

Project Description

Introduction

The *Orbis Initiative* (OI) project aims to build a large repository of historical geospatial network data, made publicly-accessible in a web portal application that provides new software tools and documentation to support data creation, import from existing sources, conflation and aggregation of datasets, basic network analytic measures, and network cost modeling. The OI database, portal, and tool workbench will be a unique new system of resources, expected to see widespread use for historical research and education in the social sciences and humanities. The system will become a significant and permanent new element of scholarly cyberinfrastructure, its development extending Stanford University Libraries' multiple ongoing efforts in building innovative geospatial resources.

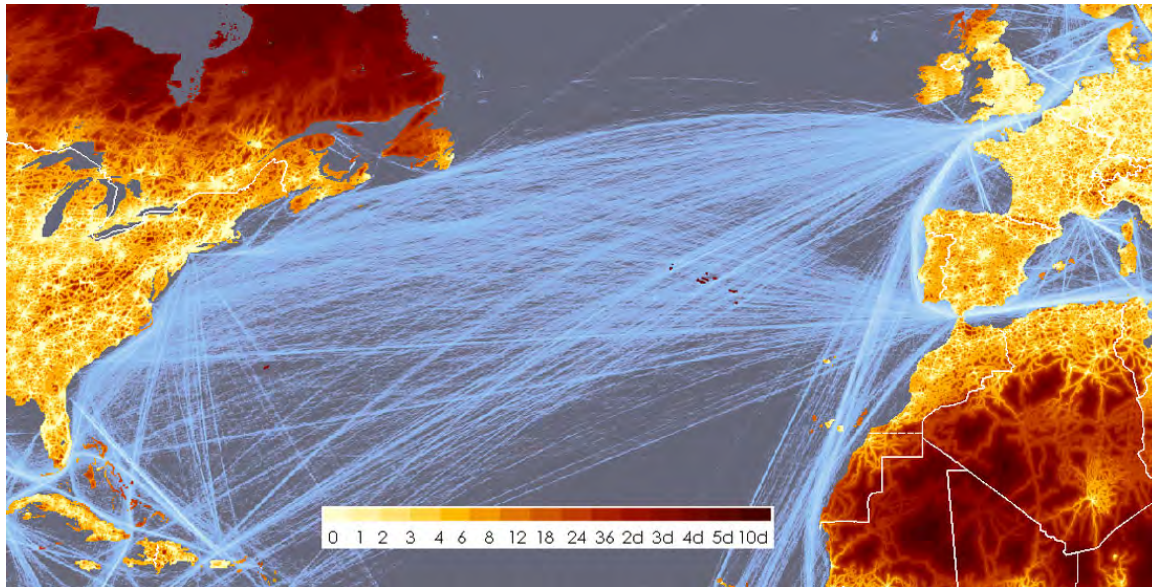


Figure 1 – A Global Map of Accessibility. Present-day travel time to major cities (in hours and days) and shipping lane density (World Development Report 2009)

Whereas modern network data is available in sufficient quantity for policy-makers to analyze present conditions, historical spatial network data of all kinds is sparse, difficult to find, and frequently not readily usable in computational analyses. It is not possible to study the evolution of the complex regional and global intermodal systems depicted in Figure 1. Many creators and owners of historical data would willingly add it to a global commons, given the technical means, lower cost, a reputable and sustainable repository to hold it, and assurances their contributions would be acknowledged publicly and cited at each re-use. The Orbis Initiative will be that global commons and provide the means to bring several kinds of new and existing network data into a permanent and stable database.

There is also a vast untapped store of geospatial network information existing only on historical maps. High-resolution scans have been created for hundreds of thousands of these, and a great many are publicly available under Creative Commons licenses¹. The Orbis Initiative project will develop software

¹ Old Maps Online (<http://www.oldmapsonline.org/>) is a union catalog of historical maps housed in 20 collections worldwide. At this writing it indexes 160,000 map scans; further accessioning in the near term will bring the number to 500,000.

² <http://orbis.stanford.edu/>

³ In its 3rd year, the site has averaged over 10,000 visitors per month

that facilitates the digitization of network-related features from historical map scans, turning graphical information into actionable data for research and education. In order to facilitate rapid development of large quantities of such data, the project will foster and support communities of interest for particular regions and periods. Although networks are the particular focus of the Orbis Initiative, areal features can be digitized as well.

To accomplish these goals, software and systems developed for the project will leverage recent advancements in geospatial data portal platforms, web mapping technologies, web browser engines, and crowd- and community-sourced data development.

Motivation

Geospatial networks are the circulatory system for the movement of people, goods, knowledge, and cultural practices across the earth. Data about their historical development at local, national, regional, and global scales constitute important evidence for the analysis and explanation of current political, societal, and environmental circumstances, including the geographic dimensions of resource disparities. The spatial distributions of human populations defined by demographic characteristics like wealth, ethnicity, religion, and political affiliation can often be explained by historical activity and processes occurring within and between networks. Geospatial networks both enable and result from many kinds of spatial interaction, including commerce, migration, communication, and territorial control.

The Orbis Initiative was motivated in part by the Stanford University Libraries supported project, *ORBIS: The Stanford Geospatial Network Model of the Roman World*² (Scheidel & Meeks, 2012; Meeks & Grossner 2013) first released in 2012 and significantly updated in 2014. That project demonstrates how the shape and size of the Roman Empire effectively changed according to transport costs determined by location, purpose, mode of transport, and the time of year. Response to the project has been strongly positive and sustained³, and there have been many inquiries as to how one might construct “an ORBIS of {x},” with x being any place or period in history, at any scale. ORBIS has also been used in classrooms, not only for the study of transport in Rome, but of how computational models can serve historical inquiry.

Whereas the ORBIS: Rome project entailed building an elaborate model of travel in the that era based on extensive historical scholarship, the *Orbis Initiative* will provide building blocks with which others might develop their own models, tuned to answering their own questions, and beginning where all such efforts must – with data.

The vision driving the Orbis Initiative will be fully realized when there is a publicly available web portal having at its core a dynamic data-driven world map and interactive timeline that allows its users to (i) visualize the global development of inter-city networks, from estimated footpaths between the earliest settlements, to modern road and rail systems, to maritime routes of all eras, and to commodity, information, and cultural flows of all kinds; (ii) perform network measures of centrality, connectedness, and density upon data for selected space-time regions; (iii) contribute existing data from offline sources and new data traced from historical maps; and (iv) download subsets of data for offline study, aided by one or more methodological “cookbooks” collaboratively authored by expert contributors.

The creation of a large store of historical geospatial network data will not only support historical studies in the social sciences, but further basic research in the fields of Geographic Information Science, Network Science, and Complex Systems (discussed in the *Broader Impact* section below).

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