CHAPTER 1

The Cultural History Information System of the Western Himalayas

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1 Introduction

At the University of Vienna, Austria, an interdisciplinary research consortium, working under the auspices of the Austrian Science Fund research network, which includes cartographers, art historians, numismatists, Buddhist philosophers, and Tibetan and Sanskrit philologists, is undertaking research focusing on the Western Himalayas. The main objectives are to intensify research on the cultural history of the Western Himalayas as well as to develop an on-line cartographic information system for sharing knowledge with experts and the interested public. 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 aim of the "Cultural History Information System" (CHIS)[1] project is to design and build a collaborative spatially enabled system for archiving, analyzing and visualizing datasets of cultural history. Through the interdisciplinary aspects of the various partner projects involved, a more holistic view on the overall cultural history of a wide region (including

The research described in this article was carried out within the project "Cultural History of the Western Himalaya from the 8th Century (S98)". It is a National Research Network (NRN) funded for six years (2007–2012) by the Austrian Science Fund. It deals with the four great cultures of Asia — China, India, Persia and Tibet — which converge in the Western Himalaya.

[1] Cf. http://www.univie.ac.at/chis.

Afghanistan, Pakistan, India and China) can be achieved. The CHIS therefore serves as a communication platform for information dissemination. Research outcome of all "NRN" sub-projects lead to a wider understanding and greater publicity of the disciplines involved.

The CHIS project is based on major cartographic research topics and knowledge acquisition, focusing on the development of an online application to foster geo-communication in a broader context with special emphasis on the field of humanities.

The system builds up on the fundamental objectives of cartographic communication, utilizing design and system architecture features as well as aspects related to data availability and accuracy. Furthermore, conceptual issues such as organizing and delivering a spatio-temporal gazetteer and the design of an appropriate cartographic visualization interface are addressed.

2 Methodology and Design Issues

As a basis for the design and implementation of the CHIS, applied geographic and cartographic research is undertaken in various fields, focusing on cartographic communication, system design and evaluation, non-standard visualizations, Geographic Information Systems (GIS) analyses of geographic data, as well as research in historic maps.

The basic conception of the CHIS is to create an information system of the cultural history of the Western Himalaya from the 8^{th} century. The main focus of the CHIS is to offer a map-centered system approach in order to locate as well as display objects by their geographical location.

The system addresses a selected subset of functionalities commonly integrated in Geographic Information Systems. Special attention is given to capturing, storing, analyzing and managing of data. The CHIS does not intend to replace or change the common and approved working methods of domain experts, coming mainly from a cultural historical background, but aims to be a platform that assists the gathering and retrieval of information by these disciplines.

To further enhance user guidance and recognition of the system design issues had to be considered. Standardized symbols are used throughout the system for re-occurring elements. Likewise, consistent symbols are employed for various system functionalities, such as the connection link between map display and data browser or the image preview.

Based on the results of detailed user testing, a series of prototypes has been designed and evaluated. The implementation of all system functionalities as well as content is based on the results of a user group definition as well as the evaluation of user group objectives. Every prototype underwent a reviewing process to identify possible usability problems and obstacles (Kinberger 2007).

The CHIS is not only a system for experts in the various disciplines of cultural history. It also has the purpose to visualize and communicate the research outcomes of the NRN to the general public, thus promoting the involved disciplines and aiding increasing public awareness about this remote area of the world.

The development of the system followed a User-Centred Design (UCD) approach with a special focus on learnability and intuitivism of the user interface. Following a UCD philosophy and evaluating usability are essential procedures during the development of web-based cartographic information systems (Norman and Draper 1986). Application design has to shift its focus from technology-driven approaches to the final users of mapping products, their requirements, wishes, context and knowledge. Following this procedure it can be assured that the system being built is useful and usable by a majority of the intended audience. Through creating an aesthetic and easy-to-use interface the user experience and satisfaction can be raised (Cartwright et al. 2001).

Nausner (2009) describes the principles of interface design that were incorporated during the development of the CHIS. A special focus of his research concentrates on the application of graphic variables (color, hue, saturation, form, size, direction) for enhancing the user interface. By facilitating user navigation within the application and utilizing rational placement of functional domains, the efficiency of user interaction and cartographic communication can be significantly increased.

3 Data Issues

The acquisition of geodata for the CHIS is a demanding and time consuming task. Freely available data is oftentimes coarse and inaccurate. Such available datasets for South and Central Asia are conceptually designed for scales of 1:1 million and smaller. Names and locations of geographical features such as settlements, mountains, and passes are often imprecise and require further treatment. Therefore the refinement of geodata is

indispensable in order to achieve a sound and correct geographical base dataset.

