State of the Fields

Progress in Historical GIS in Japan

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Abstract: Research works with historical GIS (HGIS) have well started since the beginning of the 21st century in Japan. Historical GIS will play a key role to integrate the results of individual research in the humanities and social sciences, including historical geography. HGIS researchers must undertake following four important tasks. To propose a new framework for better understandings of the region, the local history, and the lives of people in the past based on the discoveries with HGIS. To collect, dispatch, and distribute relevant results from research works with HGIS. To develop a four-dimensional HGIS architecture with longitude, latitude, elevation, and time axis, in order to fulfill spatio-temporal analysis. To construct a digital-historical gazetteer with cross-reference functions between the names of places and their longitude/latitude, as well as an inter-local calendar conversion system.

Keywords: four-dimensional HGIS architecture, digital-historical gazetteer, inter-local calendar conversion system, spatio-temporal analysis, historical geography

1. Introduction

Geographical Information System (GIS) has made remarkable progress since the 1980s. It is now developing interdisciplinary studies and this trend implies terra incognita in the so-called Geographical Information Sciences (GISc). During the 20th century many Japanese historical geographers doubted that GIS would enable them to make important discoveries, but a few of them tried to analyze historical materials under serious constraints using conventional types of GIS software that did not take into account temporal axis. This paper reviews major achievements of Historical Geographical Information System (HGIS) research in Japan.

It is possible to combine historical materials such as handwritten documents, old maps, fieldwork results, statistics, archaeological artifacts, etc. with spatio-temporal information. However, it is very difficult to pinpoint the latitude, longitude and time of a given historical event. It is also necessary to construct a data mining methodology to facilitate the discovery of new data from historical materials using GIS. In order to overcome these two obstacles, cross collaboration across narrow fields of study is important.

2. Academic Organization and Publication

Papers carrying GIS in the titles were first introduced at the 11th International Conference of Historical Geographers (ICHG), in 2001 (Figure 1). At the 14th conference hosted by Kyoto University in 2009 (the first meeting held in Asia), 9 per cent of the sessions dealt with digital humanities and historical GIS, while 5 per cent of the total number of papers included GIS in the titles. As of the beginning of the 21st century, ICHG registered a substantial increase of research works with GIS.

In order to speed up the progress of research GIS, the Asia-Pacific countries support the GIS Center of the Academia Sinica, the Institute of Chinese Historical Geography at Fudan University, and the Center for Geographic Analysis of the Institute for Quantitative Social Science at Harvard University. Their excellent products – National Digital Archives Program (NDAP) in Taiwan and China Historical Geographic Information System (CHGIS) developed with Fudan University and Harvard University – are available on the Internet. The School of Information at the University of California, Berkeley and the Academia Sinica Computer Center in Taipei co-organized the Electronic Culture Atlas Initiative (ECAI) and the Pacific Neighborhood Consortium (PNC) to foster digital technology, especially historical GIS.

Figure 1 Papers presented at the International Conference of Historical Geographers.

In Japan, GIS research institutes and academic societies were established since the 1990s: the Center for Spatial Information Science (CSIS) at the University of Tokyo (1998) and the Center for Integrated Area Studies (CIAS) at Kyoto University (2006), approved by the Ministry of Education, Culture, Sports, Science and Technology as Joint Usage Research Centers; the Geographic Information System Association of Japan (GISA) in 1992 and, in 2002, the Japan-Vietnam Geo-Informatics Consortium set up the International Conference on Geo-Informatics for Spatial-Infrastructure Development in Earth & Allied Sciences, GIS-Ideas. The Asian Network for GIS-based Historical Studies (Japan), ANGIS (JAPAN), has been established in December 2012. Since the year 2000, symposiums related to historical GIS have been held almost every year (Kawaguchi 2009).

