



Simulating Secularities: Challenges and Opportunities in the Computational Science of (Non)Religion

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RESEARCH ARTICLE

]u[ubiquity press

ABSTRACT

This article provides scholars of nonreligion and secularism with an introduction to some of the major opportunities and challenges associated with the growing application of computational methods to the phenomena they study. It also illustrates these opportunities and challenges by describing several overlapping research projects and some of the models of (non)religion they have produced. Finally, the article addresses some of the significant philosophical issues surrounding the use of computer modeling and simulation, focusing on the ethical and epistemological concerns that these tools often raise. I invite scholars of nonreligion to consider adding these techniques to their methodological toolkits, and to join in on the fascinating and important conversations about simulating secularities that these models engender.

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KEYWORDS:

computer modeling; social
simulation; nonreligion;
secularities; Asad; Atran

TO CITE THIS ARTICLE:

Shults, FL. 2021. Simulating
Secularities: Challenges
and Opportunities in the
Computational Science of
(Non)Religion. *Secularism and
Nonreligion*, 10: 10, pp. 1–10. DOI:
<https://doi.org/10.5334/snr.154>

INTRODUCTION

This article is part of a special issue on “computer modeling of secularism and nonreligion,” which was designed to showcase some recent contributions in the computational science of (non)religion, a rapidly growing sub-discipline in the academic study of secularism and related phenomena. While the other articles published in the special issue so far (Wildman et al., 2020; Cragun et al., 2021; Galen et al., 2021) as well as those in the pipeline, report on specific computational models that simulate some of the dynamics and mechanisms that drive secularity up (or down), this article has a broader purpose. My main goal here is to provide readers of *Secularism & Nonreligion* with a brief introduction to some of the challenges and opportunities that have emerged in the relatively recent application of these methodologies to the study of these topics in the social sciences and the humanities. However, the successful development and deployment of simulation techniques with high levels of explanatory and even predictive power raise a host of ethical and other philosophical issues that are extremely relevant for scholars of nonreligion. I address these in the last major section of the article.

The central section of the article describes the wider context out of which the call for papers for this special issue emerged. Since 2015 an expanding transdisciplinary team of international scholars have been working together in a series of overlapping research projects supported by a variety of funding agencies. The main institutional partners in this expanding network include the University of Agder and the NORCE Center for Modeling Social Systems (Norway), the Center for Mind and Culture in Boston (USA), the Virginia Modeling, Analysis and Simulation Center (USA), and the Society and Cognition Unit at the University of Bialystok (Poland). Our experience has been that modeling (non)religion with cognitively realistic agents in culturally realistic “artificial societies” requires teams of competent and open-minded subject matter experts and computer scientists who are willing to devote a significant amount of time and energy into the collaborative process of participatory modeling. We call this process “Human Simulation” (Diallo et al., 2019).

As I hope will become clear in the following pages, such tools and techniques provide an array of new opportunities for scholars of secularism. However, as with all new methodologies, there are also serious challenges, not the least of which is convincing busy scholars that it is worthwhile learning how to use – or at least learning how to appreciate the values and limitations of – computational approaches in their field. I take an initial shot at tackling this task in the next section.

1. WHY SHOULD SCHOLARS OF NONRELIGION CARE ABOUT THE COMPUTATIONAL TURN IN THE SOCIAL SCIENCES AND HUMANITIES?

The explanatory power of computational modeling and simulation (CMS) techniques has had such a profound effect on a wide variety of scientific disciplines (Humphreys, 2006) that they have been called the “third pillar” of science, alongside theory and experimentation (Benioff & Lazowska, 2005). Computational tools have been widely utilized in the natural sciences since their invention in the middle of 20th century and have become increasingly popular in the social sciences in the last few decades (Alvarez, 2016; Gilbert & Troitzsch, 2005; Squazzoni, 2012). Even more recently CMS methods have been making inroads in the humanities, generating new insights into history, culture, philosophy and other fields (DeLanda, 2011; Elsenbroich & Gilbert, 2014; Youngman & Hadzikadic, 2014; Wildman, Fishwick, & Shults, 2017; Youngman & Hadzikadic, 2014; Dignum and Dignum, 2014; Shults, 2019). As I will illustrate in some detail below, the use of these tools among researchers interested in (non)religion has been growing quite rapidly in the last decade. Why might scholars of secularism find such approaches attractive?

