Interdisciplinary Research in High Mountain Areas of North-East India

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Abstract

The Himalayan Mountains have always been a fascinating area for cartographers, scientists and the general public. With four of the greatest Asian cultures – China, India, Persia and Tibet - converging in the Western Himalayas and the trade and pilgrimage routes that cross them, the vast number of cultural artefacts available has prompted much research.

At the University of Vienna, Austria, an interdisciplinary research network, working under the 'umbrella' of the Austrian Science Fund, is undertaking research focussing on the Western Himalayas. The research network includes cartographers, art historians, numismatists, Buddhist philosophers, and Tibetan and Sanskrit philologists. The main objectives are to intensify research on the cultural history of the Western Himalayas as well as to develop a map-based Cultural History Information System (CHIS) for sharing the outcomes with other experts and the interested public.

When developing an interdisciplinary (Web-delivered) Cultural History Information System, one of the challenges is to obtain an understanding of the scope of all project partners and their need for geo-located information. This information is the connecting factor for research stakeholders and plays an essential role for communicating within and without the project. For a deeper understanding of the interdisciplinary work of the individual project partners a field trip to Himachal Pradesh (India) in summer 2007 under the participation of art historians and cartographers was undertaken.

The paper presents the experiences from this field trip and what influence it had on the overall objectives of the cartographic information system. Furthermore it provides information about the underlying design and architecture of the system. Finally, crucial issues such as designing and delivering a spatial-temporal gazetteer and the design of an appropriate cartographic base map will be addressed.

1. Introduction – The NRN

"The Cultural History of the Western Himalaya from the 8th Century" is a National Research Network (NRN) funded for three years (2007-2010) by the Austrian Science Fund. It is dealing with the four great cultures of Asia – China, India, Persia and Tibet – which converge in the Western Himalaya. This region was traversed by historical trade and pilgrimage routes from the Mediterranean to the China Sea and the Indian Ocean. These corridors of communication connected far flung centers and thus over the millennia contributed to common cultural features despite great ethnic and linguistic diversity.

The research within the NRN is concentrated on the western-most part of this region: Northern and Eastern Afghanistan, Northern India (Himachal Pradesh, Jammu and Kashmir), Northern Pakistan, Northwest Nepal, and West and Southwest Tibet, including the neighboring regions in Central Asia. Through the centuries this region was, and continues to be, an area of intense cultural exchange. Our knowledge of the cultural history of this complex region is changing rapidly as a result of the great mass of previously unknown primary documents: e.g., manuscripts, coins, inscriptions, and art objects that are daily discovered in Afghanistan, as well as to a lesser degree in nearby regions. One of the purposes of the NRN is to facilitate the documentation and descriptive analysis of vanishing cultures of the Western Himalaya in order to study, with comparative methods and from different professional perspectives, the manifold facets of those cultures.

One of the project parts, conducted by the University of Vienna, Department of Geography and Regional Research, is aiming at assembling a Cultural History Information System (CHIS) of the Western Himalaya. The basic question to be addressed within the scope of the project is to what extent a Geographic Information System can be built to deliver an integrated cartographic decision-support tool for information-collection and analysis that stores data gathered from multiple resources and provides a communal internet-delivered repository of information and geo-located artifacts? Because of the diverse research fields of the project partners (art history, numismatics, Buddhist phi-

losophy, Tibetan and Sanskrit philology, and ethnography of the Western Himalaya), the goal of the CHIS is a high quality cartographic output, which allows the user to derive a holistic view of the entire data within its regional, cultural, as well as historical context.

In the following the concept and design of the first prototype including the geodata requirements and the structure of the gazetteer for the various geographic locations of individual objects will be described. The fieldtrip to Himachal Pradesh (North East India), conducted in summer 2007, as an example for interdisciplinary field work in very steep mountainous regions, will conclude the paper.

