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First approaches to the usability of Digital Map Libraries

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Introduction

To close the distance among citizens and governments in a new style of society based on knowledge, institutions are reaching to certain deals and decisions in order to consider and approach information in a new way. The incorporation of the geographical component as a main part of data and information habitually used; it can arise in geo-knowledge, a new sort of information related to territorial domains.

Geographical digital management of information is giving its first steps and the process related to the development of a new society based on geographical knowledge should advance still more. Internet is and will be the powerful tool which gives way to different online communication options on geographical approaches.

So, why are going to be spatial portal or geoportal functionalities so useful to manage old cartography? These portals provide tools to search or find spatial information. The spatial search tools may display a map and allow users to define boundaries of an area of interest. In fact, users can often combine spatial searches with a range of textual parameters.

Historians and documentary experts need to access remotely to every existing information, that can be compiled in a single place to facilitate the access and comparison. They have established a number of well-defined international standards, as well as they assemble catalogs using similar harvesting techniques. ISO 23950 (Z39.50) and Open Archive Initiative (OAI) are the most popular standards for spatial metadata harvesting. However, geoportals provide tools to visualize, explore and download information; in addition to search.

Apparently, that is not so useful to these users which are getting used to work with catalogs and metadata. However, the fact is that geographical browsing functionalities are essential to “play with maps” and it indirectly helps to disseminate old cartography in all society statements. So far, old maps were reserved to high cultural level people, with such specific interest, but now geographical technologies are helping to easily re-discover old cartography to the whole society.

In this sense, we must deal with new peculiarities to be considered when designing these Digital Map Libraries (DMLs), according with a specific kind of users and contents. At the

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end, usability plays an important role to success in the provider-citizen communication process.

Spatial portals

The usual practice which allows citizens having contact with geographical information is the use of the so called spatial portals or also known as geoportals. They are defined as a Web site which is the main entrance to several resources related to geoinformation. Such resources are varied and define the type of geoportal which has been created.

Spatial portals could be classified in: catalog, application and enterprise portals (the integration of spatial data with business enterprise solutions). [1] All facilitate access to geospatial information, but in different ways.

In the catalog portals, the portal arranges metadata records into a consistent and searchable way with the aim to create and maintain indexes or catalogs describing information that is available through services. The users can make queries based on some metadata parameters. These portals are useful when catering to a wide variety of services and providers. In the case of catalog portal that provides map browsing tools they tend to be more generic.

On the other hand, application portals combine information services into Web-map services that are generally focused on a particular task or application, but they do not normally have metadata catalogs. They provide an efficient access to data and services according to the users needs. Application portals are structured in User Interfaces that guide users to the specific services they need.

Digital Map Libraries can be considered in the middle of these two types. They should be designed combining the variety and potentiality of catalog services and the efficient access of the application portals.

Geospatial One-Stop (2002) was part of a wider e-government initiative of the USA Office of Management and Budget “to improve coordination, access, clarity and speed of the delivery of geographical information in the government-citizen communication”. It came with a clear motto: “Two clicks to content”. [2]

The Geospatial One-Stop philosophy should be also the first step towards the goal of a Digital Map Library making possible to search and assembly data and services from various sources in a fraction of time. In fact, usability plays an important role to success in the communication provider-citizen communication.

Usability principle

The organisation of the information on a Web site or an Intranet is one of the factors, on which success or failure depends. The organisation systems are classified into: organisational schemas and structures. Schemas of organisation point out the shared characteristics of the elements, which integrate the contents and the influence of the logic joining of these elements. On the contrary, structures of organisations define the relationships among content elements and the groups of such elements. [3]

Web usability arises from the birth and development of Internet as a way of communication. Web programming languages have made possible the implementation of new functional and powerful interfaces though more complex to handle and use by users. Thus, usability is defined as “the capacity of a software of being understood, learned and used by the user on specific usage conditions”. (4) This results in tangible benefits for the organisation, such as cost reduction, increase of the number of visitors and improvement of organisation image. (5)

Among usability, the heuristic evaluation is a method created to find design problems in a User Interface. It is required a reduced number of evaluating people who will examine the interface and decide if it fulfils or not a series of usability principles known as heuristic. (6) (7)