I’ll return to this question below but first it is important to acknowledge that not everyone who researches nonreligion is equally enthusiastic about adding CMS to their methodological toolkits. Among the many distinctions within this broad multidisciplinary field is between scholars who prefer Asad over Atran – or vice versa. I use these authors metonymically to indicate two distinctive approaches to the study of (non)religion: one that is primarily grounded within qualitative, social, anthropological, and historical research and another that is primarily grounded within quantitative, psychological, cognitive, and evolutionary research. These are well illustrated in works such as *Genealogies of Religion* (Asad, 1993) and *In Gods We Trust* (Atran, 2002). Of course, the Asad and Atran camps overlap and interact, but it is not difficult to detect a basic methodological (and often political) tension between them. Scholars who favor Atran-like approaches have been far more likely to embrace the (rather obviously quantitative) methodologies within CMS. In fact, the *Journal of Cognition and Culture* hosted a special issue on computer models of religion (Lane and Shults, 2018) and social simulation was included in a special issue on methodology in the *Journal for the Cognitive Science of Religion* (Lane and Shults, 2020). We will look at several other examples below.

However, it is important to emphasize that qualitative and hermeneutical research on nonreligion is not excluded (much less replaced) by the use of CMS methods. On the contrary, insights that can only be generated by Asad-like approaches and theories (and

the humanities in general) are increasingly incorporated within the construction of computer simulations based on models of complex and changing social systems. This is the case, for example, in three recent system-dynamics models designed to simulate the transformation of civilizational forms at key turning points in human history. The first is a model of the Neolithic transition, whose causal architecture incorporates insights from subject matter experts in history and philosophy, as well as empirical evidence gathered by scholars from other disciplines such as archaeology and anthropology. It was able to simulate the shift from a population with primarily hunter-gatherer lifestyles to the sedentary-agricultural lifestyle that emerged in the Neolithic “town” of Çatalhöyük in southeastern Turkey (Shults and Wildman, 2018). The second model integrated a variety of theories and insights from scholars of history, ideology, and cultural studies, as well as from scholars in the cognitive sciences and quantitative sociology, within a single computational architecture. It was able to simulate the shift into the civilizational forms of human society characteristic of the axial age (first millennium BCE) from populations with a preference for pre-axial modes of organizing the social field (Shults et al., 2018e). Finally, simulation experiments on a third model, which were reported in an article in the current special issue, were able to recreate the shift from populations in which social cohesion depends largely on shared belief in supernatural agents to modern, secular populations in which the majority of individuals have naturalistic worldviews. Construction of the causal architecture of this model required the integration of six major theories of secularization, including some whose insights are based largely on qualitative research and hermeneutical judgments (Wildman et al., 2020).

Agent-based models (ABMs) have become more common than system-dynamics models (SDMs) in the computational study of (non)religion. SDMs track the flow of some “currency” through “stocks,” exploring how different variables affect the rate of that flow (e.g., the flow of people who prefer one civilizational form to another). ABMs, on the other hand, involve the construction of “artificial societies” with heterogeneous agents who behave and interact with one another and their environment in simulated space and time. In other words, they provide a sort of “digital twin” of a real-world target society. I will highlight several examples below. Once these models are calibrated, verified, and validated, one can run simulation experiments to test hypotheses about the conditions under which – and the mechanisms by which – secularization (for example) is likely to emerge within a population. CMS methods have many features that make them attractive for scholars interested in studying complex psychological and social phenomena such as nonreligion. These

include the way in which they can encourage and enable researchers to:

- achieve higher levels of *clarity* as they formalize concepts in their theories and surface their assumptions about causal interactions among various elements within the social systems they study,
- integrate insights from *qualitative and quantitative* research within the same computational architecture,
- design and execute policy-relevant *experiments* in artificial societies that would not be feasible or ethical in the real-world societies these models target,
- explain the *emergence* of a complex macro-level social phenomenon by “growing” it bottom-up from micro-level agent behaviors and meso-level interactions, and
- explore the multi-dimensional space of a social system in order to determine the parametric and probabilistic *conditions* for specific configurations (such as the emergence of more secular individuals or groups in a population).

