

**Computational Models in Anthropology:
What are they good for,
and why should you care?**

A Panel Proposal

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Since the 1940s, computational modeling and simulation methodologies have come to occupy a critical role in the physical sciences as indispensable tools for data exploration, theory creation, and experimental design. In the social sciences, computers have not been as decidedly transformative, and in anthropology they have had negligible impact. Researchers in social sciences with strong quantitative traditions (e.g., sociology, political science, and economics) rely on computational methodologies as system dynamics, agent-based, and social network models; moreover, they do so in ways that are not dissimilar to colleagues in the physical sciences. In contrast, among cultural anthropologists, computers are indispensable for communication, data collection, data management, and text analysis – but computational modeling of cultural and social phenomena remains a curious rarity among ethnographers.

In this panel, we ask the question, “What are computational models *good* for?” Included in this discussion are examples of models developed in a wide range of geographical and historical contexts, including models for academic knowledge production and national security policy formation. We also look at the increasingly widespread development of computational modeling and simulation technologies for real-world decision applications and ask whether computational social science is ready for the burden it is being asked to bear.

KOEHLER, Timothy. TESTING OPTIMALITY IN SITE LOCATION IN THE ARCHAEOLOGICAL RECORD: LOCAL EXAMINATION OF A GLOBAL QUESTION. Disagreements concerning the role of optimality and adaptation in human behavior and culture constitute major planes of cleavage among and within the social sciences. In archaeology, the lines are clearly drawn between those who, like Shanks and Tilley (1992:56), argue that “99% of [human] action has no direct survival value in terms of conveying any definitive selective advantage...the archaeological record is, primarily, a record of style” and those who believe that adaptation and optimization can be potent forces. It has proven difficult to provide data relevant to this foundational disagreement, partly because adaptationism is a slippery concept, and partly because our ability to build models predicting optimal behavior has been extremely limited. Agent-based modeling now allows us to make provisional and partial tests of the degree to which farmers optimized habitation site locations in a 700-year-long archaeological record from southwestern Colorado. We examine the extent to which site locations are optimal from the perspective of the household, on time scales of years, with respect to a specific suite of resources (water, potential maize productivity, hunting opportunities for three species of mammals, and wood for fuel). Current results from on-going simulation exercises indicate that (1) under low population levels there is little pressure for optimality in site

location; (2) there is a long-term trend towards optimality in this record; (3) pressures for optimality increase with population density; and (4) during episodes of depopulation, households in less-optimal areas are the first to leave. I discuss the implications of these findings.

WHITE, Douglas. (Anthropology, UC Irvine) IDENTITY AND DIFFERENCE: WHAT GOOD ARE MODELS? There is nothing that goes by the name of research that does not involve models, although they are often implicit, and one of the uses of modeling as a research activity is to bring the models used in research to the surface whether they are implicit or explicit. Models provide points of intersection between the different strands of a discipline. They can provide fulcrums of potential understanding, translatability, comparability, and also debate and contention, where criticism can lead to model reconstruction. Models can bring together narrative, cognition, history, qualitative and quantitative data, simulations, tests of hypotheses, and challenges to reigning methodologies. A major research achievement is to “weaken” our models to state more general or generic understandings, stripped to essentials but also encompassing a wider range of variability. Weaker testable models for different aspects of theory can then be more easily combined. I discuss ethnographic examples from studies of Turkish nomads, the Irish Republic, and other social networks—Australian, Dravidian (Pul Eliya), Natchez, Chuukese, Gailtal Austrian farmers—to highlight propositions about ethnographic modeling. These cover *benefits of modeling* (Part 1), useful guidelines for modeling (Part 2: including narratives, exceptions, theorems, computation in people’s heads, verifiability, and boundaries), and general perspectives and theoretical framings (Part 3). What I have to say is for models generally and computational models as a special case.