In the monumental landscape of the Himalayan mountains, routes used by merchants and pilgrims were the main channels for the dispersion of cultures, their artefacts and religion. Therefore the course and stations of such trade and pilgrimage routes are in the main focus of interdisciplinary research within the project.

Together with the network's partners and external experts, pilgrimage and trade routes were identified and subsequently visualized in the mapping environment of the CHIS. A combination of the following methods were used to achieve these goals:

- Analyses of pilgrims diaries, texts and inscriptions
- Exploration of historical maps showing passes, tracks and paths
- Application of GIS methods and geographical analysis of areas of interest

Object data of cultural historical research (e.g., coins, inscriptions, images) that have been collected and studied in the other sub-projects of the NRN, are stored in relational databases and consequently visualized in the CHIS. The spatial reference is established by connecting these databases to a gazetteer, a dictionary of place names and their coordinates. Thus the objects and their spatial relationship to geographical realities can be visualized. Through analyzing spatial distribution patterns of objects with similar attributes, the course of cultural development lines and the routes of transport become evident.

The base maps featured in the CHIS are a combination of multiple data sources consisting of shaded relief, digital elevation data, topographic features as well as geographic textual information. Inconsistencies in the available datasets often required tedious manual correction to achieve a homogeneous rectified dataset for further processing. The shaded relief is produced from the freely available "Shuttle Radar Topography Mission 30" data (Ramirez 2009). The color overlay is based on Tom Patterson's Natural Earth II datasets (Patterson 2009). The dataset for settlements was compiled from a variety of sources including *Digital Chart of the World* (2009) and *USGS Geographic Data* 2009 datasets, as well as various available local printed maps. Road and river data is derived from the *Vector Map Level 0* (2009) data of the U. S. Geological Survey.

4 System Architecture

The system architecture has to take account of the fact that the system is aimed at the general public as well as domain experts. To fulfill the task of being a holistic gateway to very specific information, the system has to offer several approaches to enter the information landscape. Three individual system layers—*Information*, *Map Archive* and *Special Views*—were intended to present the CHIS as a spatially enabled cultural history information portal. The user is able to access all three layers directly from the systems entry point. *Information*, *Map Archive* and *Special Views* can be seen as equal parts of the system.

4.1 Information The CHIS *Information* page (see FIGURE 1.1) offers the user an overview of locations of art-historical importance. The screen is separated into a map (left) and a content (right) area. On the map, thematically relevant locations are marked. The user is able to change the map scale and extent of the area of interest. In the content area, locations and their associated art-historical objects within the current map extent are shown (*In Current View*). Furthermore, results of user's search queries are displayed in *Search Results*).

Every location is associated with a series of art-historical objects. Detailed information on these objects can be retrieved via a pop-up, appearing by clicking the respective location symbol. Within the pop-up, an external link offers the possibility to retrieve further information from the objects data source (e.g., the Western Himalaya Archive Vienna, the Tibet Album of the Pitt Rivers Museum, or Inscriptions of Western Tibet).[2]

Within the content area, *Narratives* offer a unique form of information presentation. Experts from various fields have assembled information concerning aspects of the art-historical landscape of the Western Himalaya (e.g., *Wooden Portals*, *Historical Inscriptions*, or *Monetary History of the Iranian Huns*) into clearly arranged narrative paragraphs. These *Narratives* are compiled out of the raw content and offer non-expert users an easy and intuitive way of understanding specific thematic sections.

4.2 Map Archive Available printed maps covering the Western Himalaya are collected and displayed in the *Map Archive* page of the CHIS

[2]See, respectively, http://whav.aussereurop.univie.ac.at, http://tibet.prm.ox.ac.uk, and http://www.univie.ac.at/Tibetan-inscriptions.