Given these characteristics and capacities, it is not surprising that scholars of religion (and nonreligion) have increasingly engaged CMS methodologies in recent years (Nielbo et al., 2012). Pioneers in the computational science of (non)religion used ABMs to model the behavior of agents within artificial societies, addressing classical issues such as the mechanisms of religious cognition (Bainbridge, 2006) and the emergence of new religious movements (Upal, 2005). As the computational and explanatory power of CMS techniques expanded, other scholars applied them to explore a wide variety of hypotheses about topics such as the persistence of religious regionalism (Iannaccone and Makowsky, 2007), the function of costly beliefs and practices in the stability of religious groups (Wildman and Sosis, 2011), the emergence of extremism within religious clubs (Makowsky, 2012), the divergent modes of religiosity theory (Whitehouse et al., 2012), the rise of a priestly class in complex societies (Dávid-Barrett and Carney, 2015), and the role of contagious altruism in religious groups (Roitto, 2015).

Many early computational models of religion had relatively simple agents, often presupposing “rational choice” theory, and lacked sophisticated social network structures and structurally realistic simulated environments. Increasingly, however, modelers have been developing more complex cognitive architectures for heterogeneous networked agents with “bounded rationality” and whose interactions are guided by algorithms more deeply informed by scientific research on biocultural systems. As we will see in more detail below, this approach, which is sometimes referred to

as *multi-agent artificial intelligence* (MAAI) modeling (Lane, 2013), has proven fruitful in the analysis of causal mechanisms within a variety of cybernetic cultural systems with (non)religious variables such as increased ritual engagement in response to environmental threats (Shults et al., 2018c), the escalation of intergroup religious conflict (Shults et al., 2018b), and the role of education and existential security in the expansion of secularism (Gore et al., 2018).

But what is new and distinctive here? What can CMS (and especially MAAI) methodologies provide that other approaches more common among scholars of secularism in the Asad and Atran camps do not? In the next section I'll try to provide an initial answer to these questions as I briefly describe an ongoing series of research projects that are utilizing MAAI and other CMS techniques to study (non)religion.

2. THE MODELING (NON)RELIGION PROJECT(S)

As noted above, most of the articles in this special issue were produced by transdisciplinary teams of a growing international collaborative network of scholars interested in applying CMS to complex scientific hypotheses in order to address complex societal challenges. This work has been made possible by funding from a series of overlapping research grants. The first of these was the Modeling Religion Project (MRP), led by Wesley J. Wildman at the Center for Mind and Culture (CMAC) in Boston. The MRP project was funded by the John Templeton Foundation (JTF), and CMAC's main partners for this grant were the Virginia Modeling, Analysis and Simulation Center (VMASC) and the Social Simulation Research Group at the University of Agder.

MRP ran from mid-2015 to mid-2018 and provided the context for the development of several computational models of religion. For example, the team constructed a model of the role of religiosity in terror management that was able to simulate the emergence of increased population level anxiety ritual behaviors in the wake of threats related to contagion, natural hazards,

predation, and cultural others (Shults et al., 2018c). The architecture of that model was expanded to include behaviors and interactions informed by social identity theory and identity fusion theory, enabling the simulation of the mutual escalation of xenophobic anxiety between religious groups that is observed in the real world (Shults et al., 2018b). MRP also sponsored the development of a radically transdisciplinary and policy-oriented participatory modeling approach in the process of constructing several other models, some of which are described in *Human Simulation: Perspectives, Insights, and Applications* (Diallo et al., 2019).

One of the MRP models that was most directly related to simulating secularism is sometimes referred to as the "Non-Religiosity Model" or NoRM (Gore et al., 2018). The computational architecture of NoRM was based on an integration of several empirically grounded theories that show how non-religious worldviews emerge and expand in a population as critically thinking individuals learn about natural causes and human capacities within a wider social field in which they feel safe and secure. In other words, religiosity is "prevented" (or lowered) in a population as education and existential security are increased. These are not the only relevant mechanisms in the secularization process, but their effects in lowering religiosity are among the most well-documented (Ellis et al., 2017; Hungerman, 2014; Inglehart and Welzel, 2005; McLaughlin and McGill, 2017; Norris and Inglehart, 2011; Shults, 2018; Strulik, 2016; Zuckerman et al., 2013). **Figure 1** displays the variable dependencies within NoRM.

