Digital Library of Historical Cartography

Open access to cultural heritage and public good

Maria Imaculada da Conceição, Íris Kantor, David Alejandro Ramirez Palacios, Maria de Lourdes Rebucci Lirani, and Rogerio Toshiaki Kondo

University of São Paulo
São Paulo (SP), Brazil
imak@usp.br

Abstract — This paper describes the integration of information between the Digital Library of Historical Cartography and the Bibliographical Database (DEDALUS), both of the University of São Paulo (USP), to guarantee open, public access via Internet to the maps in the collection, making them available to users everywhere. This digital library was designed by the Historical Cartography Studies Laboratory team (LECH/USP), and it provides map images on the Web, of high resolution, and presents the information on these maps as technical-scientific data (projection, scale, coordinates). It also offers printing techniques and material support that have made their circulation and cultural consumption possible. The Digital Library of Historical Cartography is accessible not only to the historical cartography researchers, but also to students and the general public. Beyond being a source of information about maps, the Digital Library of Historical Cartography seeks to be interactive, exchanging information and seeking dialogue with different branches of knowledge.

Keywords: Cartographic collection, Databases (keywords), Digital libraries, Historical cartography.

I. INTRODUCTION

The Digital Library of Historical Cartography [1] makes high resolution digital reproductions of maps printed between the 16th and 19th centuries that belonging to the University of São Paulo (Brazil) collections available. Each map is presented with carto-bibliographical and biographical references, and relevant technical, editorial and historical information for the analysis of the cartographic documents.

The group of digital libraries of the University of São Paulo (USP) contains the Brasiliana USP [2], the Digital Library of Rare Books [3] and the Digital Library of Theses and Dissertations [4]. The Digital Library of Historical Cartography consists of a collection of digitized copies of the printed maps of the former Santos Bank, about 250 in number, which are currently in the custody of the Institute of Brazilian Studies, University of São Paulo (IEB/USP), as determined by the Brazilian Federal Court. The IEB is responsible for the digitalization of maps and also for the conservation of the originals [5].

The Digital Library of Historical Cartography seeks to be a dynamic repository of information (technical and carto-bibliographical) to make research of different kinds (demographic, archaeological, linguistic, environmental, ethnographic and iconographic) possible. Given the need to deal with the nature of cartographic evidence, we chose to provide Web mapping images of high resolution, offering the user a range of information on maps, the contexts of their production, reception and editorial manipulations. Also included are data on technical-scientific aspects (projections, scales, coordinates), printing techniques and material support that have made their movement and cultural consumption possible. This is a database that seeks to deal with cartographic information in its many facets: as part of the history of art and science, within historical, political, economic and social development, urban history, ethnography, ecology, etc.

The Digital Library of Historical Cartography was conceived by the Historical Cartography

Studies Laboratory team (LECH/USP). The site is a research tool which facilitates the gathering of relevant information for the registration of the production, circulation and appropriation of historical maps in their different contexts and media. The LECH team thought it fitting to give differential treatment to cartographic images, since the placing of digital maps on the Internet creates new dilemmas for researchers of ancient cartography. Each cartographic image is available along with extensive carto-bibliographical and biographical reference, technical, editorial and historical information relevant for cartographic documents analysis. The Digital Library was conceived to also trace data from similar sites constituting a useful research tool to gather relevant information [6].

II. DIGITAL LIBRARIES

As a reflection of our current cultural context, the printed collections are changing to meet the enormous challenges of the information technology era, adding digital spaces to their collections. The document concept has taken on new meaning with the inclusion of hypertext and new media in the everyday life of libraries that have to live with users, or groups of users-that demand dynamic, personalized content. This new generation of users finds it easy to use Internet resources, especially interactive communication, such as Web 2.0 [7].

The information explosion has boosted the emergence of new information technologies which have created a virtual space with previously unthinkable peculiarities for mankind. These technologies allow the use of electronic resources that promote the improvement and ever-growing speed with which information is transferred. Thus, the resources for the access to, and dissemination of, cooperation regarding the diffusion of knowledge are being constantly enhanced, especially in the academic area.

Within this context, digital libraries are already part of the agenda of leading universities, research institutes and organizations devoted to education and culture [8]. The availability of rare books, in a digital format to a wide audience, that could not otherwise be handled, except by specialists, is an invaluable tool for cultural improvement. [9]. The fact that digital libraries are a means of providing universal access and visibility, thus publicizing collections or cultural events the knowledge of which was previously restricted to their own respective communities [10, 11], is worth highlighting.