Some habitual usability mistakes made in the process of a Web site design especially applied to geoportals are: the use of frames, (content management tools are better), the excess in the use of visual effects, pages without linking to the initial page, excessive use of scroll bars, the lack of design of a suitable site map and of search options into the navigation system, non updated information, excessive downloading time... (8)

Classification of web maps

The Web is a very interesting way to present and spread spatial data. It constitutes a virtual, independent, matchless basis regarding its capacity of reaching an infinite number of users at a minimum cost. Besides, it offers new techniques and possibilities of use with respect to traditional paper maps, such as the multimedia integration.

Nevertheless, on a first approach to the peculiarities of old cartography publication on Internet a little promising classification is found. From Kraak (2000) (9), a schema of map classification for the Web indicates that the classification of ancient maps is little promising. His classification is within the static type of map since they are scanned maps arising from the original ones, made on paper predestined to their visualization. On one hand, they give a very exact idea of the original since they transmit all available information with respect to such scanned map. On the other hand, it is normal to deal with a series of problems such as low quality, file size or the excessive density of information which unable reading on screen.

It is necessary to search different ways to present old maps preserving the original information needed by researchers without reducing visual quality and Web potentiality.

The key lies on georeferencing process which allows overlapping, linking and manipulation of modern geographic information. Through it, the quality of the scientific document is preserved and the visualization is improved. Unfortunately, this solution could not always be considered for old cartography.

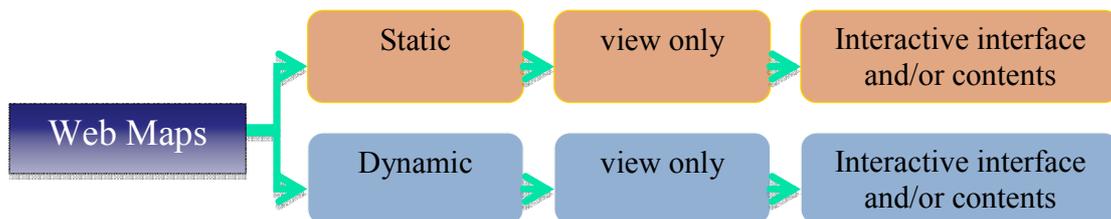


Fig. 1: Classification of Web maps (from Kraak, 2000)

From a technological point of view, several technologies and geoportals map publication languages are found. The HTML languages are the most used on Internet for presenting any type of documents but it becomes an unsuitable language whenever another sort of information is presented. With the aim to create a more general language capable of embracing other purposes, the W3C [10] consortium has developed the XML language, from which SVG (Scalable Vector Graphics) language has been derived. This language enables the Internet display of vectorial images as an alternative to the Flash language which is not based on standards. Language could be adapted to the objectives and the needs of the project. Nevertheless, interoperability through standard achievements constitutes a main requisite to the distributed access to Digital Map Libraries resources, following the principles of Spatial Data Infrastructures (SDI).

Considerations in digital map libraries (dml)

There are useful and basic similarities between the global reality of a SDI as a distributed geoportal and a DML; according with standards (e.g. geographic metadata: ISO 19115 [11], Dublin Core [12], agreements (e.g. local, regional, national or international level; INSPIRE Directive [13] and services (e.g. Open Geospatial Consortium [14]: Web Map Service [15], Web Feature Service [16], Catalogue Service on Web [17], etc).

However, there is a number of technological and policy considerations to be taken into account apart from the characteristics common to all SDIs in any thematic field. Cartographic heritage contained in the DMLs stands out as an exceptional case within the generic frame of an SDI. [18]

Maps catalogued in libraries have been usually described according to generic bibliographic metadata schemas such as the MARC standards [19] (UNIMARC, MARC21, IBERMARC, etc.). That is not always compressive by traditional geoportals which use geographical standards templates so it is necessary to define the appropriate gateways for these descriptive profiles to be understandable among themselves.

The risk of deformation of documents of historical interest against the advantages of their publication together with other data in the Web should be also taken into account during the georeferencing process, dealing with the image distortion that could not be funny for some scientific users. This should be taken into account considering that distinct kinds of users

would utilize cartographic funds for different purposes. It is generally recommended to provide bounding box approximate coordinates so as to avoid image distortion.