The goal of the model was to understand and explain factors that influence changes in average religiosity and existential security in a population (dependent variable). The artificial society was populated with networked heterogeneous agents with cognitive architectures and distributed levels of the relevant variables such as supernatural beliefs, religious formation, and practice, as well as education and existential security (independent variable). Data for initializing the model were derived from factor analysis and structural equation modeling based on respondents from the International Social Survey Programme and from the Human Development Index for multiple countries. The simulation experiments

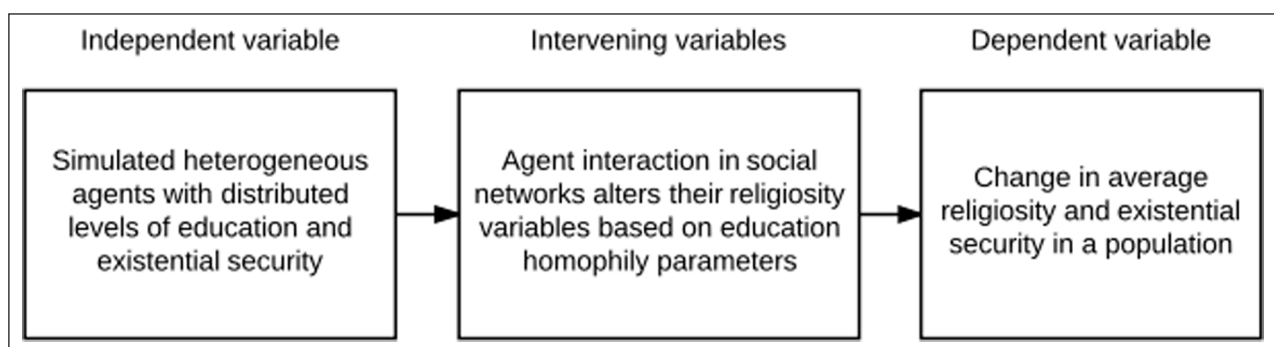


Figure 1 The variable dependencies within NoRM.

(intervening variables) explored the conditions under which – and the mechanisms by which – the dependent variable was affected.

Validating NoRM required us to determine whether the model could simulate the emergence of *macro*-level shifts in religious practices and existential security within its artificial population (in a way that matched their change over time in the real-world data sets) from *micro*-level agent behaviors and interactions. We calibrated the model by comparing its capacity to predict the (real-world) shifts in the relevant variables that occurred during a 10-year period (1990-2000) within 11 countries. Using the calibrated model, we then predicted shifts in the relevant variables for 22 countries (including 11 for which the model was not initially calibrated) during a different 10-year period (2000-2010). NoRM's predictions were up to three times more accurate than its closest competitor, which used linear regression analysis, lending plausibility to its theoretical synthesis and causal architecture (Gore et al., 2018).

After the successful launch of MRP, the team applied for another grant from the Research Council of Norway, which led to the Modeling Religion in Norway (MODRN) project. Based at the University of Agder (UiA), this project was led by the author of the current article and ran from mid-2016 to mid-2019. In addition to strengthening the collaboration between UiA, CMAC, and VMASC, the MODRN project also laid the groundwork for the founding of the NORCE Center for Modeling Social Systems (CMSS) in January of 2018. Some of the MODRN models were explicitly oriented toward understanding and responding to the 2015 Syrian refugee crisis, whose causes and consequences involved variables related to religiosity, humanitarian aid, and peacebuilding (Padilla et al., 2018; Paloutzian et al., 2021). MRP and MODRN overlapped both conceptually and temporally, and included many of the same team members who collaborated in the development of a variety of computational models for studying (non)religion. One of the most interesting and complex was a model of minority integration in a western city (Puga-Gonzalez et al., 2019), which was based on a more generic platform for simulating societal changes such as secularization (Shults et al., 2020).

In this context, however, perhaps the most relevant MODRN computer models were those that emerged out of a 2018 seminar at UiA's Metochi Centre in Lesbos, Greece. This seminar brought together three teams of computer scientists and subject matter experts for a week to work on three different models designed to explore cognitive variables and mechanisms involved in the increase of religious disbelief (analytic atheism), the growth of prosocial attitudes and behaviors among the nonreligious (altruistic atheism), and the role of social networks in exiting religion (affiliated atheism). Work on the first is still underway, but the latter two models have

already been published in this special issue (Galen et al., 2021; Cragun et al., 2021).