2. CHIS

The CHIS itself is a complex system, the main parts of which are different data archives, holding topographic and thematic data, and the user interface for information retrieval and analysis. For the connection of geographic and thematic data a gazetteer, containing geographic locations, their according coordinates and the needed synonyms of the location names, was built. The heart of every spatial information system, the base map, is a combination of various datasets. To implement a first prototype these three points (geodata, gazetteer and system design) have been discussed and will be described below.

2.1. Geodata

A main component when building a cartographic information system is the provision of adequate raster and vector geodata for different visualization purposes and scale levels. Datasets needed for the CHIS include administrative boundaries, cities, rivers, lakes, coastlines, roads, railroads, digital elevation models and special datasets showing objects which have significance in cultural historical context like temples or monuments.

For budgetary reasons, the small and middle scale base maps for the main application are created by using free-geodata sources as a basis.

Sources for vector data include
- the Digital Chart of the World (DCW, http://www.maproom.psu.edu/dcw/),
- Vmap0 (http://earth-info.nga.mil/publications/vmap0.html),
- ESRI Data DVD,
- Hydro 1k (http://edc.usgs.gov/products/elevation/gtopo30/hydro/index.html).

The raster datasets used are amongst others
- SRTM (http://www2.jpl.nasa.gov/srtm/),
- GTOPO30 (http://edc.usgs.gov/products/elevation/gtopo30/gtopo30.html)
- and Tom Patterson's Natural Earth2 (http://www.shadedrelief.com/).

Names are derived from various Atlases, as well as printed maps, digital gazetteers, and the global name database GeoNames (http://www.geonames.org/).

The datasets are processed for multiple scale levels, so that a high quality output for screen and printing purposes can be assured. Processing involves automatic generalization algorithms and also a lot of manual workforce. The aims are to create refined datasets, which are consistent for the whole area of interest, topologically correct and which ensure a high quality for cartographic visualization.

2.2. Gazetteer

To avoid ambiguous place names and geographic coordinates for one and the same location used by different network partners a gazetteer was established. This list of geographic place names contains spatially referenced data as well as a defined hierarchical structure within the geometric objects (country -> state -> district -> city). Besides this data, the different names and spellings of locations are stored.

