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A method to create interactive gazetteer to old globes

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Summary: An interactive gazetteer serves a good example of how to create a database and visualize various geographical names. A 150-year-old-globe was digitized with the method developed in the Virtual Globes Museum. Every name on the globe were organized into a database, and visualized on a website, which uses the Google Earth plug-in. The interactive gazetteer is also suitable for research in cartography or linguistics.

Introduction

The gazetteers not only help to find names on maps, but also they are small encyclopaedias, a collection of geographical names. In the case of web maps, the names can be put to a list. Searching in the list is a basic requirement. If the position of geographical objects is indicated by coordinates, they can be shown on maps. If the users can select the items in the list and the application shows them on the map, this is what I call an interactive gazetteer. In 2013, GEBCO made "The Undersea Features Name" interactive gazetteer. The base map, created by ArcGIS Server, is a physical world map with some switchable layers such as contour lines. In this interactive gazetteer the undersea features names, their types, their discoverers and other information can be read. Furthermore, the names can be downloaded for scientific research. Not only the names in maps can be organized into an interactive gazetteer. The best way of representing the names on old globes is a web-base interactive gazetteer. Using Google Earth provides an interactive, three dimensional environment in the browser. This paper presents a method of creating interactive gazetteers from old globes, which was developed in a project to process the content of a globe.

The project

Making the gazetteer was a part of a project to digitize a 150-year-old manuscript globe and to re-draw it for saving it from further decay. The 132 cm diameter globe was created by László Perczel in a village in Hungary in 1862. It became internationally recognized when it won a medal at the third International Geographic Congress in Venice, 1881. This manuscript globe is currently owned by the Hungarian National Széchényi Library. The project of the Department of Cartography and Geoinformatics at Eötvös Loránd University is going on within the framework of the Virtual Globes Museum (VGM 2013). Now the digital reconstruction project of one of the largest globes in Central Europe is going to reach the end. A highlight part of the project was saving the names to the posterity. This was not easy work, because the globe surface is badly damaged. The globe was "restored" in the 1970's: it got a lacquer layer, and this layer began turning to yellow soon and dissolving some of the red ink, making a part of the names illegible (Márton

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2008). Unfortunately, when this globe was moved to shelter during World War II, parts of the globe map tore around the Equator. Despite, the names are of huge cultural value. Using of modern technologies made the contemporary names become available for examination (Márton, Gercsák 2011).

Figure 1. The globe in the Map Room of the Hungarian National Library (Photo by Zoltán Nemes).

The cultural value of names

After the examination of names, about 8100 names were counted on the globe. These old names have a huge cultural heritage, and the participants of this project feel it important to save them from further decay. Before the lacquering, Zoltán Ambrus-Fallenbüchl described the colour and geometry of the globe (Ambrus-Fallenbüchl 1963). The place names are illegible in some cases, while other names are easily legible on the undamaged part. Some conclusions on the spelling are as follows:

In the middle of the 19th century, there were no conventional transcription systems, therefore Perczel wrote the names after pronunciation in many cases.

He did not translate the generic term into Hungarian sometimes. For example: “Jesi Irmak” (Turkish: ırmak /river/), “R. Blanco” (Spanish: río /river/) “Lob-noor” (noor /lake/).

He made unconventional abbreviations. “Taytao f.sz.” or “S. Jose f. ” (“f.sz.” and “f.” is the abbreviation of Hungarian “félsziget” /peninsula/).

The use of hyphen is not consistent either. The rules of the Hungarian orthography just began to be formed in his time.

László Perczel used the most recent sources of his time to create the globe map, which is proved by the detailed and mostly correct geometry as well as the rich collection of names (Zubán 2013).

Another aspect was to reconstruct the legibility of names at the time of collecting. Several partially illegible names could be concluded from current maps or atlases. In many cases, it was necessary to use contemporary sources. The examined contemporary globe was the Hungarian 31.5 cm diameter globe made by Károly Nagy in 1840. As the difference between the map scales of the two globes was quite big, cartography students had to identify the names in other atlases like Schrämblischer Atlass printed in Vienna in 1800. If the contemporary and the present Hungarian names were different, the students registered the changes.

The next captions represent how to save the content of this damaged globe from further decay.

Figure 2. The legibility of names (e.g., Tunis is fully legible).