The third major funded project in this series of collaborations is the Modeling Religious Change (MRC) project, which began in early 2020 and is still ongoing. MRC was made possible by a grant from JTF and is led by Wesley J. Wildman at CMAC, with several collaborating institutions including VMASC and CMSS. One of the main goals of the MRC project is to develop and execute a new approach to the demography of religion and non-religion that builds on and expands agent-based modeling and social simulation techniques developed in the team's prior work (Wildman et al., 2021). Traditional approaches in the demography of religion tend to focus on self-reports of religious identity or affiliation, in part because these are variables on which longitudinal data is most readily available. Such approaches often employ cohort-component methodologies to make projections. MRC aims to enhance demographic projections of religion (and secularization) by using multi-agent artificial intelligence modeling of the sort described above. This will allow us to take account of other dimensions of religiosity such as supernatural belief and private religious practice. Moreover, linking cohort-component methods to simulations within artificial societies could also help demographers take account of non-linear feedback loops and interaction among variables, produce narrower error estimates, and integrate a rich array of disciplinary insights relevant to religious and non-religious change within demographic projections.

The "Religion, Ideology, and Prosociality" (RIP) project was also launched in 2020 and will run through 2023. This project is funded by an EEA-Norway grant and is a collaboration between CMSS and the University of Bialystok in Poland. RIP is led by Konrad Talmont-Kaminski whose work on religion and secularization incorporates theories and data from a wide variety of disciplines (Talmont-Kaminski, 2014). Four main models are currently being developed, each of which will contribute to the task of simulating secularities. The first model aims to simulate the role of the growth and decline of "fuzzy fidelity" within a secularizing population, a process hypothesized and first demonstrated by David Voas (Voas, 2009), one of the main subject matter experts on the team. The second is a model of the relationships among anxiety, religiosity, and secularization as these engender (or enervate) prosocial behaviors within and across groups. The third will attempt to implement error management theory within a computational model in order to simulate the function of some evolved cognitive biases in religiosity. The architecture of the last planned model will include the mechanisms articulated in epistemic vigilance theory, which hypothesizes that source vigilance and content vigilance play a dominant role in religious and scientific thinking respectively.

Finally, the Research Council of Norway also awarded CMSS a research grant in 2020 to run a project called “Emotional Contagion: Predicting and Preventing the Spread of Misinformation, Stigma, and Fear during a Pandemic” (EmotiCon). The main goal of the EmotiCon project, which is also led by the current author, is to develop user-friendly multi-agent artificial intelligence tools that will enable Norwegian municipalities and other governmental agencies to (1) analyze and forecast the societal effects of their public health responses and social countermeasures to pandemics and (2) experiment with alternative intervention strategies for “flattening the curve” of psychologically and politically debilitating social contagion before trying them out in the real world. EmotiCon has collected and analyzed Twitter content (using new natural language processing techniques) and attitude data (via a representative Norwegian panel survey) that will be used to specify, calibrate, and validate an ABM or artificial society (“digital twin”) of Norway. Simulation experiments on the ABM will be designed to explore the psychological mechanisms and cultural factors that have shaped reactions to COVID-19 and to forecast the way in which individuals and communities are likely to understand and react to future pandemics under various conditions.

This is relevant for simulating secularities because the algorithms guiding the social media analysis, the scales used in the panel survey, and the architecture of the ABMs currently being developed, all include variables related to (non)religiosity as they bear on belief in misinformation and conspiracy theories, as well as attitudes toward following social restriction guidelines and outgroup members, in the wake of the pandemic. Each of the institutions that are part of this international collaboration have other grant proposals under review or in process and are working on models that are not linked to specific funded projects. And, of course, there are other research groups pursuing similar projects and developing other models.

The unique capacities of CMS tools, briefly outlined and illustrated in sections 1 and 2, provide exciting new opportunities for the study of nonreligion. As programming and participatory techniques for incorporating Asad-like insights derived from qualitative research and hermeneutical analysis, and Atran-like insights derived from quantitative research and evolutionary anthropological analysis, into computer modeling and simulation continue to improve, it will become increasingly easy for scholars of secularism in the social sciences and humanities to take advantage of these methodologies (Diallo et al., 2019). The use of such tools, especially multi-agent artificial intelligence models, will also enable scholars in these fields to have a more direct impact on public policy discussions and decision-making in relation to major societal problems such as those reflected in the United Nations Sustainability Development Goals (Shults and Wildman, 2020a).