Regarding the analysis of historical maps, there is now a growing number of institutions developing digital collections, making these maps available to anyone with an Internet connection. Some collections are being developed as clearinghouses for those who might not otherwise have the opportunity to read or use the maps, targeting not only the most sophisticated researchers of academic communities, but also the general public, for their personal or professional use.

Preservation concerns and accessibility affect the decisions made as to which materials should be added to the collections of digital maps. Instead of a physical wear-and-tear, there is now a "virtual" wear-and-tear of these rare and fragile artifacts. Many of the resources in special collections are unique and irreplaceable. Because of their unique characteristics, their preservation, digitization and availability on the Internet should be a top priority for the library and in many cases should be part of the respective institution's strategic plan.

As there is still no consensus regarding the techniques and formats for digitizing historical cartographic material, a broader discussion on the criteria to be adopted for the selection of the maps to be digitized has become necessary. The philosophical aspects, such as the importance of the statement and the likelihood of use, and the more practical aspects such as physical condition, ease of scanning, preservation etc., need to be considered [12]. The participation of a multidisciplinary team of professionals, the standards to be adopted and the possible solutions to the problems involved in scanning are other aspects that should be included in the discussion.

III. PROJECT DEVELOPMENT

The conception of the Digital Library of Historical Cartography was developed by the Historical Cartography Studies Laboratory team (LECH) of the Jaime Cortesão Chair of the Philosophy, Literature and Human Sciences

Faculty (FFLCH/USP), and was carried through by the Informatics Center of São Carlos (CISC/USP).

A multidisciplinary team was put together to specify the requirements of the new public digital library. Live and remote meetings were held and a discussion list including all team members was created to foster interaction. The multidisciplinary integration carried out the possibility of building a database tool able to interact with the University's Bibliographical Database (DEDALUS) [13] as well as to retrieve information from other databases, not only from the University but also in other available Internet databases.

After analyzing the collected information, the new database was designed to gather all information and to be easily queried. At the same time, an intranet web site was developed to allow the LECH team to insert and update the collected information in the database.

One of the basic requirements was defining how to present high-resolution maps with a low cost to the network bandwidth. A careful research for adequate image formats was performed, not only to satisfy this requirement but also to preserve the original characteristics of the map. As a result, both free and paid software were chosen to convert the digitalized files into adequate formats for Web distribution. To allow for new, future formats, the Web system was conceived to allow easy integration of output drivers.

The second step was specifying the requirements and functionalities of the new Digital Library: Which indexes should be available to visitors? Which map data should be displayed? How should each map be linked to the available indexes and other sites? Which map data or detail should anchor those links? How can several digital objects from the same map on the screen be presented?

Finally, the CISC team also used a technique developed by Zoomify, Inc. [14], to present high-quality images in a fast and easy way over the Internet, that we call here the *Zoomify format*. This technique splits the image in small JPEG images in different levels, creating several image matrixes, which are browsed more quickly than the full high resolution image over the Internet and displayed to the user creating the illusion of a perfect zoom effect.

Some data available in the maps can be related to the present day world, to legitimize their historic and cartographic values. Therefore, these maps were geo-referenced by a specialized professional and inserted into i3Geo [15], an open source map file server developed by the Brazilian Ministry of the Environment, based on MapServer [16]. All files are stored in a storage file system. Each map has its own directory and a subdirectory is created for each digital object of the same map to be easily retrieved when required.

We have worked with the Santos Bank's map collection and Admiral Max Justo Guedes' carto-bibliographical information which is a cartographic inventory prepared by Admiral Max Justo Guedes. It is a universe of 2,000 handwritten sheets with accurate and erudite information about cartographic and bibliographic production from the fifteenth to the nineteenth centuries, prepared by the renowned scholar of Luso-Brazilian cartography [17].

The aim of this study is to guarantee open, public access via the Internet to the maps in the collection and make them available to users everywhere, whether through the Digital Library of Historical Cartography, or by means of DEDALUS. We believe it is important to increase public access to collections that were often treated as treasures, and therefore have been blocked to protect the institutional assets or treated as objects rather than as the sources of information they really are.

