

## **ADVANCES OF INTERDISCIPLINARY CARTOGRAPHY IN THE HIMALAYAN MOUNTAINS**

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### **ABSTRACT:**

This paper follows up on the ongoing development of a cartographic online information system for cultural history that was first presented at the 2008 Workshop of the Commission on Mountain Cartography of the International Cartographic Association in Lenk, Switzerland (cp. *Kinberger et al. 2008*). It describes the design of the system with its various information layers as well as additional integrated applied research projects and the production of printed maps as a support of research tasks in the office and the field.

**Keywords:** *Cartographic online information system, system design, information layers.*

### **1. INTRODUCTION**

The Cultural History of the Western Himalaya from the 8th Century is a National Research Network (NRN) that is being funded for six years (2007-2012) by the Austrian Science Fund. The network includes scholars from Art History, Numismatics, Buddhism, Tibetan and Sanskrit Philology as well as geographers/cartographers at the University of Vienna. The main aim of this diversified research group is an intensive study of all facets of cultural history in a large region enclosed by the Himalayan Mountains (North-eastern Afghanistan, Northern Pakistan, North-western India, Nepal and large parts of Tibet). The network is dealing with the four great cultures of Asia – China, India, Persia and Tibet – which converge in the Western Himalaya. The region was traversed by historical trade and pilgrimage routes from the Mediterranean to the Chinese 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 cartographers' role within this interdisciplinary setup is to facilitate research by providing geo-located information and taking a bridging role between the research endeavors of all involved by spatial location. Thus geoinformation and cartography play a vital role in many stages of the interdisciplinary research network. The cartography group at the University of Vienna has designed and implemented a flexible web-delivered information system (Cultural History Information System – CHIS) for sharing knowledge with experts and the interested public. This system encompasses a variety of spatial representations from classical topographic and thematic maps to integrated media side-applications that show special areas of interest in a very detailed manner. These applications do not only have a strong eye-catching effect but also a high potential for jointly communicating multidimensional information from various disciplines.

Besides design and implementation of the CHIS the cartography group tries to assist the scholars from the humanities with tools and equipment for data acquisition in the field. A large online repository of maps has been compiled, the contents of which to a large part

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can be downloaded and printed for office and field work tasks. Proper foldable large scale topographic maps have been produced for selected areas in Northwestern India to facilitate travel and research in the selected area. Easy-to-use GPS software has been designed for surveying sites of cultural historic importance and facilitating the transfer of geo-referenced data to the information system.

This paper will outline the past and ongoing developments that are part of the CHIS project at the University of Vienna and will give an outlook on future research lines within the scope of this interdisciplinary project.

## **2. CHIS SYSTEM DESIGN**

The CHIS is a Web-based cartographic information system that understands itself as a collaborative spatially enabled system for archiving, analyzing and visualizing datasets of cultural history. Various databases of stationary and portable objects from the involved disciplines are interconnected through their spatial location, thus allowing interdisciplinary and more holistic insights on the cultural history of a wide, geographically and culturally diverse area. The geographic reality, topography and surrounding physical and man-made features, are taken into account by high quality base maps in several scale levels as well as geo-referenced scanned images of printed maps. Multimedia applications are embedded in the system as eye-catchers and to demonstrate the potential, which modern forms of cartographic communication can offer.

The development of CHIS strictly followed a user-centred design approach. The Web-based system is what is considered to be a cutting-edge application for cartographic information systems in the field of cultural history. The objectives concerning usability and especially user experience are ambitious and can/could only be met by iterative design steps.

The current version of the information system consists of three main views:

- The information view,
- The map archive, and
- Special Views.

### **2.1. Information View**

The information view can be seen as the core of the system where locations of cultural historic interest are highlighted and the objects stored in connected databases can be visualized. The map interface uses OpenLayers technology, thus enabling an intuitive navigation (zooming and panning) that most users are familiar with from other products (e.g. Google Maps). Base maps in the system were prepared in four different scale levels with increasing level of detail. The content area in the information view features the possibility to browse the content in thematic lists that are generated on the basis of the current map extent. All databases and object descriptions can be searched and the locations of the outcomes are highlighted on the map with mouse-over effects. Narratives have been designed to guide the non-expert user through the system by highlighting items that are thematically connected and to generate interest by giving the user additional background information on relevant topics of cultural history.