3. PHILOSOPHICAL REFLECTIONS ON SIMULATING SECULARITIES

But doesn't this great power come with great responsibility? Will the CMS “revolution” in the philosophy of science reinforce the divide between the STEM disciplines on the one (dominant) side and the social sciences and humanities on the other (often marginalized) side? Even scholars in the latter fields who decide not to adopt or engage CMS in their own work may still have a vested interest in exploring the ethical and epistemological implications of the rapidly growing deployment of such tools in their own and neighboring disciplines.

First, let's address some of the *ethical* concerns that inevitably arise when discussing the use of social simulation to analyze and predict changes in social systems. As with artificial intelligence in general, so with *multi-agent* artificial intelligence, many worry that the development and use of such technologies will have a deleterious effect on human well-being. This is a valid concern that applies to all new technologies. Whose moral assumptions are built into the model and whose goals are reflected in the simulation experiments? We have argued elsewhere that it is worthwhile tackling these ethical concerns head on, surfacing the normative assumptions at work in the construction of model architectures as well as in the purposes for which simulation experiments are designed. Moreover, in the case of CMS technologies, we have the opportunity to scientifically *test* our hypotheses about the *social* effects of changing norms in human populations under varying conditions (Shults et al., 2018d; Shults and Wildman, 2020b; Diallo et al., 2021). This has the potential to alter the way in which public moral debates occur, as well as to increase the diversity of individuals who are able to participate in them.

Our work in social simulation has also led us to propose a metaethical framework for guiding discussions within and around collaborative teams developing computational models in which human (all too human) factors play a significant role (Shults and Wildman, 2019). This is particularly relevant when developing models of (non)religiosity because ethics and moral foundations have been associated with religion for most of human history. The *philosophical* aspect of this framework calls for clarification and invites contestation of philosophical claims about the nature (or existence) of “the good” and “the right.” In other words, it is important to attend to the meta-ethical assumptions that often surreptitiously shape ethical discussions about which moral rules we should follow or which moral goals we should pursue. The *scientific* aspect of the framework calls for serious consideration of the findings of the biocultural evolutionary sciences and their incorporation into computational models that aim to simulate religious (or secular) minds and groups.

The *practical* aspect of this metaethical framework calls for the integration of the philosophical and scientific aspects in a way that avoids moral evasion (by, e.g., appealing to unfalsifiable supernatural revelations about a particular ingroup's moral code) and moral confusion (by, e.g., failing to account for the actual cognitive and moral equipment that is part of our phylogenetic inheritance). We cannot fully understand (much less address) most of the major challenges facing global society, including extreme climate change, excessive consumer capitalism, and escalating cultural conflict, without accounting for the role played by various forms of religious belief and behavior (Shults, 2015; Shults et al., 2018a). Adapting in the Anthropocene will require us to learn new ways to challenge cognitive tendencies that promote superstition and segregation, a task that may be facilitated by adopting depolarizing policies and debiasing strategies (Shults, 2020).

Second, let's address some of the *epistemological* worries that may be behind the reticence of some scholars of secularism to embrace (or even tolerate) the rapidly expanding application of computational techniques to the study of nonreligion. CMS provides scaffolding for radical interdisciplinarity and powerful tools for analyzing and forecasting changes in human minds and societies. Will the humanities and the social sciences be left behind? As noted above, the teams represented in the simulating religion projects described earlier have been committed to the inclusion of subject matter experts from those disciplines in a process we call *Human Simulation* (Diallo et al., 2019). While this is not always easy, our experience so far is that humanists and social scientists, even those trained in hermeneutical and qualitative methods, usually become enthusiastic about the process as they see their own theories come to life in a computational model and are able to test their own hypotheses through simulation experiments on the artificial societies they have helped to create.