Digitizing techniques

Papers gave a summary of the digitizing techniques of globes at the Department of Cartography and Geoinformatics at ELTE in the past few years (Gede 2009; Gede, Ungvári 2012). We took more than 700 photographs of the globe surface systematically (Figure 3).

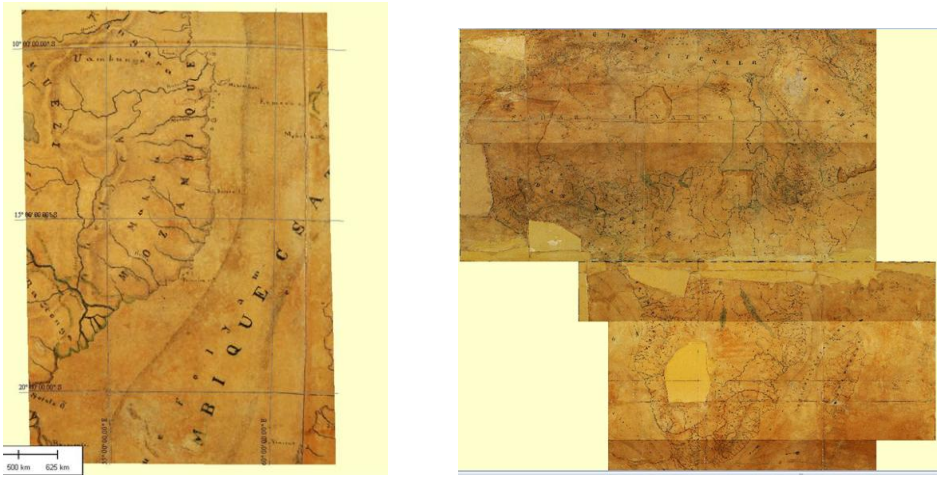

Figure 3. The image on the left shows a georeferenced photo and the right-side represents the photo mosaic of Africa.

After georeferencing the photographs with Global Mapper, the authors compiled the virtual globe. There are two types of virtual globes: a VRML model (the VGM 2.0 contains X3D models, the new version of VRML), and an overlay in Google Earth (Gede, Ungvári 2013). This globe map, which was created from high resolution photos of the manuscript globe, was prepared with projection transformations for further processing to digitize the content of the map. As the prime meridian of the globe goes through Ferro (El Hierro), the coordinates of the globe had to be transformed to the new system of Greenwich (Timár 2007).

After creating the virtual globe, several students joined the globe restoration project. The goal was to save the globe's content, re-draw the readable parts of the map, and to try to reconstruct

the content on the damaged areas with the using of contemporary sources. The final part of this project will be the reconstruction of the globe in real size (Gede, Márton, Ungvári 2011).
The identification of geographical names was a major part of this project. The authors decided to create an online database to inform the public about the result of this project, and to give the opportunity of examining the contemporary names to the experts of cartography and linguistics.