Additional information about the themes and the age in which the maps were created will be of great help to those documentary experts who have to link these maps with the historical events which took place on that age. That is quite related with the usability rule to provide a Webmap and a Help menu.

Geographical browsing in DML

As a specific geoportal in cartographic heritage, some usability recommendations should be taken into account when designing navigation browsers in the Digital Map Libraries. The aim of these recommendations is just to help users in the navigation, apart from the application functionalities. [20]

a) Communication user/map

The users need to know that the computer is ready to their requirements. This is possible through the change of the pointer shape, of the colour information zone or of the object shape.

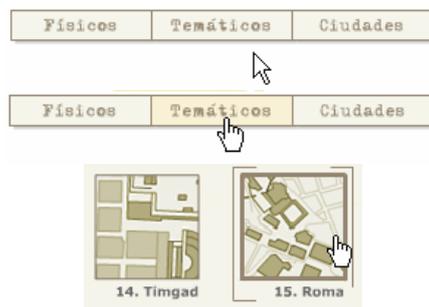


Fig. 2: Menu option selection; Textual mode and Icon mode [21]

b) Simultaneous selection

The simultaneous activation tools constitute a great help. It must exist a functional relationship with the browser when activating layers or moving the mouse. In this way, a more complete information of the visualized phenomenon could be obtained, before opening the map (e.g. through frames or colour changes.)



Fig. 3: Simultaneous map selection: by general menu and through frames. [21]

c) Dynamic timelines

Dynamic timelines are especially useful as well as dynamic labels since they establish a functional correspondence with the browse objects. Nevertheless, the timelines design is delicate since contents are not distributed constantly along a chronological line. Besides, the reader needs to know not only the events happened in an ordered way but also the quantification of temporal distance among phenomena. Thus, each case should be studied carefully.

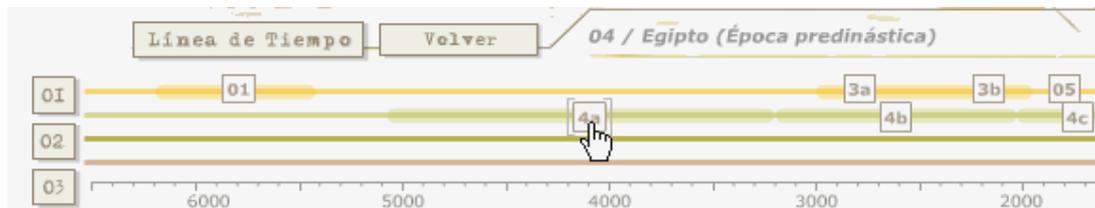


Fig. 4: Dynamic map selection by timelines. [21]

d) Hidden information

Moving the pointer over a selected point, written information will appear, which if it were permanent could restrain the reading of another map information.



Fig. 5: Secondary data visualization in small scales. [22]

e) Selective information

Traditional maps include the impression of all available information about the piece of land represented on the map. The possibility that the user chooses the observation of a feature, without others restraining the reading, can be done through the activation-deactivation of information layers.



Fig. 6: Management of information layer visualization. [21]

f) Spatial information

Navigation on the map allows quick framing of a specific geographical place, increasing or decreasing the visualization scale, helping and guiding the user whenever using the geographical browser.



Fig. 7: Dynamic navigation tools; change of location and scale. [21]

g) Information modification according to scale

The visual perception is selective respect to the visual size variable [23], so it could be used under the condition that longer texts may disappear as the reader gets close to the land. This process of selective hidden information provides a cleaner and more attractive image.