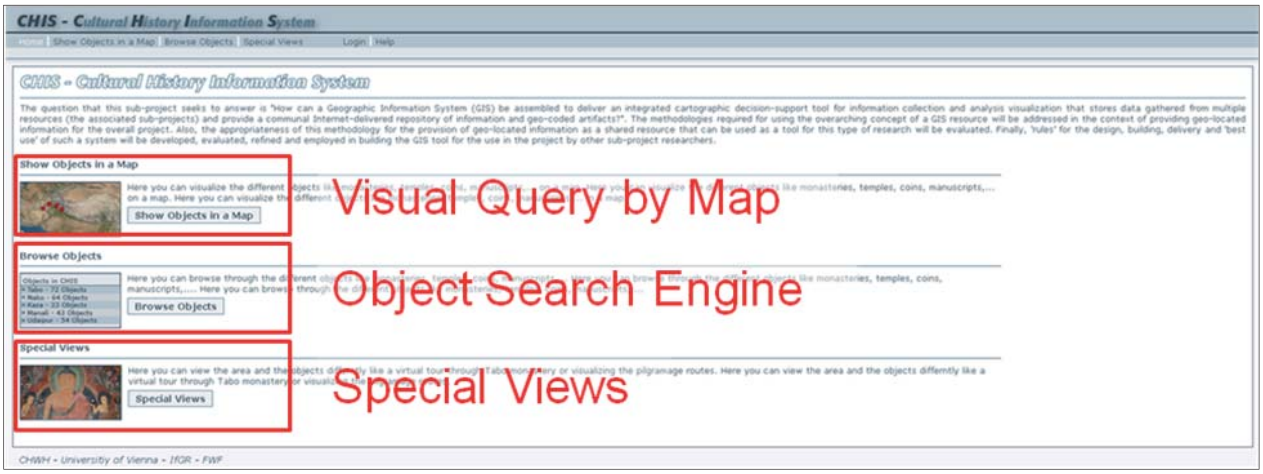

Fig. 1: Main Page

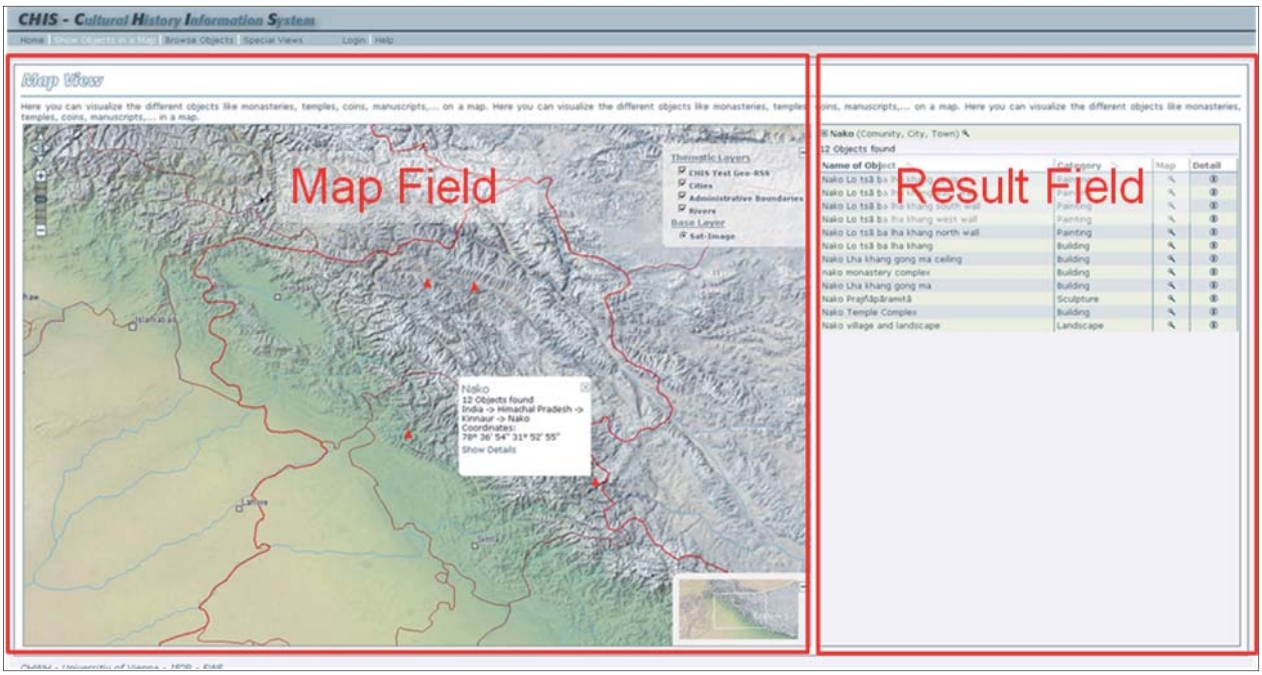

Fig. 2: Map View

2.3. System design

The architecture of the information system provides the user with three approaches to get information. It is possible to search for objects in a map (visual query), by a search engine or by opening special views (only for particular locations). The CHIS is an online application and can be accessed by a standard internet browser.

In all parts of the application there are a few fixed elements. The top frame contains the main menu, the logo and the search box. The bottom frame closes the application and contains less important links like imprint or contact. The main content of the application is situated in the "Main Frame".

The basic design of the application can be divided into the "Browse Objects" view and the "Map View". In the "Browse Objects" view the result list of the search is more important and therefore the "Result Field" frame is relatively large. In the "Map View" the result view has a less prominent role and the map occupies the largest part of the application.