The increasing number of papers on ICHG, the establishment of new institutes and academic societies, as well as the frequency of symposiums, show that historical GIS is highly valued by computer scientists and specialists in the humanities, social sciences and historical geography. Encouraged by this positive trend, in 2005 Historical Geography prepared a special
issue on historical GIS and several books were published in English (Knowles 2002; Gregory and Ell 2007; Knowles 2008, etc.). In Japan, books on historical GIS started to appear from the beginning of this century (Kaneda et al. 2001; Okabe 2006; Uno 2006; Yano et al. 2007; Shibayama et al. 2008; Yano et al. 2011; Shibayama 2012; Japan Council for Historical GIS Research 2012; Yoshigoshi and Katahira 2012, etc.).

3. Four Tasks on HGIS

In order to reconstruct the lives of people in the past using GIS as a methodological tool, historical GIS researchers must undertake four important and urgent tasks (Kawaguchi 2009):

1. To propose a new framework for better understandings of the region, the local history, and the lives of people in the past, based on the discoveries with HGIS.
2. To collect, dispatch, and distribute relevant results from research works with HGIS.
3. To develop a four-dimensional HGIS architecture with longitude, latitude, elevation, and time axis, in order to fulfill spatio-temporal analysis.
4. To construct a digital-historical gazetteer with cross-reference functions between the names of places and their longitude/latitude, as well as an inter-local calendar conversion system.

These four tasks were already identified in the last decade of the 20th century, in the light of the rapid development of storage capacity and functions in computers and the Internet.

1. The aim of historical geographers is to find out how people organized their daily living space, and they collect their research results in “real world”, “imagined world”, and “abstract world” as defined by H. C. Prince (Prince 1971). Methodical descriptions of the research process to obtain results can help create a new framework to better understand the region, local history and lives of people, and to develop information systems, including HGIS. This new information system for historical geography will allow: (i) to reduce data processing, (ii) to ensure data processing reliability, (iii) to preserve the historical materials in digital form, (iv) to share the data and data analysis methods with other researchers. It can also help researchers to systematize the methodology to visualize the spatio-temporal changes of landscape, environment and regional structures, and to carry out quantitative analysis to discover the underlying rules of living space.

“Real world” carries case studies of landscape reconstruction from historical maps, old photographs, satellite images, etc. (Ogata 2000; Hirai 2009, 2012; Yano et al. 2011; Nishimura and Kitamoto 2012; Yoshigoshi and Katahira 2012). Mamoru Shibayama reconstructed urban transformation in Hanoi and proposed a new Area Informatics methodology in his book (Shibayama 2012). The historical geography database of the Nara Basin project is developing a system to reconstruct the ancient landscape (Ide 2012). Also the natural environment was reconstructed in Nara and Hanoi (Kawasumi 2012; Yonezawa 2009). The distribution of population and domestic migration were analyzed with HGIS (Arai and Koike 2003; Kawaguchi 2009; Takahashi and Nakagawa 2010; Nagata 2012; Kato and Kawaguchi 2012).

In “imagined world”, Akihiro Tsukamoto analyses the spatio-temporal changes in places of scenic interest in Kyoto with guidebooks and pictorial maps dating back to the 17th-19th centuries (Tsukamoto 2006, 2009, 2012). The next step will be to try to understand the mentality of the people in the past through the appearance and disappearance of notable places reflected in the presentation and distortions in old maps.

In “abstract world”, several attempts were made to find out the underlying rules of regional structures. Tsunetoshi Mizoguchi discovered the core-periphery structure around the Nagoya castle-town in the 18th and 19th centuries, which was proposed by G. W. Skinner (Mizoguchi 2012). Kenji Ishizaki analyzed the spatial pattern of the central places in the Nara Basin in the 19th century (Ishizaki 2012).

2. In addition to the growth of HGIS research itself, it is also important to develop a complete system to store, open and share scientific information with HGIS. In a context of strong competition among the different media, researchers have to face a real challenge to make the result of their research work look appealing to the international academic community. Web HGIS has potential to become a more powerful and multiform medium than printed books or journals. There are many efforts to construct virtual museums, digital archives, and e-learning systems with Virtual Reality (VR), Computer Graphics (CG), and HGIS. New technologies such as Semantic Web construct ontology in the World Wide Web, and Linked Data connects many kinds of data with Semantic Web. Some HGIS projects may follow the steps of NDAP in Taiwan, which will transform its digital archive into an e-learning system. In Japan, the Virtual Kyoto Project at Ritsumeikan University promotes attractive touristic places in Kyoto (Yano et al. 2007).