READ, Dwight. W. (UCLA) CULTURE: THE CHALLENGE FOR COMPUTATIONAL MODELING Any representation of "cultural knowledge" depends on what we mean by cultural knowledge. We can identify 4 major claims about what constitutes cultural knowledge: (1) cultural knowledge/information is analogous to genotype/phenotype information and computational modeling is based on Darwinian (inclusive) fitness of cultural knowledge; (2) cultural knowledge is expressed through behaviors that are transmitted through learning/imitation processes (direct phenotype to phenotype transmission) and computational modeling is based on evolutionarily salient conditions under which imitation will occur (dual inheritance); (3) cultural knowledge consists of idea units called memes and computational modeling is based on the fitness of memes and processes for transmission of memes/ideas (memetics); and (4) cultural knowledge consists of constructed, conceptual systems that enable common understanding of the meaning of behaviors and are transmitted through enculturation, thereby forming a "universe" within which behavior takes place; computational modeling is based on both representing the underlying logic of a conceptual system and its cultural instantiation. Most attempts at computational modeling of cultural phenomena, both in and outside of academe, are based on some variant of (1) – (3); e.g., Department of Defense projects such as a Cultural Knowledge Base or Technology Enhanced Cultural Awareness, even though the concept of cultural knowledge expressed in these three claims only accommodates an impoverished notion of the full richness of cultural knowledge. Computational modeling aimed at implementing cultural knowledge as expressed in (4) will be illustrated using kinship and marriage rules among the !Kung san.

GESSLER, Nicholas. (UCLA) COMPUTER MODELS OF CULTURAL EVOLUTION (Transcending the Limits of Natural Language – Evolving Artificial Cultures via Simulation and Facilitating Emergence through Intermediation.)

Empirically, culture comprises individuals, artifacts and groups embedded in social, technological and physical environments, all complexly interacting in simultaneous mutual causation. Although sharing many commonalities, each individual has a distinct identity and conception of the world, a specific repertoire of experiences, beliefs, perceptions, interpretations and behaviors. Each artifact similarly carries information in a distinctive way. Describing, understanding and explaining culture thus necessitate representations which not only capture this complexity but ENACT it, thereby enabling the researcher to evaluate suites of theoretical experimental “what-if” scenarios. Moreover, the work of David Fogel (Evolutionary Programming), John Koza (Genetic Programming), Karl Sims (Evolved Virtual Creatures) as well as research presented in over 500 conferences since 1985 has shown that simulations not only ENACT their initial states, but dynamically modify themselves through evolution. Recent conferences on “Dynamical Hierarchies,” “Dynamic Ontology” and “Computational Synthesis” have focused on building software that not only CREATES emergences from their primitives, but CAPTURES those emergences as new more complex primitives thus facilitating even higher orders of EMERGENCE. Cultural information is always instantiated on a marker, and the materiality of that marker changes the character of the information it conveys. Each material cultural marker has a life of its own: its own audience and capacity, its own costs of inscription, maintenance and presentation. Each has its own vagueness, ambiguity, accuracy, precision, repeatability, robustness, durability, eventual failure and decay. The symbiosis of Evolutionary Computation and Intermediated Material Cultural Cognition (Intermediation) may well provide the foundation for actualizing what Stanislaw Lem envisioned as Sociodynamics and Personetics.

KUZNAR, Lawrence A. (Indiana University – Purdue University, Fort Wayne) APPLIED VERSUS PURE RESEARCH IN COMPUTATIONAL MODELING: IS THERE A DIFFERENCE? Researchers’ intellectual curiosity still drives most anthropological research, despite growth in the fifth subfield of applied anthropology. Critics of pure research have argued that this has led to a conceit and detachment from reality among “pure” researchers. Postmodernist critics such as Bruno Latour have argued that the “tests” of pure scientists pale before the real tests of actual applications. In this paper I review arguments for pure science vs. arguments for application and conclude that these debates are a chimera. Applications are tests of theory, and “pure” research is nothing more than tests in the absence of an immediate application. The realism afforded by computer modeling has encouraged applied research in anthropology. I compare the theoretical insights and advances derived an applied computational model of Brazilian colonization to the applications derived from a computational model of the genocide in Darfur that was inspired by pure science.

MCNAMARA, Laura A. (Sandia National Laboratories, Albuquerque, New Mexico.) COMPUTATIONAL CRYSTAL BALLS AND THE SEDUCTION OF PREDICTION.

Walk through the halls of any intelligence or military institution these days and you are likely to overhear someone asking for and/or selling a computational tool that can ‘do’ culture. Although the military and intelligence communities have long relied on computational simulations for a variety of analytical applications and training programs, the interest in culture is a newer twist, and is largely traceable to the United States’ concerns about Islamic terrorism and its expanding involvement in the Middle East and Central Asia. In this paper, I contrast this trend with the relatively more established use of modeling and simulation for academic knowledge production in anthropology. The use of computational social science in non-academic decision environments represents a new form of applied social science, one that raises epistemological and ethical issues that we are arguably not well-positioned to consider. However, the Department of Energy’s nuclear weapons programs have much to teach anthropologists, modelers, and decision makers about the seductive promises of prediction, the challenge of verification and validation, and limitations to the use of modeling and simulation in high-consequence decision making.