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A GIS for Visualizing the Complex, Self-Organizing Commercial Networks of the First Global Age (1400-1800 C.E.)

A position paper submitted to the UCGIS Workshop on Computation and Visualization for the Understanding of Dynamics in Geographic Domains

I am interested in participating in this UCGIS workshop because of my interest in representing the dynamic process of the first global economy. Although my training as a historian (Ph.D., University of Wisconsin-Madison, 1972) leaves me poorly prepared to deal with the mathematical aspects of this type of visualization, I am able to bring to workshops such as this one problems, perspectives, and cognitive models that are often not considered by other types of researchers who deal with themes with a strong temporal component. In my own teaching and research and in the instructional and research programs over which I have some directional responsibility, I have to move, in the context of collaboration with those with different types of technical training, beyond the more or less static representations and the query forms permitted by contemporary GIS software. This need is particularly evident now because I am assembling an international (France, Israel, Italy, Netherlands, Portugal, Spain, and the U.S.), multi-disciplinary (geography, economics, history, mathematics) collaborative research group that will create a GIS on the basis of mathematical modeling of the dynamics of the flexible, complex webs of commercial interaction during the first global age (1400-1800 C.E.), and we want the result to permit the creation of graphic representations of patterns and relationships for analysis and presentation and allow users to drill down to the data on which the representations are based.

Research

Early in 1998, during a private, online discussion of research problems suggested by Frank 1998, I explained the difficulties I had visualizing the interactions of data for my study of the development of a cohesive governing oligarchy in southeastern Spain (Murcia) in the period 1500-1650, and the participating historical geographers pointed me to GIS, which I began to study at my university's new GIS Center. My first GIS grant proposal (Owens 1998) was funded at the end of that year, and that work has led to my current research on clandestine economic activity and the exercise of political authority in the sixteenth-century Hispanic Monarchy, which has been funded over the past two years by consecutive National Endowment for the Humanities (NEH) and Guggenheim fellowships. In addition, at the end of 2000, I began a parallel project to develop a GIS of Spanish Roman Catholic shrines. For a session on GIS that I organized for the annual meeting of the American Historical Association in January 2006, the AHA published online my precirculated paper (Owens 2006), in which I summarize many of my prior papers and articles on this body of work.

Teaching

With my colleague Dr. Laura Woodworth-Ney, I have created what may be the first graduate program in History based on the use of GIS (Owens and Woodworth-Ney 2005), which is scheduled to begin in the fall of 2007. I already have students do GIS-related projects (for example, Owens

2003), and I have developed sufficient expertise in cartographic design to teach a new course “Cartography: History and Design.”

The Evolution of Cooperation and Trading (TECT)

TECT is a European Science Foundation program within its EUROCORES (European Collaborative Research) Scheme.

Where cooperation is dealt with in the social sciences, especially in evolutionary and historical anthropology, economics, political science, and sociology, the dominant perspective asserts that greater human cooperation in trading activities became possible with the increasing effectiveness of the State, which was accompanied by the rise of Capitalism and individualism characteristic of modernity (for example, Greif 1994, 2001). This assumption about close relationship between the development of the State and of cooperation in trading is evident in the original proposal of the TECT theme to the ESF (Noë *et al* 2005), where one of the companion slides is captioned “Large scale cooperation among unrelated individuals became stable only after **control mechanisms** evolved: policing, religion.” This paradigm appear largely based on the standard periodization scheme of the discipline of history, which has viewed the year 1500 as the great watershed after which the metanarrative has been based on the rise, primarily in Europe, of the State, Capitalism, and the modern individual, concepts that are frequently reified into actors. Beginning in the early 1990s, famed economist Andre Gunder Frank launched a devastating attack of this paradigm on the basis of its spatial and temporal deficiencies, but although he could mobilize a mountain of data to destroy it, he admitted that he did not know how to capture and analyze global dynamic complexity even of economic activity, much less to include in the analysis the ecological, political, and cultural factors crucial to any real understanding of the first global age (Frank 1998).

