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## Digital Support for Globe Exhibitions

*Keywords:* cartographic heritage; globes; globe digitising

### *Summary*

A special temporary exhibition took place at the Hungarian National Széchényi Library between October 2010 and April 2011. This exhibition, entitled “Printed Hungarian Globes from the Beginnings to Our Days” shows a cross-section of Hungarian globe production.

This is the first occasion in Hungary when most of the exhibited terrestrial and celestial globes could be seen as well as examined on computer screens at the same time and place due to the “virtual exhibition” that completed the event. Next to the showroom of the globes, two computers were placed for the visitors, who could spin around the 3D models of the globes they had seen beyond the security barriers minutes before. The virtual part of the exhibition was prepared by the authors of the Virtual Globes Museum web site.

This paper introduces the exhibition and the techniques used for its digital support.

### Introduction

The Hungarian globemaking has a rich history. Its products were widely known and recognized in Europe from the second half of the nineteenth century until the 1980's. The first printed globes were made in 1840, and since then a rich palette of globes was produced always using the most recent technology and depicting the latest geographic discoveries. The exhibition of the Hungarian National Széchényi Library displayed the most important items of this history.

As many of these globes are unique and valuable, the exhibited objects were separated from the visitors by security barriers. However, what is the use of a globe if one cannot spin it around? To solve this problem, the globes were digitised so that their “virtual models” could also be exhibited. This initiative is not unprecedented: the digitised model of Mercator's globe can be examined next to the original in the Globe Museum of Vienna (Hruby et al, 2006). Researchers of the Technical University of Dresden created a 3D model of Blaeu's globe, which is also planned to be exhibited after the re-opening of the Mathematisch-Physikalischer Salon of the Zwinger Palace; furthermore, the creators plan to use an autostereoscopic display to enhance the experience (Knust & Dolz, 2008).

### The “real” exhibition

The exhibition is installed in three rooms, which represent the three major periods of the history of Hungarian printed globes.

The first room is “the beginning”: these are the oldest items dating from 1840 to the turn of the century. The common point of these globes is that they are not “pure” Hungarian products: the printing and mounting process was usually completed abroad as these facilities were rather undeveloped in Hungary at that time. One of the globes is totally “foreigner”: it was made in Vienna, and even the names are in German. However, the author is supposed to be Hungarian.

Luckily, the oldest pair of globes is in very good condition thanks to the author, who donated them as new globes to a museum. These terrestrial and celestial spheres, created by Károly Nagy

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have a diameter of 316.5 mm (Figure 1). The globes were engraved to copper by Charles Dien in Paris and Bernhard Biller in Vienna. (Márton, 2010).



Figure 1: The earth globe of Nagy Károly from 1840.

The majority of the globes in the first room are translated versions of Felkl (Prague) or Schotte (Berlin) spheres. The translators of the globes were Pál Gönczy and János Hunfalvy. There are several special objects here, such as a combined terrestrial and celestial globe (a “combo”: the sky globe nested into the other one, Figure 2), or a “planetarium” (model of the solar system, Figure 3). (Márton & Plihál, 2010)



Figures 2 and 3: “Combo” globe of Gönczy (left) and a “planetarium” (right).

The second room is dedicated to the years between 1896 and 1945. This period is marked by beautiful globes of high quality (Figure 4). The authors of these globes were Manó Kogutowicz, later his son, Károly Kogutowicz, and the workshop of István Turner. The first date, 1896 is an important year in the Hungarian cultural history: the nation celebrated its 1000-year anniversary of living in the Carpathian Basin with a series of events including a world expo. The end date, 1945, meant the end of the private globemaker companies for the next forty years due to the introduction of the Soviet system.



Figure 4: A globe of Manó Kogutowicz from 1905.

The third room shows the globes produced after World War II. Most of the spheres were made by the monopolistic mapmaker company, “Cartographia”. Being a state firm with no competitors on the domestic market did not mean any inclination in quality as the best professionals of the former private firms were working at this company. Thanks to this and the good management of the company, the globe production volume of Cartographia became incredibly high. Between 1965 and 1990, more than 600 000 spheres were produced in six languages (of them, 100 000 in English, German, Czech and Polish). Thus, the company provided not only Hungary with globes, but exported a lot to European countries. (Kovács & Márton, 1989)

Around 1990, Cartographia finished globe production, but a former subcontractor of the company founded a new one-person firm, which is the only globe manufacturer in Hungary today. The latest spheres of the exhibition are products of this small firm.

The exhibition is completed with two “non-globular” sets of objects: postage stamps and coins depicting globes, and globe-shaped household objects, e.g. pencil sharpeners and lamps.

### Digitising the globes

The aim of the globe digitising process is to generate Plate-Carée maps of the globe content. These maps are then used to create the textures of the 3D models.

Two different methods were used to produce these maps, depending on the sources available.