Moreover, the use of CMS can provide scholars in these disciplines with the capacity to *explain* the emergence of the phenomena they study by growing it in artificial societies. This approach is sometimes called *generative* social science (Epstein, 2006) because of the way it gets at *causality* (rather than mere correlation) but, as noted above, in recent years it has increasingly been applied in humanities disciplines such as history, culture studies, and philosophy. Some scholars in these and related fields may experience an allergy to language about explanation and causality, preferring to stick with the more familiar language of understanding and interpretation. However, we are not dealing here with an either/or but with a both/and. A computational architecture can be informed by and include insights from classical theories in the humanities and social sciences, while also providing

techniques for experimenting and testing such theories in a way that has never been possible before. As Manuel DeLanda explains:

Simulations... can stage interactions between virtual entities from which properties, tendencies, and capacities actually emerge. Since this emergence is reproducible in many computers it can be probed and studied by different scientists as if it were a laboratory phenomenon. In other words, simulations can play the role of laboratory experiments in the study of emergence complementing the role of mathematics in deciphering the structure of possibility spaces. And philosophy can be the mechanism through which these insights can be synthesized into an emergent materialist world view that finally does justice to the creative powers of matter and energy (DeLanda, 2011, p. 6).

This is likely to sound more interesting to scholars of secularism who are already comfortable with Atran-like approaches, which typically or at least often include mathematical analysis and empirical experimentation.

However, the use of CMS tools can also serve to highlight and even confirm the importance of claims by nonreligion scholars in the social sciences and humanities disciplines, including those that emerge from Asad-like approaches. Take, for example, the conceptual issue barely disguised in the title of this article: simulating *secularities*. Just as there is no such thing as "religion" in the abstract sense, we should avoid collapsing all processes related to the diminishing role of supernatural beliefs and religious institutions in some societies into a rigid category called "secularism." Several nonreligion scholars have pointed out the importance of acknowledging that there are "multiple secularities" beyond the west (e.g., Wohlrab-Sahr and Burchardt, 2012). CMS provides a way for such scholars to *clarify* the interactions among different mechanisms at work in divergent pathways followed by various "secularizing" societies and to *demonstrate* how and why they operate differently in varying cultural and ecological environments.

4. CONCLUSION

This article has attempted to introduce scholars of nonreligion and secularism to some of the major opportunities and challenges associated with the growing application of computational methods to the phenomena they study. It has also illustrated these opportunities and challenges by describing several overlapping research projects and some of the models of (non)religion they have produced. Finally, it

touched on some of the significant philosophical issues surrounding the use of CMS, especially the ethical and epistemological concerns that these tools often raise. I conclude by inviting scholars of nonreligion to consider adding these techniques to their methodological toolkits, and to join in on the fascinating and important conversations about simulating secularities that these models engender.

Where to start? A good place to begin for humanists and social scientists would be the edited volumes mentioned above on *Complexity and the Human Experience* (Youngman and Hadzikadic, 2014) and *Human Simulation* (Diallo et al., 2019). Both these books provide a rationale for and examples of the process of building models and running simulations with subject matter experts from the humanities and social sciences. For those preferring an article length introduction, any of the following provide a good introduction: (Grim, 2002; Conte et al., 2012; Squazzoni et al., 2014; Wildman et al., 2017). It is important to keep in mind that one can participate in model construction and simulation design without programming experience or mathematical expertise (as long as other team members bring these to the table). Scholars of secularism working in fields such as the cognitive science of religion and evolutionary psychology might be interested in exploring some of the literature that spells out and illustrates CMS methodologies in ways that engage those disciplines (Nikitas and Nikita, 2005; DeLanda, 2011; Elsenbroich and Gilbert, 2014; Sun, 2016). For an overview of some of the projects mentioned above (as well as others), see <https://mindandculture.org/projects/modeling-social-systems/>.

However, based on my experience (and the experience of other colleagues whose initial training, like mine, was in fields outside the computer sciences), the best place to start is with a conversation about CMS with someone you trust who is familiar with the methodology. Engaging any new approach, but especially computational approaches that involve robust transdisciplinary cooperation, can be challenging. On the other hand, such engagement also opens up new opportunities, not only for expanding one's toolkit with novel collaborative methods but also for refining and sharpening one's use of long-established and time-honored tools of the academic trade.

COMPETING INTERESTS

The author has no competing interests to declare.

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TO CITE THIS ARTICLE:

Shults, FL. 2021. Simulating Secularities: Challenges and Opportunities in the Computational Science of (Non)Religion. *Secularism and Nonreligion*, 10: 10, pp. 1–10. DOI: <https://doi.org/10.5334/snr.154>

Submitted: 23 June 2021 Accepted: 31 August 2021 Published: 15 September 2021

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