

An Overview of Work on an Historical GIS of China An Introduction to Robert Hartwell's Work

**Peter K. Bol
Harvard University
USA**

What do we have?

The late Robert M. Hartwell was the first influential social historian of middle period Chinese history. He worked for many years with his wife, the late Marianne Colson Hartwell, and his students to create a database detailing the careers and kinship networks of 25,000 mainly Song dynasty officials and the software applications to analyze that data.¹ Once Hartwell learned of digital mapping systems that could be dynamically linked to datasets, he committed himself to the creation of a geographic information system (GIS) for Chinese history. This project was undertaken originally in conjunction with the China in Time and Space Project, then led by Bill Lavelly at the University of Washington, which Hartwell was asked to join by the Joint Committee in Chinese Studies of the ACLS/SSRC. As his work progressed he received significant help from Lawrence Crissman of Griffith University, Australia.² Prior to his death Hartwell willed his scholarly estate to Harvard, in the belief that the tradition of East Asian scholarship at that University was likely to ensure that his work was not lost.³ The GIS was created in MapInfo; it has since been converted to an ArcView format as well.

At his death maps for the following time cuts has been largely completed.

Tang in 741

Northern Song, Liao, and Xi Xia in 1080

Southern Song, Liao, and Xi Xia in 1200

¹ For an introduction to this material see Peter K. Bol, "Robert M. Hartwell's "Chinese Historical Studies, Ltd." Software Project," EBTI, ECAI, SEER, and PNC Joint Meeting, Academia Sinica, Taipei, January 18-21, 1999.

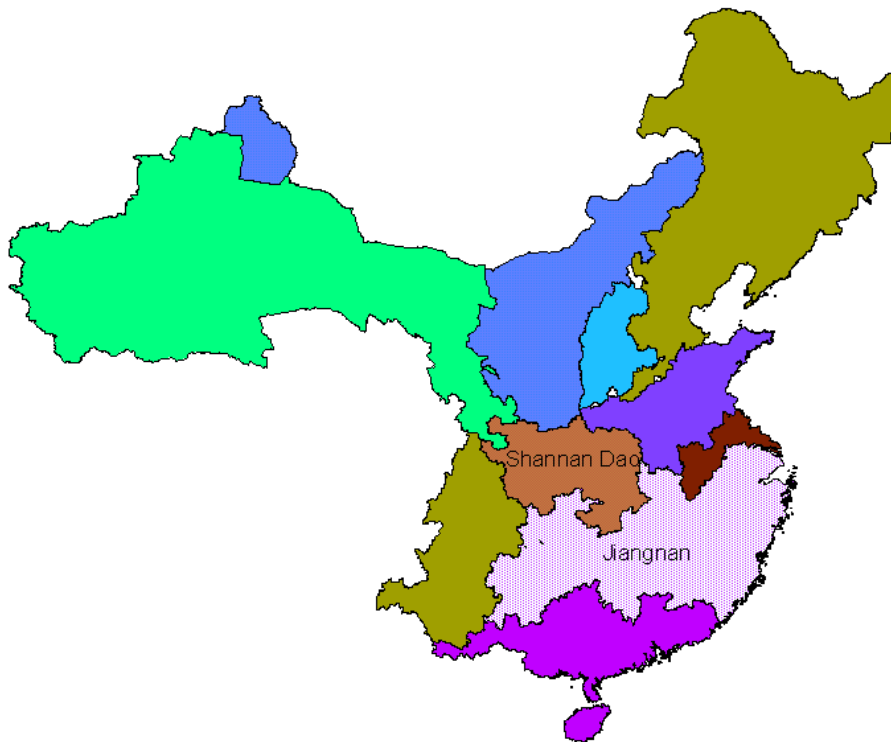
² There are no doubt a number of other scholars whose help still needs to be acknowledged.

³ More specifically he willed it to the Harvard-Yenching Institute, which is technically independent of the University.

Yuan in 1290

Ming in 1391

For each of these five years Hartwell compiled boundary maps down to the county (*xian*) level and identified the higher order administrative units to which the counties belonged, such as the *dao* or circuits of Tang in 741:



and the prefectures in 741:



The data files contain as well the names of the administrative unit in Chinese and in *pinyin* romanization, the *Guobiao* code for the unit, 1990 population data, and so on.