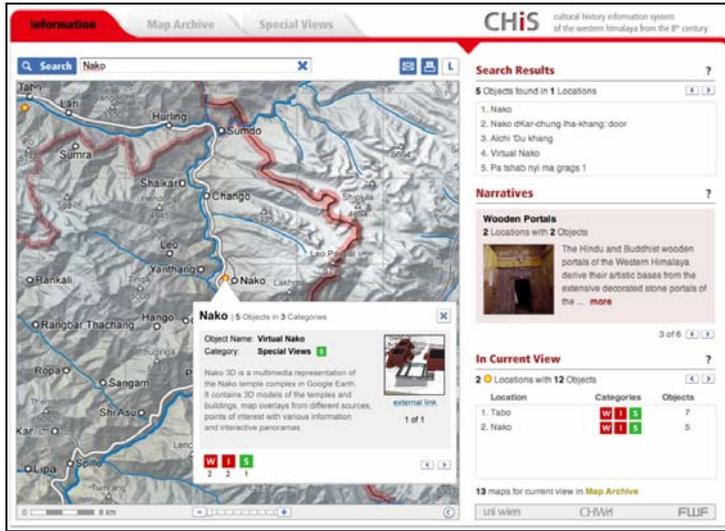


Fig. 1 The Cultural History Information System's Information section

## 2.2. Map Archive

The map archive is a compilation of printed maps that have been digitized or carried together from various online sources. These maps are available for download by the users and can be selected not only by sorting through a list of various map criteria but also by selecting them geographically by their extent on the CHIS system map. The Browse Maps area shows a preview image of the maps respectively the map covers. Maps produced as part of this project are also available via the integrated map archive.

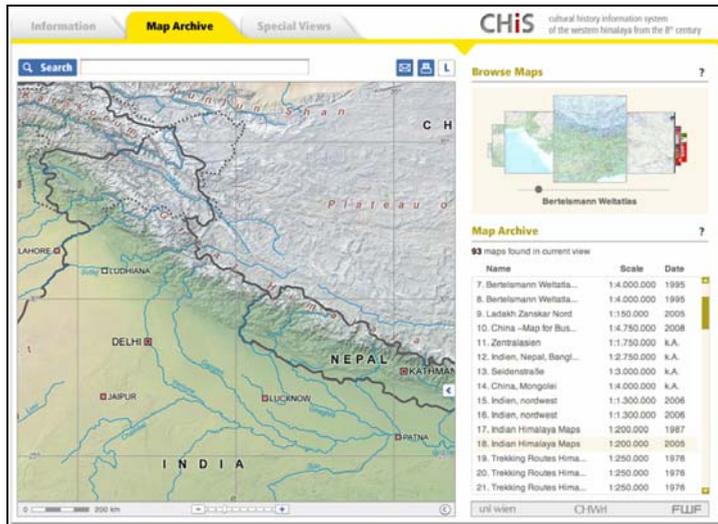


Fig. 2 The CHIS Map Archive

### 2.3. Special Views

The CHIS additionally offers a series of Special Views providing different perspectives on various aspects of the art-historical landscape of the Western Himalayas. These views assemble objects of different areas into innovative presentation forms (e.g. Google Earth, 3D perspectives, panoramic views). They have an eye-catching effect on the interested public and thus help generate interest in the topics and disciplines presented.

With their certain individual technical requirements (e.g. Google Earth, Flash) these views are outside the core system and expand the scope of CHIS to other applications. One example for such a special view is the digital reconstruction of a Buddhist temple in Nako (Spiti valley, India) called ‘Virtual Nako’.

### 3. VIRTUAL NAKO

‘Virtual Nako’ is a 3D digital reconstruction of the Nako temple complex embedded in the virtual surroundings of Google Earth. Following this the geospatial location and placement of the model on its exact position in the Himalayan mountain range and the integration of additional multimedia content (text, images, VR-panoramas, map-overlays) were assured.

The added value given by a 3D perspective in combination with an interactive and intuitive navigation concept allows the user to explore and learn about cultural objects more effectively and intensely. Further emphasis was put on visualizing the structural changes of the temple complex before and after the restoration in a comprehensible way and thus offering the user a direct comparison between different periods.