3. Scientists in the humanities and social sciences should bear in mind GIS architecture when they use or construct HGIS, as it influences the way to process, combine and share information of historical materials. Before ESRI released ArcGIS 10 in 2010, it was difficult to analyze and visualize spatio-temporal transition with conventional GIS software. Only TimeMap, developed by Ian Johnson, could visualize spatio-temporal changes with the time bar function. In the last decade, computer experts in Japan started to develop outstanding next generation four-dimensional GIS architecture: Reki-Show Authoring Tool, by Masato Hanashima (Hanashima 2005); GLOBALBASE architecture, by Hirohisa Mori (Fujita and Mori 2012); HuTime/HuMap, with the collaboration of Shoichiro Hara and Tatsuki Sekino (Kubo 2007; Kubo et al. 2010; Hara and Sekino 2012).

4. The digital-historical gazetteer and the inter-local historical calendar conversion system are essential resources for HGIS to shorten the process of drawing digital maps from historical materials. The Getty Thesaurus of Geographic Names Online and the Alexandria Digital Library Project Gazetteer Development are the leading digital gazetteers in the world. However, there is no cross-sectional gazetteer for countries that use Chinese characters. In Japan, some geocoding services are provided through the Internet. CSIS at the University of Tokyo offers a Geocoding service for CSV formatted files on WWW. Kenji Tani pro-
duced Geocoding and Mapping.\(^{(5)}\) Yuji Murayama constructed Gyousei KukakuHen'senWebGISand provides administrative boundary data since 1889.\(^{(6)}\) Ikuo Oketani released the Japanese Historical Gazetteer Database with Dainihon Chimeji Jisho (Gazetteer of Imperial Japan), Dai-Nihon Jiin Meikan (List of Buddhist temples in Japan), and old 1:50,000 maps (Oketani 2012). The Gaiho-Zu Digital Archive Project will construct a digital gazetteer with old maps of neighbor countries, made by the former Japanese Imperial Army (Yamamoto and Kobayashi 2012). Mitsuru Aida provides an inter calendar conversion system for Japanese, Chinese and Western local-historical calendars (Aida 2007). These useful contributions can support HGIS projects worldwide if we standardize the metadata of the digital gazetteer and calendar, develop the cross-sectional retrieval system, and set up a portal to access each system.

4. Conclusion

This condensed review shows that in Japan HGIS research on the four tasks mentioned above has well started in the first decade of the new millennium. As they are complementary and supplement each other, it is necessary to foster collaboration across specific fields of study and to systematize research methodology by sharing specific research topics, discussing the definition of the themes, finding ways to solve the problems, and consolidating the results in a single complete system. HGIS has potential to become a groundbreaking method for holistic evaluation, offering a new framework for better understandings of the regions, the local history, and the lives of people in the past. It will also help overcome the divisions among the different narrow fields of study in the humanities and social sciences, including historical geography.

Notes

(1) It is possible to access the products of Virtual Kyoto Project in following site. http://www.geo.it.ritsumei.ac.jp/webgis/ritscoe.html (last accessed 13 April 2013).

(2) It is possible to download the recent version of GLOBALBASE from the following site. http://www.globalbase.org/ (last accessed 13 April 2013).

(3) It is possible to download the recent version of HuTime/HuMap from the following site. http://www.h-GIS.org (last accessed 13 April 2013).

(4) It is possible to use Geocoding service from the following site. http://newspat.csis.u-tokyo.ac.jp/geocode/ (last accessed 13 April 2013).

(5) It is possible to use Geocoding and Mapping service from the following site. http://ktgis.net/geode/ (last accessed 13 April 2013).

(6) The administrative boundary data since 1889 are provided from the following site. http://giswin.geo.tsukuba.ac.jp/teacher/murayama/boundary/ (last accessed 13 April 2013).

References

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