Simulating the past and predicting the future:
Brain-culture networks and the evolution of thought

S Farmer[*†], W Zaumen[†], R Sproat[‡†], J Henderson[§†], B Farmer[∞†], and M Witzel[#†]

Abstract

The production of cultural simulations with serious research and policy uses has become possible in the last decade, thanks to new models that picture key phase transitions in history as products of brain-culture networks of many types and scales. These models have important affinities with nonlinear models used to simulate the outputs of other complex systems, from earthquakes and weather fronts to large-scale cosmic structures, whose dynamic processes include both deterministic and probabilistic elements. One force enabling the production of these simulations has been recent work in cultural neurobiology, which focuses on how brains and cultures reshape each other over time; one remarkable implication of that work is that future advances in the brain sciences can be expected to depend in part on historical research. One class of brain-historical research already underway studies how demographic and technological changes that impact information flows have reshaped human culture since the emergence of anatomically modern man over the past 200,000 years; related studies combine data from brain and philological research to explain once-puzzling parallels in the global evolution of traditional religious and philosophical systems in the roughly 5000 years of past literate history. Research on how conflict in those systems were resolved over long periods in manuscript traditions is providing new insights into how brains handle cultural conflict in general; those insights are currently being used to construct flexible belief models in intelligent-agent simulations applicable to probabilistic modeling of the future as well as the past.

This paper discusses these advances as well as persistent science-humanities divides that continue to impede work in the field. The latter include traditional views of history as the product of "autonomous" or "free" individuals; the scarcity of historians with advanced programming skills; and naïve or dated views of historical change that inform the early cultural simulations of computer scientists who have those skills. The paper discusses strategies to overcome these problems through broad cross-disciplinary collaborations and novel graphic-user interfaces that simplify production of simulations applicable to a broad range of linguistic and cultural fields. Evidence is reviewed that shifting rates of information flows provide sensitive tuning parameters in developing such simulations; theoretical predictions based on this evidence are noted that have led to major discoveries in studies of premodern civilizations in the last decade. The paper continues with discussion of nonlinear effects that rising rates of information flows are currently having on scientific, social-political, and economic developments. Special attention is paid to how even minor policy changes that affect those flows can amplify or moderate the violent political-religious movements and global economic volatility that number among the unpredicted effects of the information revolution. Paradoxical effects that accelerating data flows can have on the net quality of information, which may ironically drop as those rates increase, are illustrated using a new generation of cultural modeling software designed and built by our group. The paper concludes with a look at the future of cultural modeling. Designs of models are described that attempt to simulate the evolution over several thousand years of premodern religious and ethical systems that continue to guide the lives of billions of the world's modern inhabitants. Arguments are given that due to constantly accelerating data flows, our ability to build useful probabilistic models of the future that in part involve such systems, and to construct effective filters to help sort useful data from rising floods of misinformation, may be critical to the long-range survival of higher civilization.

[*] To whom correspondence should be addressed: saf@safarmer.com.

[†] The Cultural Modeling Research Group, Palo Alto, CA.

[‡] Center for Spoken Language Understanding, Division of Biomedical Computer Science, Oregon Health and Science University, Portland, OR.

[§] Asian Studies, Department of History, Louisiana State University, Baton Rouge, LA.

[∞] Interactive Softworks, Leesburg, VA.

[#] Department of Sanskrit and South Asian Studies, Harvard University, Cambridge MA.