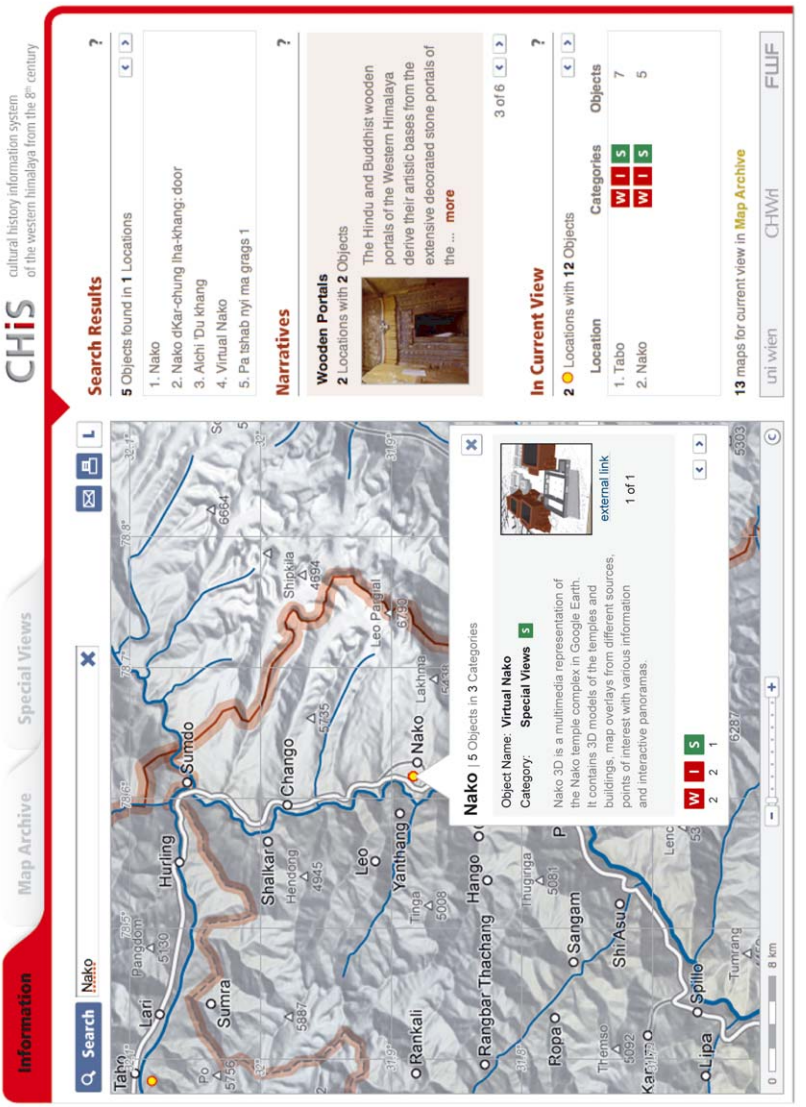

Figure 1.1 The *Cultural History Information System*'s Information section

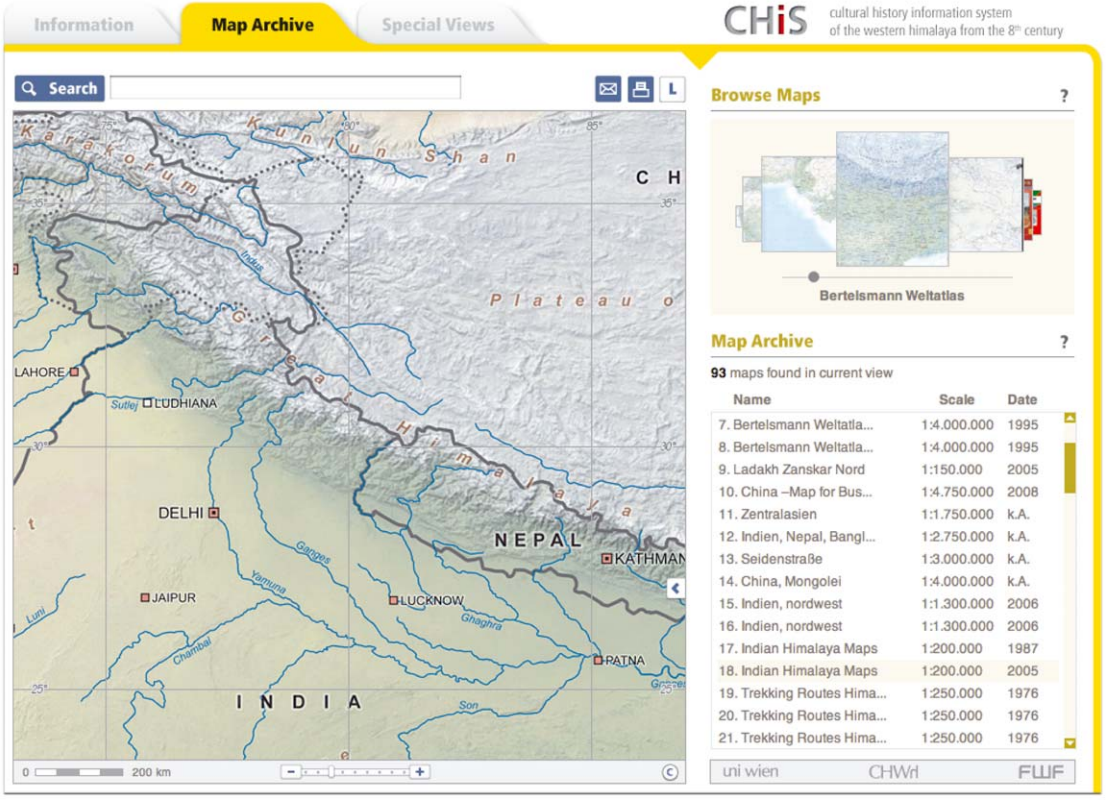

Figure 1.2 The *Cultural History Information System* Map Archive

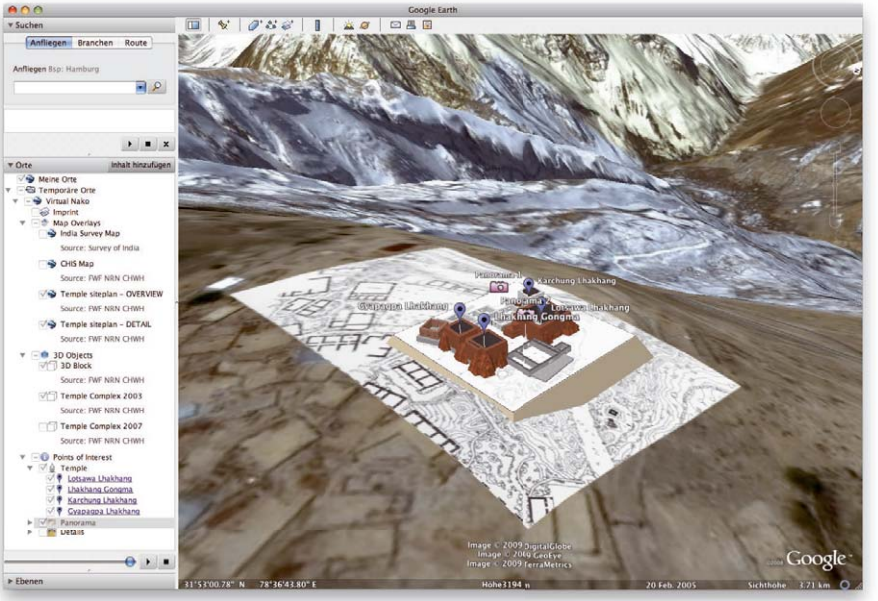

Figure 1.3 3D visualization of the Nako temple complex

(cf. FIGURE 1.2). The screen is separated into an overview map (left) and a content (right) area. All printed maps can be browsed (*Browse Map*) and displayed by clicking on the respective printed map icon. Changing the scale and content of the overview map automatically updates the list of available printed maps for the shown area of interest (*Map Archive*).

4.3 Special Views Besides retrieving information on art-historical objects in the *Information* page, the CHIS offers a series of *Special Views* (cf. FIGURE 1.3), providing manifold perspectives of various aspects of the art-historical landscape of the Western Himalaya. *Special Views* assemble objects of different areas of the CHIS into innovative presentation forms (e.g., Google Earth, 3D perspectives, panoramic views). These *Special Views* expand the CHIS and therefore have certain individual technical requirements (e.g., Google Earth, Flash).

Virtual Nako as one example is a multimedia representation of the Nako temple complex in Google Earth.[3] It contains 3D models of the tem-

[3]See CHAPTER 14 in this book.

ples and buildings, map overlays from different sources — such as the Indian Survey (*Survey of India* 2009), the CHIS application, or architectural plans (*NRPP* 2009) —, and also provides access to points of interest with various information of the temple complex and interactive panoramas.

5 Conclusions