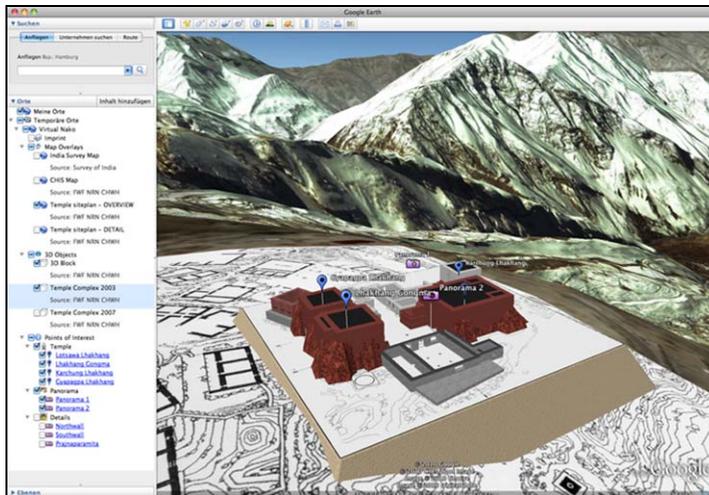


Fig. 3 Virtual Nako screenshot in Google Earth

### 4. GPS DATA ACQUISITION TOOL

Mobile consumer electronic devices with built-in GPS receivers such as PDAs, smart phones and recently tablet computers have become increasingly popular and affordable in the past years. Against this background, and with the need of the collection of detailed spatial information in mind, the CHIS sub-project group has decided to design and develop

an easy-to-use GPS Data Acquisition Tool (GDAT) for mobile devices. The software for project partners and scholars in the fields of cultural history was designed to work on all GPS-enabled windows mobile devices, thus guaranteeing a wide availability of the service. By simultaneously capturing exact coordinates with the aid of GPS together with the object information such as images and descriptions, the archives can be made more valuable and sustainable and the work of the CHIS group can be greatly facilitated.



**Fig. 4** Start-up screen and interface of GDAT

An intuitive and easily manageable interface (compare **Fig.4**) allows users to quickly employ the system and to acquire data in the field. The system allows capturing point data (single objects), line data (e.g. prayer walls, routes of pilgrimage) and area data (large objects like the layouts of temple compounds). Through the utilization on PDAs and smart phones, which come along with full (touch-screen) keyboards, metadata about the captured objects can easily be stored and edited.

## TOPOGRAPHIC MAPS

Currently available topographic maps for Northwest India – one of the projects hotspots – are often inaccurate or heavily outdated. Due to the Survey of India's restrictive policy when it comes to maps and data, foreigners are not allowed to buy any detailed topographic maps for parts of the country that are close to the Chinese or other borders. These maps are considered a military secret and thus the best available maps of the area are commercial road maps that are rather inaccurate and often inconsistent. This led the CHIS group to producing a series of topographic maps – scale 1:500.000 – to support the research tasks of participating scholars in the field or in the office. Schobesberger (elsewhere in these proceedings) described the production processes and data issues for this map series in detail.



Fig. 5 Section of topographic map (1:500.000)

## CONCLUSION AND OUTLOOK

The CHIS has matured since the first prototypes that have been presented at various occasions such as the 2008 workshop of the ICA Commission on Mountain Cartography in Lenk. The usability and the overall user experience of the system that is a core part of the user-centred design philosophy could be strongly increased through frequent system evaluation by the project partners. The tools and maps were welcomed by the project partners as valuable support for their research tasks.

The main challenges for the upcoming period are defined as follows:

- To improve the data and information that underlies the CHIS by adding descriptions and narratives that guide the user through the system. By adding new data such as routes of pilgrimage and data from historical maps it is intended to add additional value to the system. Interconnections between datasets based on spatial, temporal or thematic attributes will be intensified to allow more holistic analyses of the cultural history of selected areas.
- To further improve system design, adding new functionalities that allow a personalized output of maps and views thus increasing system usability for research tasks and presentation of outcomes (e.g. conferences, lectures).
- To guarantee maintenance free operation and sustainability after the project horizon.
- To organize and put in place a major exhibition in Vienna's Art Historic Museum together with the network partners for presenting the outcomes of the research network to the general public at the end of the project.

## REFERENCES

- Kinberger M., Kriz K., Schobesberger D., (2008), *Interdisciplinary Research in High Mountain Areas of North-West India*, In: Proceedings of the 6th ICA Mountain Cartography Workshop, ETH Zürich.