IV. RESULTS

To achieve the objective of this project, two databases of the University of São Paulo, the Digital Library of Historical Cartography, and DEDALUS, the Bibliographical Database, were used. The first step consisted of filling out a worksheet at the Digital Library of Historical Cartography (Fig. 1). At this stage the historiographical data available on each map

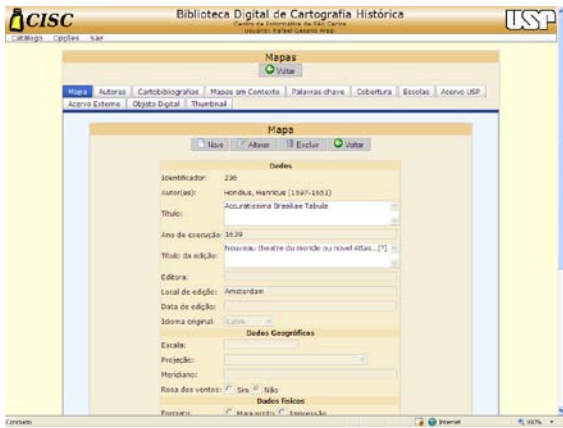and from other sources were given priority (Fig.2 and 3).
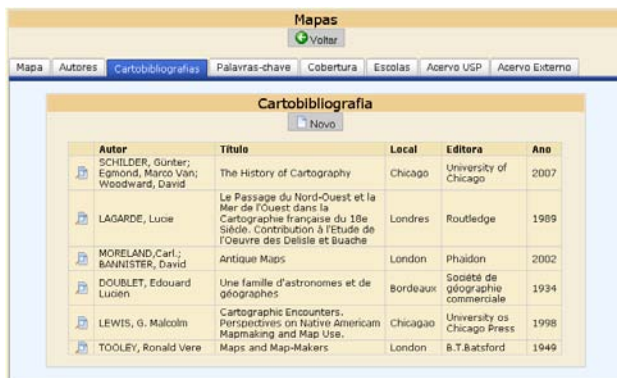

Figure 1. Screen of a record worksheet
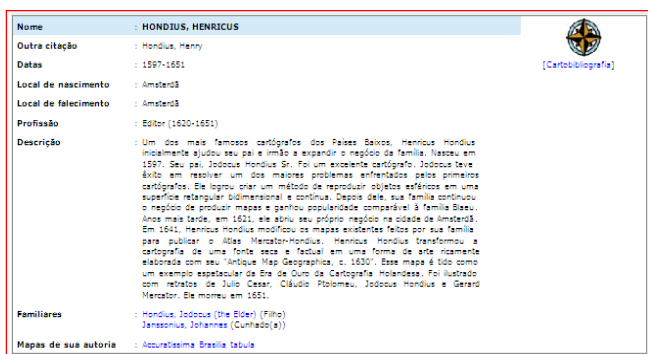
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Figure 2. Screen of carto-bibliography

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Figure 3. Screen of an author record (public site)

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The second step called for the creation of the bibliographic record in the Bibliographical Database, when the data were recovered from the Digital Library of Historical Cartography in accordance with the specifications of the MARC format (Fig. 4) within the following fields: statement of responsibility (designer,

cartographer, geographer), title, mathematical data, edition, publication, physical description, notes (cartographic school, Meridian, coverage etc.). In this phase, the bibliographical data of the map were given priority, in accordance with the specifications of the Integrated Library System (SIBI/USP). In addition to bibliographical data, links to the record and the map image are also inserted in the Digital Library of Historical Cartography. The image of the map displayed on the Web requires no plug-in.

Then the relationships involved were defined: inclusion of carto-bibliography, inclusion of links for quick viewing on the Web, download links to the images of maps in different formats: Zoomify (Fig. 5), JPEG, JPEG2000, SID and PDF, and information as to where to find the same map in other collections. When users search on DEDALUS for any of the maps available at the Digital Library of Historical Cartography, they have access to all the available resources (Fig. 6).