Our proposed collaborative research project will explore the evolution of complex, flexible, self-organizing networks of merchants, producers, communities, and government officials in the emergence of the first global age (1400-1800 C.E.). Within the discipline of history, the project is innovative in its conceptual focus, geographic and temporal scope, scale of collaboration, and use of information technologies and allied disciplines, such as mathematical modeling. These networks involved a high level of cooperation among people of various ethnic, linguistic, and religious backgrounds, and served to move goods and people within a highly open system over an expanding geographic space. These self-organizing networks, and the strategies employed to achieve cooperation among a large number of widely-dispersed people which made them possible, served as the source of the creativity and innovation necessary to respond in a flexible manner to the disruptions to transportation and capital flows occasioned by war, disease epidemics, arbitrary government actions, environmental changes, and the transportation problems associated with weather, distance, and the available technologies. Without the diffusion of authority and widespread cooperation among merchants and others, often overcoming apparently serious cultural and political barriers, the emergence and spatial intensification of the first global economy would have been impossible, but existing research on such trading activity has been too limited and fragmentary to grasp how such networks emerged and how they were sustained for hundreds of years.

It is true that those involved in these self-organizing networks sometimes employed government officials, especially notaries, who recorded their contracts, letters authorizing representation by distant colleagues, and wills, and justices, who adjudicated their disputes, they could often interact to reach the same goals without the intervention of such officials, as is particularly notable in the case of clandestine trading activity studied by Owens, which is the pilot study for this project. Moreover, the notaries and justices were frequently members of the local community at the node of commercial interactions and formed part of the same self-organizing networks. The importance of these networks even manifests itself in the studies of the public financial institutions of Crown governments in the period. Perhaps the best example of such self-organizing networks in the 21st

century is the *hawala* networks used for long-distance financial transaction that focus on the Indian Ocean basin (Ballard, R. 2003, 2005).

Besides identifying these networks and the people involved in them, we must find out how, within their social and cultural environments, individual merchants maintained the “creditworthiness” necessary for such a remarkable degree of cooperation over often great distances and with people they sometimes did not know, many of whom one would think would have been fierce rivals and competitors. The collaborating researchers will focus on types of cooperation and the cultural environment of ways of understanding the world at various scales: family, small firm, rural community, political and economic urban center, and geographically-extensive network. In part, to grasp the system as a whole, we need GIS visualizations and mathematical modeling to help us compensate for incomplete data due to the fragmentary survival of sources and to discern the possible impact of layers of interaction (for example, the oral exchange of information or oral, informal dispute resolution) of which there are few surviving traces.

We are particularly interested in the evolution of cooperating behavior (and its co-evolution with other ecological, economic, political, and cultural factors) and the possible emergence of new forms as the scale of commercial interactions increases to an ultimately global dimension. Rather than a type of deductive mathematical modeling made famous by Wolfgang Weidlich and his collaborators (Weidlich 2000; Weidlich and Haag 1983), our project requires an approach in which the processes of model creation and database development interact, as recommended by Weidlich’s critics (Lesins 2004; Rosser 2005. See also, Crutchfield 1994; Henrich 2004). In the last decade or so, some economists have shown considerable interest in the importance of understanding self-organizing networks in order to grasp economic complexity (Fujita, Krugman and Venables 1999; Krugman 1991, 1995, 1996), and some have even pointed to the need to build into models the characteristics of the individual actors (Rosser 1999, 2005), but as yet no clearly satisfactory way has been presented to do so, especially in cases where one must take into account often strikingly different perspectives about the world, such as those involving interactions between those from African and European cultural environments. We are unaware of anyone who has proposed a satisfactory scheme for modeling the complexity of this type of networked interaction within a spatially large, ultimately global geographic area and over long periods of time, which can be employed to build a GIS for data organization and visualization. From the workshop, I expect to develop ideas about how we might reach this goal.