How was it done?

It will be evident from the sample maps displayed here that at the level of international borders the maps reflect the boundaries of the People's Republic of China in 1990. Although as the following map from the 1080 file demonstrates this does not preclude the representation of multiple states:



The reason why the PRC borders appear have to do with the method Hartwell adopted to establish his maps. When we look at the lowest level, county boundaries, this will be even more apparent. Here is Wu prefecture (modern Jinhua) from 1080:



A comparison with the *Historical Atlas of China* will immediately reveal that Tang Qixiang and his fellow historical geographers did not find it possible to draw county boundaries. Indeed, they make a point of not suggesting exactitude in drawing their prefectural boundaries.

In brief, Hartwell's method was to use a single base map which, with research on historical changes in administrative boundaries, could be translated into maps for earlier years. Speaking on behalf of CITAS in 1994 he gave what turned out to be an overly optimistic picture of what had been and would be accomplished:

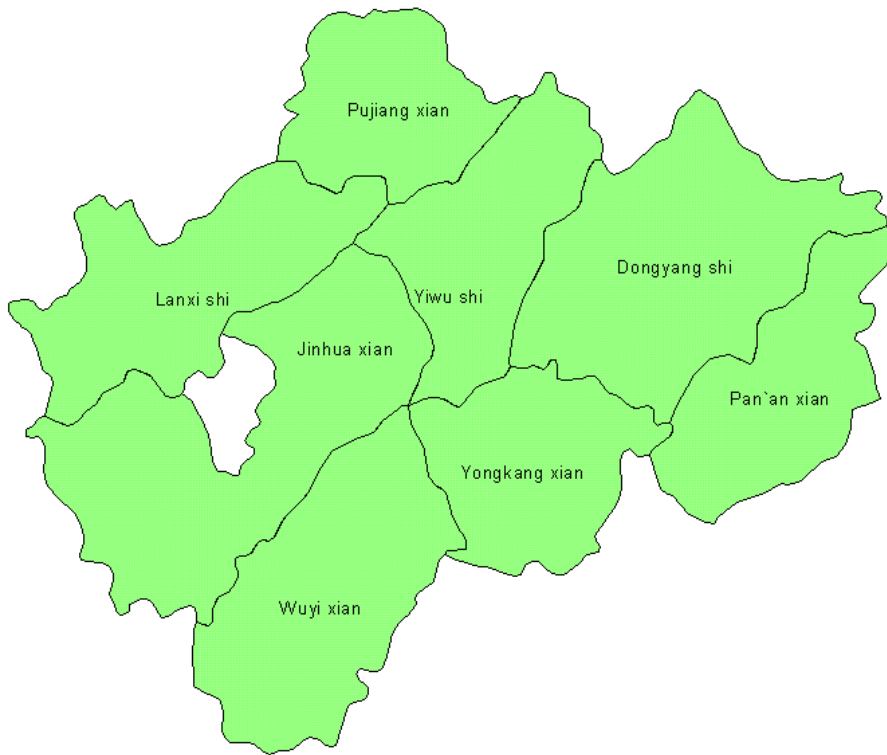
GIS development projects included 1) acquisition and creation of digitized base maps of contemporary China and 2) reconstruction and documentation of historical changes in administrative boundaries as the initial basis for the development of a cross-temporal GIS. The initial GIS database will include a 1990 county boundary map of China matched to the Digital Chart of the World. CITAS will also have coded and documented year-by-year co-locations of changes in administrative units, county-level and higher, from 741 to 1949 as well as year-by-year changes for most years since 1949. The translator year(s) for these co-locations is 1990 so as to key the historical codes to the 1990 county boundary map. By the end of calendar year, 1994, CITAS will have

extensive census and economic data for the years 1982, 1985, 1990 as well as economic data for a number of other years since 1949. The CITAS database will also include a geo-referenced collective biographical/genealogical set of 21,500 biographies containing historical demographic, migration and political variables for the period before 1644 as well as geo-coded census data for the period 741-1643; and geo-coded land use data for Lingnan during the Qing dynasty (1644-1910).⁴

In other words, the 1990 map is the source of the county boundaries that appear in the earlier maps.

