

USING THE COMBINED SPACE/TIME COMPONENT

A Spatial Turn in History

Geography and history are sister disciplines. In fact, geography as a field of scientific research evolved from the study of history. Whereas geographers have the perspective of space, historians consider change over time. This article features a fascinating and mutually beneficial emergent overlap between the two disciplines.

Geospatial scientists tend to neglect the historical roots of the processes they study. Nevertheless, some (spatial) databases are now beginning to include time aspects. On the other hand, many historians overlook the importance of spatial elements in the evolution of events that interest them. Fortunately now, if rather late, there is rising awareness of this overlap and an emerging willingness to mutually influence one another by further developing tools to handle this common field.

Spatial Turn in History

Although spatial analysis and GIS have a certain tradition within historical research, there has clearly been an explosion of interest in this field since the start of the twenty-first century. A recent issue of the influential journal *Social Science History* was entirely dedicated to GIS in history applications, carrying as a subtitle 'The Spatial Turn in Social Science History'. At history conferences such as those of the International Association for History and Computing and the Social Science History Association (see websites), more and more sessions are dedicated to spatial issues and GIS. Historical maps are also increasingly used to access and represent cultural heritage in museums, archives and libraries. The GIS and Remote Sensing revolution took place in the military sector in the 1970s, in geography in the 1980s, in archaeology in the 1990s and, finally, since the year 2000, in history – so that up until recently historians have made only limited use of GIS tools. Various reasons can be found for this, but one is that historians for a long time considered maps merely as a means of presenting data rather than analysing it.

Historical Analysis

Historians today use GIS for more than studying social and economic issues such as racial segregation in US cities, the effects of Roosevelt's 1930s New Deal on redlining (restrictive loan policies), innovations in agrarian practices during the Agricultural Revolution in Wales, or the development of the railway network in the UK during the nineteenth century. The subjects to which GIS is applied nowadays include such diverse issues as the distribution of witchcraft in seventeenth-century England, cultural landscape studies, the creation of digital elevation models and accuracy tests on historical maps, and the reconstruction of historical battles and battlefields. Mapping of the ancient world, changes over time in the spatial distribution of archaeological sites and historical settlement patterns related to land use, and the influence of farming practices on the Dust Bowl of the 1930s are now studied with the help of GIS systems.

New Insights

An example of new insights gained by historians from spatial analysis of their data is offered by a reconstruction of the historical city map of Aarhus in Denmark by Garry Keyes and Jens Toftgaard Jensen. As no historical land register map of the city existed for the early nineteenth century, the use of GIS required the construction of a credible map based on geographical information and structure found in textual sources. The resulting digital map enables spatial analysis to uncover patterns in urban social and economic structures. The spatial distribution of wealth and occupations gave an insight into the structure of the town simply impossible to get before. Keyes and Jensen compare their work to that of the famous city planner Patrick Geddes, who leased an outlook tower in Edinburgh to set up the 'Civic Observatory and Laboratory' in 1892. His goal was to give visitors new insight into the plan, function and inner workings of the city of Edinburgh. Urban historians more than a century later can still learn from Geddes' idea of 'taking a view from above' when examining the city of the past.

National Historical GIS

National historical GIS systems are under development in many countries. For instance, the Great Britain Historical GIS encompasses an impressive range of data, although not everything is publicly accessible. The National Historical Geographic Information System (NHGIS) is a project of the Minnesota Population Centre (see websites) to create and freely disseminate a database incorporating all available aggregate census information for the United States between 1790 and 2000. The great bulk of the United States summary census data exist in machine-readable form but are largely inaccessible.

Other Initiatives

The China Historical Geographic Information System (CHGIS), a project co-ordinated by Harvard University, is creating a database of historical administrative units for different periods in Chinese history. It will provide a base-GIS platform for researchers to use for spatial analysis, temporal statistical modelling and representation of selected historical units as digital

maps. The first release of CHGIS contains datasets for the year 1820, during the Chinese Qing or Manchu Dynasty. Following this release, the project will work backwards, creating a continuous time-series of records tracking changes in place name, administrative status and geography.

Other national GIS-projects are being carried out in Belgium by Gent University (a historical GIS of Belgian territorial structure over the past two centuries), Canada (the Canadian Century Research Infrastructure cartographic system) and The Netherlands. Central to many such projects is the link to historical census digitisation initiatives. For an increasing number of countries it is gradually becoming possible to reconstruct their population history. The next obvious step is to integrate such national GIS internationally.

Cultural Heritage

The Electronic Cultural Atlas Initiative is designed to be a tool for visualising and analysing historical and cultural phenomena. With the capacity to create customised maps based on a theme, era and region of interest, you can quickly answer - or at least frame - questions that would once have taken a lifetime. Which religions had sites of pilgrimage along the Silk Road from the Middle East to China? Was there much regional variation in mortality in nineteenth-century Britain and, if so, why? The Cultural Atlas can be used for research, teaching, advocacy and resource discovery. The user interested in using the Cultural Atlas to make maps must first download the TimeMap GIS viewer. TimeMap is a set of software tools for the Web developed in a project centred at the University of Sydney, Australia. The software is tailored to query, process and display the results of scholarly research in space and time.

Geo-visualisation

To stimulate insight into historical-spatial aspects, Menno Jan Kraak applied a variety of geo-visualisation techniques to Minard's well-known map of Napoleon's 1812 military campaign in Russia, the *Carte figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813*. Edward Tufte described this 1861 map as probably "the best statistical graphic ever drawn". Tufte, in his praise of Minard's map, identified six separate variables captured in it: the size of the army, latitude, longitude, the direction in which the army was travelling, location of the army with respect to certain dates, and temperature along the path of retreat. Few if any maps before or since have been able so coherently and compellingly to weave so many variables into a captivating whole. Kraak shows that geo-visualisation techniques can offer even more insights. You can play with the original, redesign it, include a third dimension, add place names, tell the story, work with space-time cubes, emphasise time, animate and recreate Napoleon's campaign in alternative ways, and even use it to play strategic computer games.

Concluding Remarks

It is clear that GIS has great potential for the study of history. But a lot of work needs to be done before GIS becomes a common tool for historians. First there is the data problem: only a fraction of historical maps is available in a digital, vectorised or geo-referenced form. It is of great importance that mapping and digitisation projects make use of quality and (open) metadata standards, so that it will be possible to integrate distributed data at a later stage. The linkage of data to spatial units is a difficult task, not least because of the incomplete and fuzzy character of many historical sources. The representation of historical data cartographically, when both source map and data may contain vagueness and cover different areas and boundaries across the time-path, has not yet been solved. Maps can look more convincing than is justified by the obscurity, ambiguity or incompleteness of the sources. Another danger is that the historian loses himself in the beauty of the map, seduced by a nice graphical presentation into giving it more attention than in-depth analysis of the story he wants to tell.

Further Reading

- Knowles, A.K. (ed.), *Social Science History*. Special Issue: Historical GIS: The Spatial Turn in Social Science History (24:3, autumn 2000).
- *Past Time, Past Place: GIS for History*, edited by Anne Kelly Knowles, ESRI Press, 2002, 250 pp. ISBN: 1589480325.
- Edward Tufte, *The Visual Display of Quantitative Information*, Graphics Press, 1983 (2nd ed. 1992), 197 pp. ISBN: 096139210X