forces. Our experience shows that there is absolutely no

intellectual impediment to this combination of approaches and also that both the humanities and the scientific approaches are strengthened by mutual engagement. Evidently, the only obstacles confronting this kind of multidisciplinary collaboration are institutional and ideological. The result of multidisciplinary collaboration is improvements in fundamental research into the social functions of religion, the deepening of insights into the evolutionary origins of religion, and the ability to tackle problems such as violent extremist groups that invoke religion to motivate and justify killing and maiming.

In this application of human simulation, or indeed any other, the inevitable challenge of reductionism is kept in check through the involvement of the humanities scholars. Likewise, the tendency of some humanities scholars to speculate without sufficient empirical grounding is kept in check by the involvement of scientists. In short, we see no downside to attempting this sort of collaboration. Human simulation really is a game changer for both the humanities and the scientific study of the human condition, and for anyone trying to solve the daunting problems we face.

=======

After Tom Lawson's Foreword and this Preface, this volume consists of three parts.

Part I, the "Promises and Limitations of Computer Simulation," introduces the research methods of human simulation. In "Human Simulation: A Transdisciplinary Approach to Solving Societal Problems," Saikou Y. Diallo lays out the method. In "Ethics, Computer Simulation, and the Future of Humanity," F. LeRon Shults and Wesley J. Wildman discuss the complex ethical dimensions of human simulation. Effectively, these first chapters introduce the volume from methodological and ethical perspectives. Then, Carlos M. Lemos describes his experience as a modeler in "Pitfalls in the Development of Agent-Based Models in Social Sciences: Avoiding Them and Learning from Them," and Justin E. Lane addresses vital epistemological questions in "Understanding Epistemological Debates in the Humanities and Social Sciences aid in Model Development: Modeling Interpretive and Explanatory Theories."

Part II, "Learning from Computer Models, Humanities Scholars, and Simulation Engineers," presents four case studies. Each author or author team describes what it was like for them to work on a model, and in some cases also present the model they built. Ann Taves explains her bold approach to "Modeling Theories and Modeling Phenomena: A Humanist's Initiation"; Catherine Caldwell-Harris takes on a classic problem in cognitive psychology with profound practical implications in "Language Learning Following Immigration: Modeling Choices and Challenges"; Jenn Lindsay gives an account of her work with us as a documentarian in "Modeling Models: Documentary Filmmaking as a Purposeful Abstraction of the Modeling Process"; and Justin E. Lane, F. LeRon Shults, and Robert N. McCauley give new voice to a well-known theory from the academic study of religion in "Modeling

and Simulation as a Pedagogical and Heuristic Tool for Developing Theories in Cognitive Science: An Example from Ritual Competence Theory."

Part III, "Applications of Computer Simulation to the Humanities," continues the pattern of blending explanation of models with accounts of the experiences of the model-building process. John Teehan and F. LeRon Shults take on one of the mysteries of the evolution of religion in "Religion, Empathy, and Cooperation: A Case Study in the Promises and Challenges of Modeling and Simulation"; Ivan Puga-Gonzalez, David Voas, Wesley J. Wildman, Saikou Y. Diallo, and F. LeRon Shults explain their innovative approach to simulating "Minority Integration in a Western City: An Agent-Based Modeling Approach"; Erika Frydenlund, Etta C. Jones, and Jose J. Padilla discuss "Mobility in Crisis: An Agent-Based Model of Refugees' Flight to Safety"; and Connor Wood and Richard Sosis engage the theme of "Simulating Religions as Adaptive Systems."

Finally, in the Epilog, Andreas Tolk ventures reflections on "Human Simulation as a Humble Approach."

There's something for everyone here, from technical models to personal narratives. Ultimately, we believe this volume is the right kind of introduction to the new venture in scholarly inquiry and practical problem-solving that we call human simulation.

=======

We have debts to acknowledge. We are grateful to the 50 (yes, count them: 50) people involved in the Modeling Religion Project, funded in large part by the John Templeton Foundation, to whom we are very thankful. Some of them have contributed to this volume and collectively they have profoundly influenced the four editors of this volume. This book is dedicated, in part, to them. We are delighted to recognize the inimitable Tom Lawson, who stepped up at short notice to write a compelling Foreword. We are pleased to acknowledge Brill, the publisher of this volume. And we are honored to recognize the formative role played by the various institutions that support our work: the Center for Mind and Culture; the Virginia Modeling, Analysis, and Simulation Center; the Center for Modeling Social Systems; Boston University; Old Dominion University; and the University of Agder.

Norfolk, VA, USA — Saikou Y. Diallo
Boston, MA, USA — Wesley J. Wildman
Kristiansand, Norway — F. LeRon Shults
Hampton, VA, USA — Andreas Tolk

# Contents