The diversity of the network's partners and their differing understanding of geographic realities, of the importance of space and location per se, pose a challenge for the design of the CHIS. This challenge can be seen as a creative chance for the development of a system that fulfils a variety of needs, not only for the specialists from the disciplines involved but also for the general public. Customized narratives have to be developed to guide the users through the application, allowing them to not only identify the individual view points and contributions of the sub-projects but also showing the region's cultural history in a holistic manner.

The CHIS plays an important role when it comes to connecting domain information from the network's sub-projects: The research objects have to be brought into context with their geographical surroundings. Geography and topography are often underestimated as an important factor for the development and dispersion of cultures and, therefore, of the objects which are their evidence. By linking objects and their topographic environment, geography becomes an even more important consideration in cultural historic research. This functionality makes the preparation of very detailed, actual, complete and accurate topographic datasets a precondition.

6 Outlook

Within the first three year period (2007–2009) of the project, the CHIS has been planned, designed and implemented up to a stable system status.

Within the second project period (2010–2012), the further development of the CHIS focused on enhancing the personal involvement of the user. While the CHIS is still intended to remain a multidimensional, interdisciplinary cartographic information system with the ability to store, analyze and visualize spatio-temporal thematic data, additional functionalities had to be incorporated. For example, it was investigated how interactive decision-support tools provided by the CHIS could be personal-

ized and individualized, and it was explored how social semantic mapping might be employed using Web 2.0 (O'Reilly 2004).

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