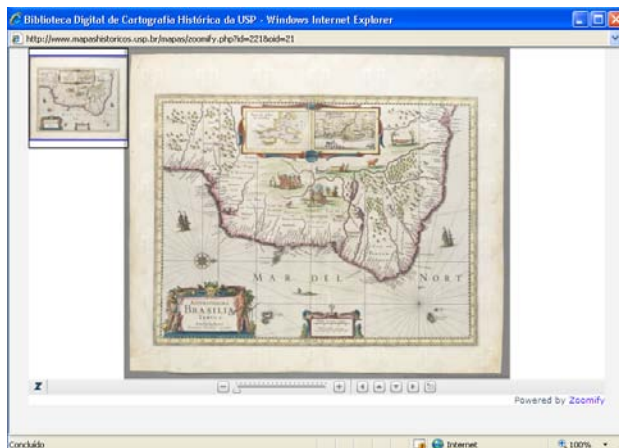Figure 4. Screen of a DEDALUS record worksheet (MARC format)

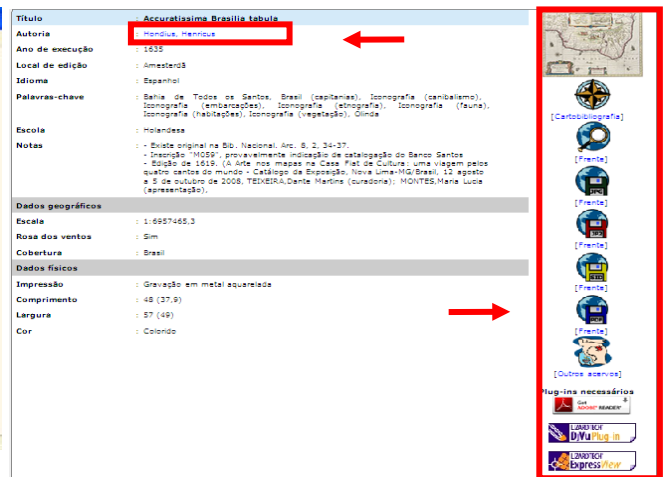Figure 5. Screen of a map (Zoomify)

Figure 7. Screen of a record on the public site

Figure 6. Screen of a DEDALUS record (public site)

The last link on the right side provides other links related to the same map available in DEDALUS or in other University's sites, as well as links available on external libraries or sites in the Internet (Fig. 7).

In its first version, 50 maps are publicly available, accompanied by the detailed technical information and metadata. We developed indexes for the subjects, biographies, geographical coverage, iconographies and carto-bibliographies that will improve visitors' accessibility. In addition to cataloging each map on DEDALUS, we concentrated our efforts on the research of the contexts of production and reproduction of images at different times. The site seeks to register data about different authorships, and forms an image of appropriation and circulation that allow a less naive approach of cartographic documentation.

Users can explore the collection using indexes for titles, authors, execution dates, subjects, geographic areas, and schools of mapmakers. Also, information can be retrieved using a simple or an advanced search in the database. A gallery of digitalized map is also available (Fig. 8).

Figure 8. Screen of the Digital Library of Historical Cartography homepage

V. FINAL CONSIDERATION

Among the challenges we face at the moment, we should be aware of the dangers of filterless surfing. This situation threatens the credibility and reliability of the cartographic documents transmitted in cyberspace. There is a consensus among scholars that browsing on the Internet requires higher cognitive skills, linguistic acuity and erudition on the part of its users to filter, discriminate among and discard irrelevant data and the possible inconsistencies that populate the entropic labyrinths of cyberspace.

These questions guided the modeling of the Digital Library of Historical Cartography, which was developed on the basis of the supposition that the rare maps and/or books (atlases, nautical routes, and geographical descriptions) could be integrated into the database. The LECH team is responsible for tracking the reproduction of the printed and/or handwritten cartographic sources available in the different digital libraries, and for making the connections that generate new knowledge. Obviously, at this stage, such links form part of a team's preliminary work, but it is with the goal that in the future the users will be able to add data to the Digital Library of Historical Cartography, as well as use geo-referencing technology for the better treatment of the information contained in the maps, thus providing greater accuracy in the analysis of this peculiar type of research source.

The Digital Library of Historical Cartography is accessible not only to the historical cartography researchers, but also to students and the general public; beyond being a source of information about maps, it seeks to be interactive, exchanging information and seeking dialogue with different branches of knowledge [18].

The first version of digital library was written only in Portuguese. We plan on turning it into an international digital library in three other languages: English, Spanish and French. Also, new functionalities will be added, such as the context map, where visitors can read texts about a map, which were written by specialists from different knowledge areas after analyzing it. With this functionality we intend to encourage the use of maps in the classroom. Having analyzed the maps, we found important information that can be geo-referenced today in a world map. Therefore, we are now creating a GIS database to be integrated to the digital library.

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