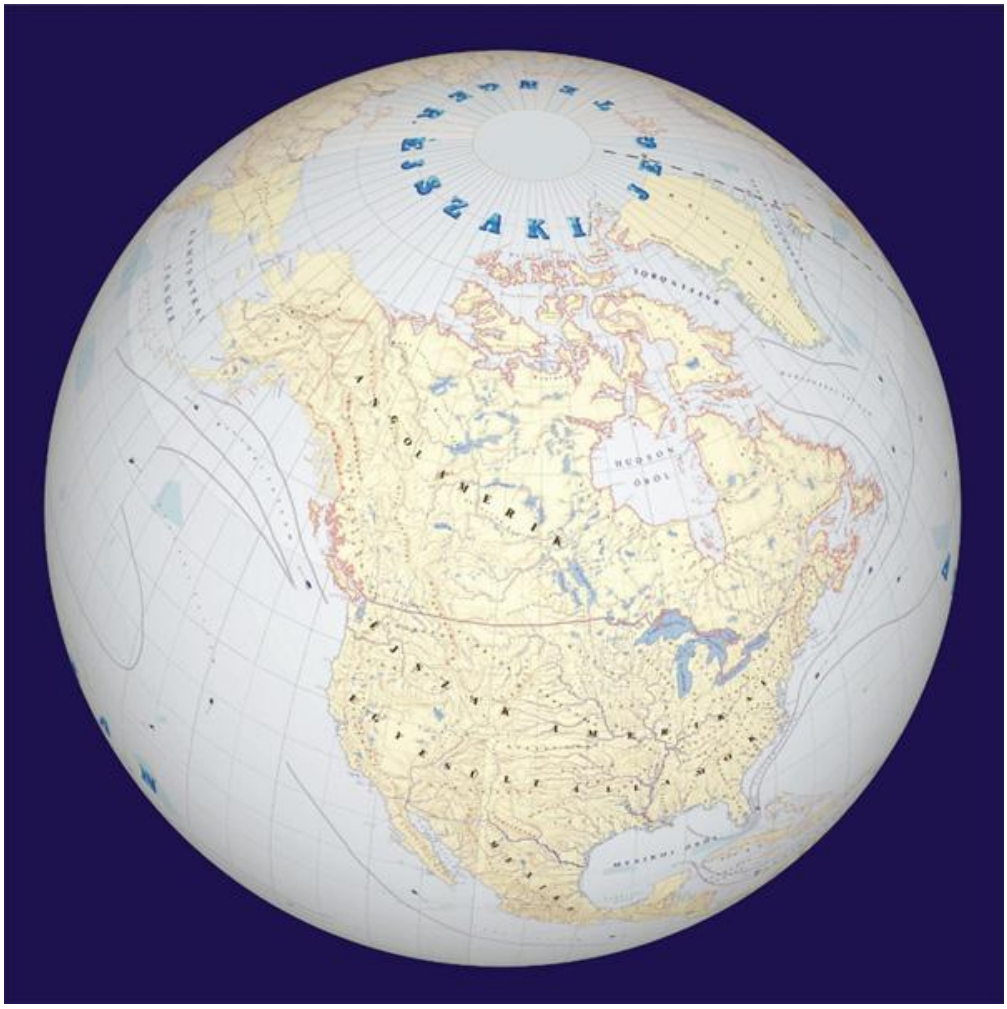

Figure 4. The restored virtual globe.

Defining the search grid

There are many names on this manuscript globe; hence, the building of the name database was not a “one person” job. Those students (Zoltán Gulyás, Judit Kirisics, Krisztián Nemes, Éva Nyuli, Renáta Szabó, Bettina Tóth, Adrienn Való, Diána Zubán) who were involved in the project collected every name including also the partially legible names, and created a geo-database in MapInfo.
Afterwards, the names were classified in two major categories: settlement names and other geographical names like the name of rivers, lands, or seas. The principle of this classification was that the settlements could be represented by one coordinate pair in small scale, while the names of other features showed up as polylines or polygon objects. In the latter case, another solution was needed. When the users search for names in a gazetteer to a map, they find the geographi-

cal objects by grids in the map. Therefore, the globe's geographical grid by 5 degrees was chosen. Each square was numbered from 1 to 72 by five degrees between the longitudes; the squares between latitudes moving away from the Equator to the poles were lettered A, B, C etc. by five degrees. To avoid the similar lettering on the globe, the squares on the northern hemisphere got an "N" prefix, and an "S" prefix on the southern one (e.g. NA or SE).

Figure 5. The searching grid based on the geographic grid.

Building the homepage

The initial work on the website was made by Tibor Tokai, a graduated master student of the department. He built a database of several settlement names, and visualized them on the web with Google Earth plug-in. This website was improved with the other geographical names and more comfortable functions (Tokai 2011).

After every name was entered into the list, a MySQL database was built based on the classification method mentioned earlier. The visualization and searching in this database on the net needed an HTML page. The HTML page was written in PHP because of the excellent functions of this scripting language. However, this was not enough to visualize spatial data. The best choice was to let the names and places be seen in the Google Earth, because the manuscript "map" was originally a globe, and the Google Earth plug-in offers several potentials to developers (Figure 6). The switchable layers of the original Perczel globe, the reconstructed one and the satellite photos give the chance of comparing the contemporary content with the current state. Furthermore, the users can set the transparency of this overlay with an interactive slider.