References

- Ballard, R. 2003. Processes of consolidation and settlement in remittance-driven Hawala transactions between the UK and South Asia. World Bank/DFID International Conference on Migrant Remittances: *Development impact, opportunities for the financial sector, and future prospects*, 9-10 October 2003, London. [<http://www.art.man.ac.uk/CASAS/pdfpapers/consolidation.pdf>]
- Ballard, R. 2005. Coalitions of reciprocity and the maintenance of financial integrity within informal value transmission systems: The operational dynamics of contemporary hawala networks. *Journal of Banking Regulation* 6,4: 319-353.
- Crutchfield, J. 1994. The calculi of emergence: computation, dynamics and induction. *Physica D* 75: 11-54.
- Frank, A. G. 1998. *ReORIENT: Global Economy in the Asian Age*. Berkeley: University of California Press.
- Fujita M, P. Krugman, A. J. Venables. 1999. *The Spatial Economy: Cities, Regions, and International Trade*. Cambridge, Massachusetts; London: MIT Press.

- Greif, A. 1994. Cultural Beliefs and the Organization of Society: A Historical and Theoretical Reflection on Collectivist and Individualist Societies. *Journal of Political Economy* 102,5: 912-950.
- Greif, A. 2001. Impersonal Exchange and the Origins of Markets: From the Community Responsibility System to Individual Legal Responsibility in Pre-modern Europe. *Communities and Markets in Economic Development*. M. Aoki and Y. Hayami, eds. (Oxford: Oxford University Press, 2001): 3-41.
- Henrich, J. 2004. Cultural group selection, coevolutionary processes and large-scale cooperation. *Journal of Economic Behavior and Organization* 53: 3-35.
- Krugman, P. R. 1991. *Geography and Trade*. Leuven, Belgium: Leuven University Press; Cambridge, Mass.: MIT Press.
- Krugman, P. R. 1995. *Development, Geography, and Economic Theory*. Cambridge, Mass.: MIT Press.
- Krugman, P. R. 1996. *The Self-Organizing Economy*. Cambridge, Massachusetts, and Oxford: Blackwell Publishers.
- Lesins, G. 2004. Book review of *Sociodynamics: A Systematic Approach to Mathematical Modelling in the Social Sciences* by W. Weidlich. *Journal of Artificial Societies and Social Simulation* 7,4.
- Noë *et al.* 2005. Interdisciplinary EUROCORES these: The evolution of cooperation and trading: from microbes to man (TECT). Available, with companion slide show, on the web site of the European Science Foundation [<http://www.esf.org>].
- Owens, J. B. 2003. Routes: Teaching About Connections in World History. *History Computer Review* 19: 69-73.
- Owens, J. B. 2006. Toward a geographically-integrated history of the global Hispanic Monarchy of the first global age: Aggregating data, connecting places, and analyzing processes. Annual meeting of the American Historical Association, 5-8 January 2006, Philadelphia, Pennsylvania [<http://www.isu.edu/~owenjack/AHA2006.html>].
- Owens, J. B., and L. Woodworth-Ney. 2005. Envisioning a master's degree program in geographically-integrated history. *Journal of the Association for History and Computing* 8,2 [<http://mcel.pacificu.edu/JAHC/JAHCVIII2/articles/owenswoodworth.htm>].
- Rosser, J. B. 1999. On the complexities of complex economic dynamics. *Journal of Economic Perspectives* 12,4: 169-192.
- Rosser, J. B. 2005. Book review of *Sociodynamics: A Systematic Approach to Mathematical Modelling in the Social Sciences* by W. Weidlich. *Discrete Dynamics in Nature and Society* 3: 331-335.
- Weidlich, W. 2000. *Sociodynamics: A Systematic Approach to Mathematical Modelling in the Social Sciences*. Amsterdam: Harwood Academic Publishers.
- Weidlich, W., and G. Haag. 1983. *Concepts and Models of a Quantitative Sociology*. Berlin: Springer-Verlag.