From the start screen it's possible to jump to the different parts of the application, either over the prominent links in the main frame or using the links in the top frame. Each part of the application is well explained to support the user.

In the Map View the main focus is on the map which occupies the largest area of the page. On the right side the result of the search query is shown. The categories are shown as selected before. The user can change the categories in the layer-list. If a town is selected, all objects within this place are shown as a list. Detailed information to the selected location is also shown (different names, coordinates, geo-gazetteer structure). On the left side of the map a pull-down menu allows to directly select and zoom to the extent of the areas with a main research focus. The zoom slider allows a simple zoom-functionality.

In the browse objects view the user can browse through all objects in the database. Selections can be made by region, categories or time span. Additionally a filter according to keywords relevant for cultural historic research is implemented. On the right side the search result is listed. Detailed information to the selected region is shown on top of the

Fig. 3: Browse Objects

Fig. 5: Inside the "Ser Lha Khang" temple (Tabo Monatery)

search frame. A list of the selected information is located below.

3. Field trip

In order to collect information in situ and learn about the project partners' research work, a field trip to Himachal Pradesh (India) was undertaken in summer 2007. Four persons, equipped with a laptop, three GPS devices and two digital cameras, have been in the field for 31 days.

The routes and way points collected by GPS extended already available geographic locations and the gazetteer. GPS data and digital photography were combined using special software. As a result geolocated pictures of important cultural historical objects were made available.

In order to present a virtual view of the town Tabo as one of the special side applications in the CHIS, pictures for interactive 360° panoramas were taken in and around the monastery as well as inside the nine temples of Tabo. For the work inside the dark buildings a tripod and/or the use of flash light (which was often not allowed) was needed.

In addition to the Tabo panoramas a lot of other panorama pictures were shot wherever the situation and surrounding was offering the opportunity. These images will also be included in the thematic archives.

4. Outlook

At the moment the NRN and the CHIS are in an early stage. The first year of the three year project is over, the project partners got familiar with the other research areas and a first prototype has been implemented.

The available geodata is sufficient for the scale used in the base map, but for large scale maps, accurate geodata is still missing. The production of a user friendly application which is rich in content, is a difficult and time-consuming task. The next two years of cartographic research will show, how the concepts for an online cultural history information system will have to be adapted, so that it can perfectly fulfil its task in spatial communication and allow the greatest benefit for the work of cultural historians.

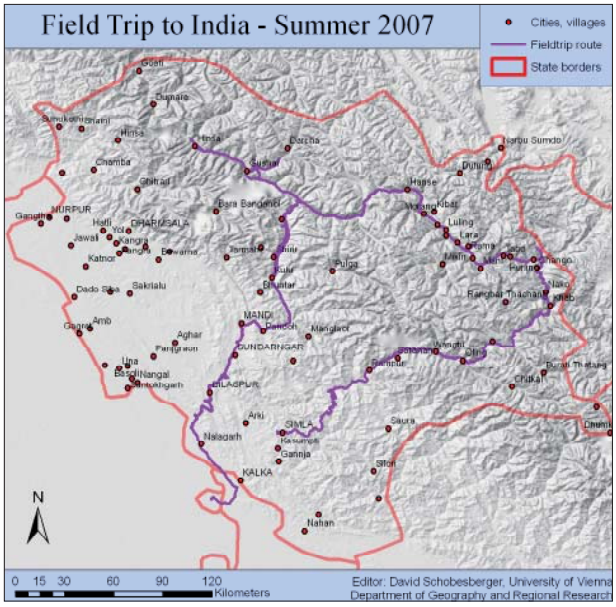

Fig. 4: Route of the field trip 2007

References

Kriz, K., Pucher, A., Kinberger, M. (2007): CHIS – Cultural History Information System of the Western Himalaya. In: Proceedings of the 23rd International Cartographic Conference, Moscow, Russia.

Website of the NRN: http://univie.ac.at/chwh