The Google Earth API gives an interactive frame to the homepage, where the result of the search can be visualized. Before the search, the users can choose from the two major categories of names from the database. Accordingly, the names were divided into different listboxes, but the asynchronous searching works on both of lists. Additionally, the placenames can be displayed with placemarks, which help to open the InfoWindow, where the users can find information about the selected contemporary name, the current name (if known), the object type, the coordinates and the code in the developed searching grid. However, the geographical names cannot be represented as a point feature in several cases; therefore, the spatial extension had to be used in the MySQL database. In view of the two coordinate pairs, the algorithm sets the focus on the whole object (Figure 6).

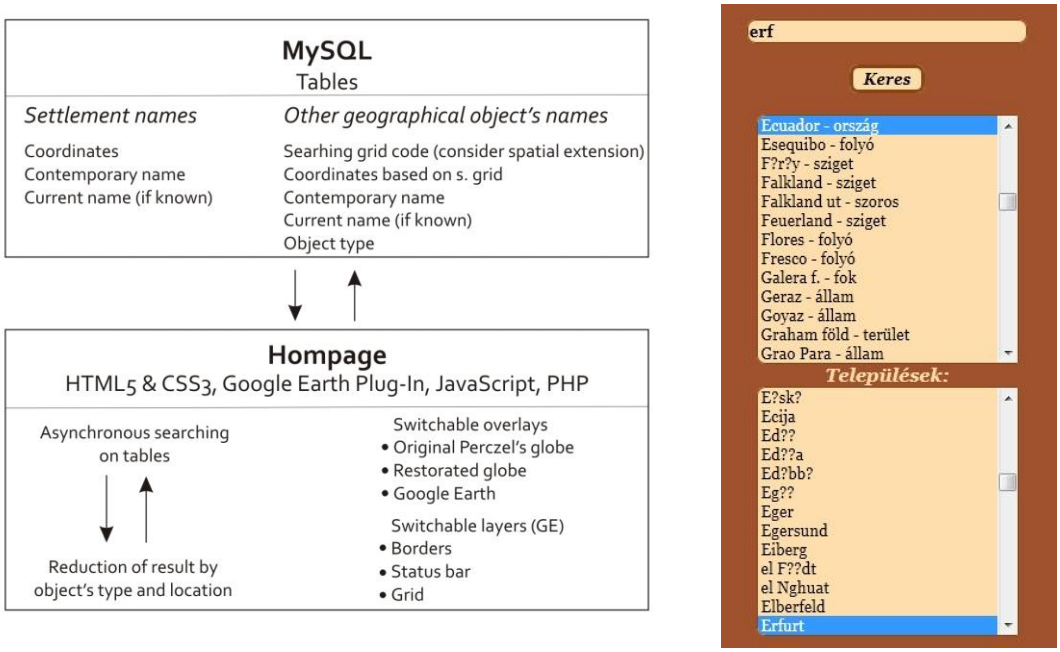

Figure 6. The structure of homepage's operation. Asynchronous searching on names: The settlement names and the other geographical names were divided in two classes.

Due to the large number of names, the users can select from categories to filter the result. It is possible to reduce the result by continents.

A new function was implemented to help the scientific research of this globe: the names can be downloaded is KML format by types and continents.

There are other options of visualizing globes. The disadvantage of Google Earth is that it is a plug-in, and it should be installed by users. It is installed on a lot of computers, but it would be well advised to revise the visualisation techniques. The main problem in the current visualization is to texture the globe with the old globe image layer. In this case, the KMZ file is too large if the image quality is good. However, the image quality has to be good or reading the original names. This is a real problem if the user's internet connection is slow.

Figure 7. The website of the 150-year-old-globe's interactive gazetteer.

Statistical analysis of names

This database is also suitable for statistical analysis. The MySQL table contains the type of the geographic object. It is not surprising that most of them are settlement names (more than 3500). The other largest group is the river names with about 1600 labels. There are approx. 900 island, 320 cape, 350 landscape, 230 mountain and 210 bay names. The number of geographical names in any other group is under 200. Altogether, there are 3900 names classified in 35 categories.

Conclusions

In this paper, a method was described how to create interactive gazetteers to old globes. This interactive gazetteer is organized from two main parts:

- on the server, there is the name database, which always considers the individuality of the processed globe;
- the website connects to the database, and there is a widely used platform, where the names can be visualized.

Besides searching in the list of names, there are other useful functions: the Google Earth allows us to switch on the current border lines and names. The interactive slider helps the reader to compare the accuracy of the old globe with the current states. This website is also suitable for further research in cartography and linguistics.

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