Hartwell's procedure of using "co-locations" allowed him to create historical maps by matching up county units from particular moments in the past with counties in 1990. In instances where more than one historical county has been absorbed by a modern county, or where a modern counties is but a piece of a historical county then he did redraw the boundaries. This procedure serves our general purpose but is not always unproblematic. Consider the Jinhua (Song dynasty Wuzhou) section of the 1990 administrative boundary map.

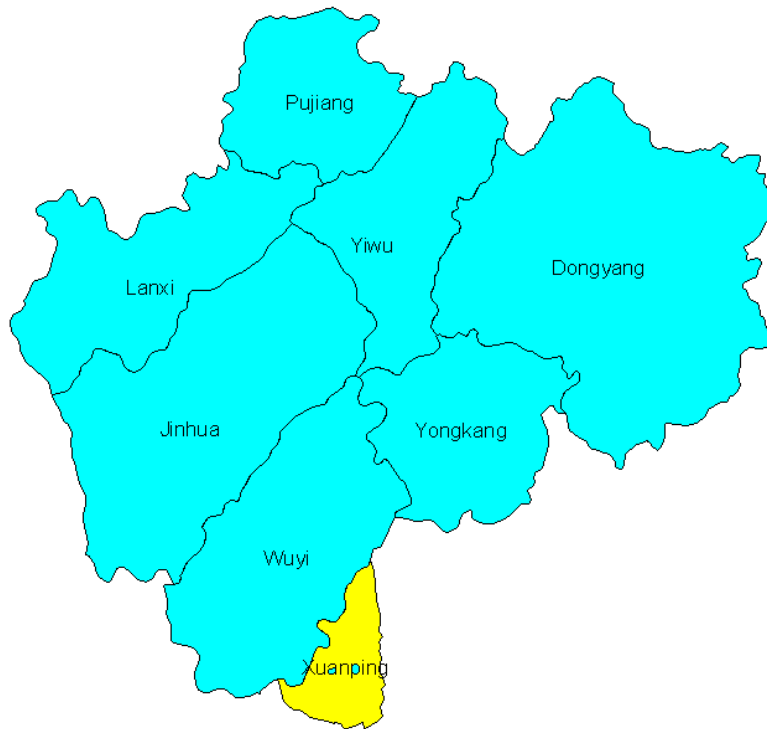
⁴ "Fifteen Centuries of Chinese Environmental History: Creating a Retroactive Decision-Support System," Robert M. Hartwell, CITAS and the University of Pennsylvania, CSS94, June 2, 1994.



In this century Dongyang was divided into two counties, creating Pan'an xian. The drawing of Dongyang in an earlier era is simply a matter of including Pan'an, thusly:



But modern Wuyi is in fact the result of a fusion of two counties in the 1950s, Wuyi xian and Xuanping xian, which formerly belonged to Chu prefecture, immediately to the south. The boundary maps try to recognize this by drawing in Xuanping as follows:



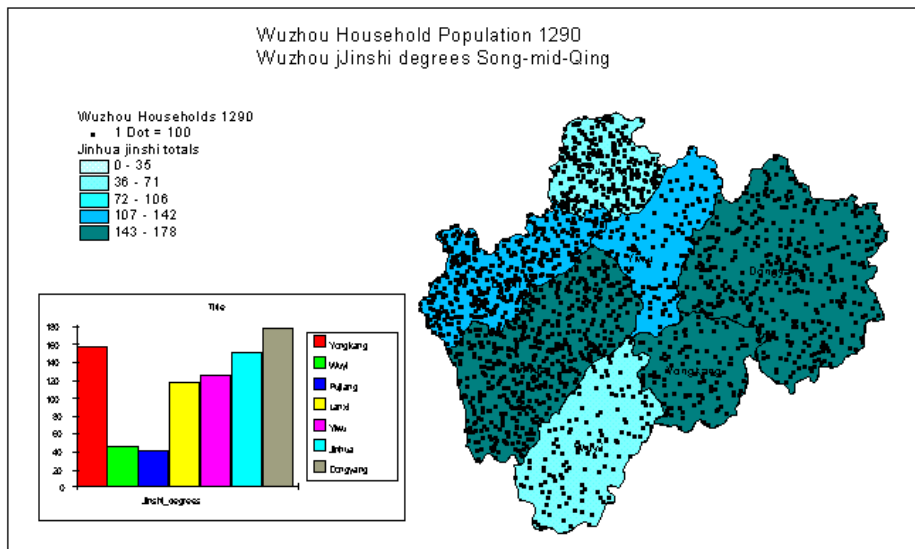
In this case an error has crept into the procedure. Ming dynasty Xuanping should be subtracted from 1990 Wuyi, which already incorporates it in its southern half.