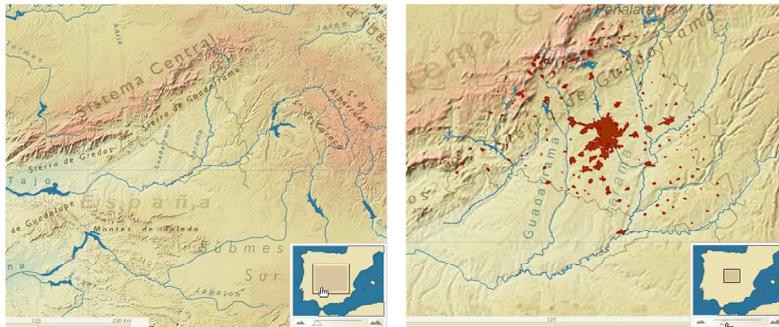


Fig. 8: Symbology variations according to visualization scale. [21]

h) Information Transparency

The possibility of transparency allows that two information layers could be visible at the same time enabling besides the possibility of visualising the background layer. The user is able to understand easily the extension of two different geographical entities which are coincident in space but dissimilar in time.



Fig. 9: Transparent layers visualization: modern and old cartography mixed. [24]

Online examples

The Digital Map Library Prototype

Some specific experiences have been carried out in this field, trying to include the DML services in a local SDI prototype. The DML of the Canary Islands, [25] studied in depth the creation of an Internet portal with access to a Map Server and a catalogue containing the historical maps and plans of the Canary Islands, which normally have a very limited access.

Visualization and query tools were used from standardized OGC Services (WMS, WFS, CSW) allowing visualization and comparison of any maps as well as access to their metadata. The HTML/JavaScript interface allows visualizing the requested results sent to the server. A first approach to visualization methodology considered working with the approximate coordinates of the map corners (bounding box). For every image processed a shapefile was generated. Polygonal limits of this file include the approximate contour of the map. For those images including plans and construction sections, the appropriate shapefile geometry is just a point. The external cartographic base is combined with raster and vector layers which can be visualized through the Web interface, including the island contour and the tiles generated with the document contours.

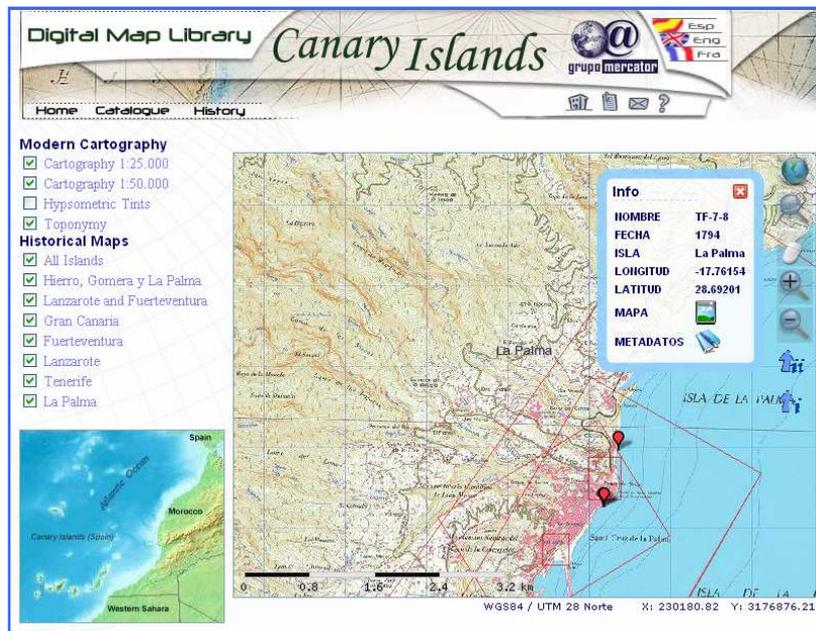


Fig. 10: Digital Map Library Prototype of the Canary Islands [24]

This application allows different types of search with the approximate contour of each map, and over the cartographic base. In this way, the searching tools would provide the document's visualization and metadata in a new pop-up window.



Fig. 11: Pop-up window to browse through an old map [24]

Besides, the metadata of the maps were included in a geographic catalogue [26] that it is accessible from the Homepage. Thus, it is possible to include advanced searches with the GeoNetwork OpenSource software according to the ISO23950 standard. [27]

The DIGMAP Project [28]

DIGMAP work towards the goal of becoming the main international information source and reference service for old maps and related bibliography. The software solutions produced with relevant standards and technology are able to be reused in other digital libraries, for standalone services, or as components integrated with other digital libraries. [29]

The targeted users of the services are citizens, students, scholars, teachers, professionals in libraries, archives, and technology, as well as institutions intending to provide similar services, such as other national, university and research libraries, archives, etc. In this sense, User Interface should be designed accordingly with usability rules and users profiles.

