

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 far-reaching research and policy applications has become possible in the last decade, applying nonlinear models that link major phase transitions in the evolution of thought from prehistory to modern times to the expansion or contraction of brain-culture networks of different types and scales. Those models correlate those transitions with changing demographic forces and innovations in communications that affect the rates and quality of cultural information flows. These models have affinities with models used to simulate the evolution of other complex systems, from earthquakes and weather fronts to large-scale cosmic structures, that involve complex mixtures of deterministic and probabilistic elements. One emerging field contributing to this work is cultural neurobiology, which studies the interactions of neurodevelopmental and genetic and epigenetic processes, including those involving culture; one remarkable suggestion of the field is that future advances in neurobiology will depend in part on historical research. One branch of brain-historical research already well underway combines brain and textual research to explain emergent parallels in the global evolution of religious and philosophical systems over the past 5,000 years of literate history. Philological studies of how conflicts in those systems were resolved in manuscript traditions provide novel insights into how brains handle cultural conflict in general; our group has used those insights to build flexible belief models in intelligent-agent simulations applicable to probabilistic modeling of the future as well as the past.

This paper discusses these advances along with science-humanities divides that continue to impede work in the field. The latter include views of history as the product of “autonomous” or “free” agents; the scarcity of historians with programming skills; and naïve or dated views of history informing the cultural simulations designed by computer scientists who have those skills. The paper discusses strategies to overcome these problems through wide collaborations and the design of graphic-user interfaces that simplify production of simulations in diverse cultural fields. Evidence is reviewed that shifting rates of information flows provide sensitive tuning parameters in building such simulations; predictions based on that evidence are noted that have led to far-reaching historical discoveries in the last decade. The paper continues with discussion of paradoxical effects that accelerating information flows are currently having on global social-political and economic developments. Special attention is paid to how even minor policy changes affecting those flows can worsen or moderate the violent religious-political movements and massive concentrations of wealth that are among the most dangerous effects of the information revolution. Paradoxical effects that accelerating rates of information flows may have on the net quality of information, which may counter-intuitively plunge when those rates reach critical thresholds, are illustrated using new cultural modeling software built by our group. The paper concludes with a look at the future of cultural modeling. Designs of models are described that simulate the evolution over vast periods of traditional religious and ethical systems that guide the beliefs of billions of the world’s inhabitants. Arguments are given that due to accelerating rates of data flows, our ability to build probabilistic models of the future that involve those beliefs, to construct effective filters to separate socially beneficial data from floods of misinformation, and to limit massive economic imbalances enabled by those flows, may be critical to the survival of higher civilization. An overview is included of how the creation of cultural simulations is critical to modeling other complex systems, including those pertinent to economic and ecological forecasting, that depend in part on fluctuations in human beliefs.

* 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.