How useful is it?

The usefulness of Hartwell's work depends to some extent on the accuracy of the co-locations. A map represents one year. Is it accurate for that year? Are all counties included, are the boundaries plausible, and are counties grouped under the correct higher order units? Even if only a two counties were renamed every year, given that there is at least an interval of ninety years between maps, a discrepancy in over ten percent of the counties would have emerged. Thus one wants to be confident, that a map is more or less representative of the decades preceding and following it rather than depicting the situation immediately prior to a major administrative reorganization. Although the details will be revised, so far his choice of years appears to be appropriate.

The usefulness of this GIS also depends upon the kinds of data we plan to represent and the level at which analysis yields meaningful results. The maps currently include counties (polygons) and the 1990 county seats (points). For all matters in which the county was the basic unit reporting aggregate data to the higher levels of authority which in turn entered them into the historical record, these maps

are surely of tremendous value. Similarly, this ought to work well for data which generally give only county level addresses (e.g. much biographical data). Data on the registered population, tax quotas, civil service degree holders can also be usefully represented with the maps as they now exist. Thus for example, I can isolate the seven counties of Wu (mod. Jinhua), add the household population in 1290 as a dotmap, and color scaled representation of the Song through mid-Qing *jinshi* degree holders by county.



The GIS already includes one example of this: a file which lists all counties for which local gazetteers were written prior to 1368.⁵

Where the maps do not serve us well yet is for the kind of local research that looks within the county and looks to its sub-units. Local gazetteers do provide us with this kind of information as well: for temples, markets, bridges and ferries, military encampments, and so on. For some regions this may be impossible to reconstruct before the late Qing period. For a few units we may be able to go back to the eleventh and twelfth century.

⁵ More research needs to be done on this file. Taking the case of the seven counties of Wuzhou as a case in point, the file notes two local gazetteers when in fact the existence of texts for six counties prior to 1368 is attested to by later editions.

What shall we do with it?

I offer three suggestions.

First, we should use it. There is a large amount of historical county level data that can be put into digital data sets. To this end it is our intention to make the GIS freely available to the scholarly community as soon as possible and at the same time to encourage researchers to share the datasets they analyze with the Hartwell GIS. Hartwell himself linked the GIS to his prosopographical dataset to examine elite migration and kinship networks. He envisioned the digitization of the disaggregated data on nearly one-million natural events collection by the Institute of Geography at the Chinese Academy of Social Sciences. This, together with historical data on land-use patterns, has immediate value for the study of China's environmental history.

Second, we should expand it. At present there is a gap between 1391 and the late twentieth century. Given the abundance of Qing data, we very much need an eighteenth century map.⁶ There are at least three institutes with the necessary expertise and experience to continue the project. In addition, some geographic overlays from modern maps may be immediately useful, others will require research to trace the course of changes in rivers and deltas, but much of this has already been done by the Historical Atlas of China.

Third, we should refine it. The creation of a reliable GIS for the study of Chinese history is something that should be done once, or at least once a generation. To do this the boundary data needs to be checked and accurate files that track all the administrative changes need to be created. There are more difficult questions that need to be decided as well. The public release of the historical map need to be accompanied by clearly thought through recommendations for common standards. What coding system should we use, for example, for polygons below the Guobiao county code level? How should we code central places within the county? Some of the policy questions can be resolved in the very near future and that will make it possible to embark on the time consuming, often tedious, and certainly expensive work of completing Robert Hartwell's project.

⁶ It is possible, that when Hartwell's hard drives are analyzed we shall find that some proportion of Qing and Republican maps exist. Lawrence Crissman has reported that at the time of his death Hartwell had nearly completed the Republican era co-locations (personal communication to the author).