GeoGraph Simulations of Globalization Processes

Catherine Dibble
15 April 2003

Abstract

Geographic research matters more than ever for the twenty-first century. We humans now bear the responsibility for creating our networked geographies of transportation and communication spatial technologies, and for their effects. Yet we also finally have the capability to study the effects of site, situation, and agent behavior under controlled experimental conditions within a laboratory. We could study systems before, but not via repeatable controlled experiments. We could perform controlled experiments before, but not at the level of complex and richly structured geographic systems.

This paper formalizes geographic landscapes as interlocking layers of spatial graphs. GeoGraphs extend relational social small-worlds (Watts and Strogatz 1998) to spatial landscapes. Spatial small-worlds weight the reassignment of small-world shortcuts according to distance and according to the existing connectivity of target nodes. A variable contraction factor for each shortcut supports models of globalization processes by reflecting the shortcut's advantage with respect to the base network.

GeoGraph computational laboratory simulations systematically explore the effects of long-run globalization processes that shrivel the world's geography via spatial technology shortcuts. Four sectors of economic agents play a locational game on spatial small-world GeoGraph landscapes. Statistical regressions analyze eleven hundred simulations spanning ten spatial small-world landscape structures, eleven contraction factors, and ten agent random number seeds that generate distinct agent histories on each.

Results show that both relative and absolute geographic characteristics become more important as spatial technologies improve. Yet geographic structure matters more than spatial technology improvements such as speed.

Keywords: economic sectors, locational game, agent-based simulation, GeoGraph computational laboratory, globalization, spatial technologies, network structure