Usability approach in the DIGMAP Portal

The preliminary DIGMAP Portal draft design offers both geographical and textual browsing options from the Homepage. Thus, the most useful services are provided to users according with each profile.

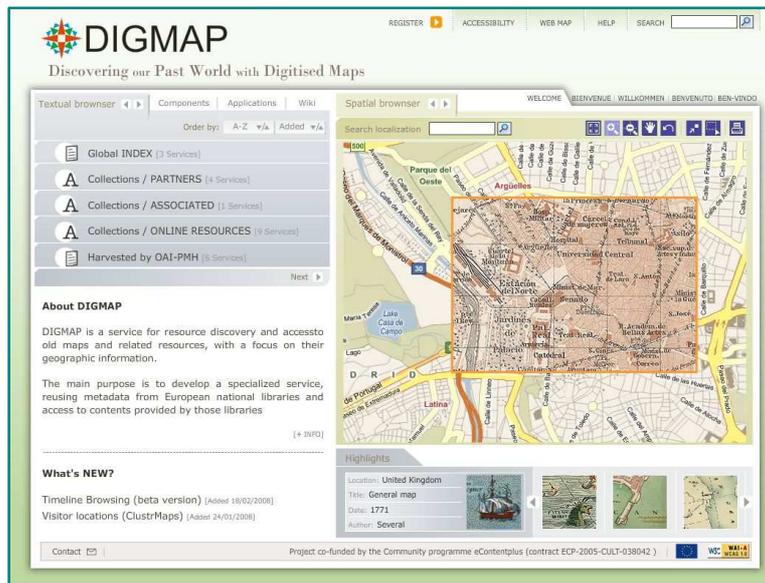


Fig. 12: DIGMAP Portal draft design

Likewise, it is avoided the use of frames in the complemented design with the use of content management tools. In this way navigation becomes easier and tidier avoiding all the time the use of scroll bars.

In the Highlights section some samples are presented from the indexing service, with a brief description below (otherwise it would seem to be a non-functional banner). The use of arrows give dynamism allowing the visualization of the map icons recently charged or updated to the system.



Fig. 13: Browsing through an old map inside the DIGMAP portal

External resources, such as exhibitions, should comprise a separate and small visualization space from the internal services. Only in these cases, the use of new emerging windows is strongly recommended to avoid the loss of communication with users. The “Site map” and “Help” buttons are programmed in the portal, as well as the accomplishment of the accessibility standards.

The User Interface will offer a browsing environment for humans. However, a definitive design it is currently under progress (April 2008). It will explore paradigms inspired by Google Maps, Virtual Earth, TimeMap [30] and other similar systems and previous research efforts. [31] Some of the specific functions that will be provided by the User Interface include timeline visualizations, clustering of related resources and advanced geographical information retrieval mechanisms. [32] This interface will also include a module for handling user questions, which will likely be developed by extending an existing forum system.

Conclusions

- Geoportals are useful tools of transmission of knowledge related to Geographical Information through valuable interfaces.
- After the approaches that have been carried out in the DIGMAP Project framework, it is possible to conclude that Digital Map Libraries agree with most of the usability rules that have been greatly agreed so far in Spatial Portals.
- To maintain the historical and geometric rigour of maps in Digital Map Libraries, we should highlight the greater importance of metadata at large than the georeferencing as such.
- In this sense, georeferencing process may alter maps, and many of their qualitative features may get lost. This fact should be borne in mind according to the user profiles.
- Further steps must be done to research about the potential users of Digital Map Libraries, as well as its specific requirements.
- A new schema of geographic integration of the historical contents must be reasoned and heuristically assessed; in order to carry out an in-depth study of Digital Map Library usability within the Spatial Data Infrastructure framework.

Future works

A better understanding of the DMLs potential users as well as the continuity of project work related to geoportals usability suits the line work of the DIGMAP Project, which is expected to be concluded by the end of September, 2008.

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