Fortunately, there were unmounted globe prints (Figure 5) available for a part of the globes (mostly for the newer ones). The digitising process of these spheres was the following:

1. The prints were scanned.
2. Each gore and polar cap (if there were any) was georeferenced. The intersections of the geographic grid were used as control points (GCPs). The projection of the gores was set to Cassini-Soldner or Polyconic (the difference between these two projections is negligible for this task) using the central meridians of the gores as the central longitude of the projection. The projection of the polar caps was set to Azimuthal Equidistant using the North or the South Pole as the projection centre.
3. Each georeferenced gore and polar cap was transformed into geographic (latitude-longitude) projection and merged into one Plate-Carée map depicting the whole globe.



Figure 5: Unmounted globe prints.

All the other globes were digitised using photographs, which needed a slightly different process:

1. A series of photographs were taken of each globe using homogenous lighting conditions. The number of photos was between 60 and 120 depending on the size of the globe. Usually, each photo depicted a  $30^\circ$  by  $20^\circ$  quadrangle and its surroundings (Figure 6), but it might vary due to special circumstances.
2. The photos were georeferenced one by one using the method the author developed for this task (Gede 2010).
3. Each georeferenced photo was transformed into geographic (latitude-longitude) projection. Rectangular parts of the transformed photos were saved and merged into one Plate-Carée map.





Figure 6: A typical globe photo used for digitising.

### Visualizing the digitised globes

The globes were visualized using a VRML model. This model consists of six surfaces: two polar caps with a radius of  $40^\circ$  above the  $\pm 50^\circ$  latitudes, and four  $90^\circ$  by  $100^\circ$  quadrangles around the Equator (Figure 7). Each surface has its own texture (Figure 8); the polar caps need Azimuthal Equidistant maps, while the equatorial quadrangles use parts of the Plate-Carée map. (The Azimuthal Equidistant polar maps were produced from the Plate-Carée map by digital projection transformation.)

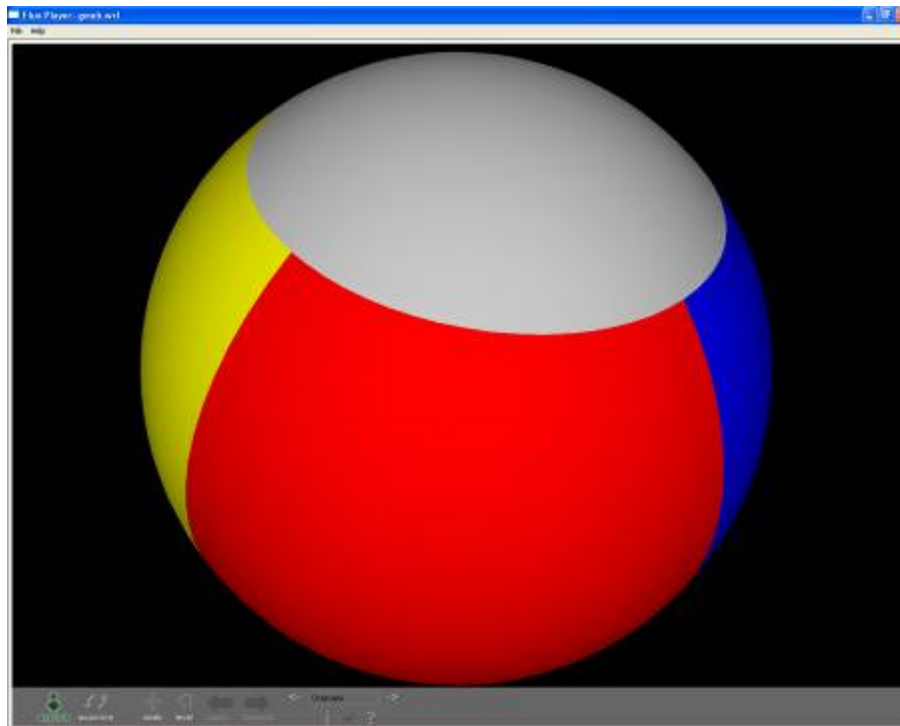


Figure 7: The VRML model used for visualizing the globes, here without textures.



Figure 8: Texture-set of a globe model.

This solution was introduced in order to eliminate some texture-mapping anomalies when using the built-in Sphere node of VRML (Gede 2009). The texture image sizes can be reduced with the use of more surfaces.

### **The virtual exhibition**

There were several requirements for the virtual exhibition. The system has to be stable and fool-proof, as the computer desks cannot be permanently supervised. The user interface should be self-explaining, because there can be visitors with limited or no computer skills.

Considering everything, the virtual exhibition was realized as an off-line HTML page with embedded VRML models. The exhibited computers are set out with a mouse only – even the right mouse button is disabled and there is no keyboard. The browser starts up automatically in full-screen mode without any controls (no menu bar, no toolbars etc.). This ensures that the users cannot navigate away from the HTML page of the virtual exhibition either accidentally or on purpose. The exhibition screen consists of three parts (Figure 9). The upper part contains the list of globes and a language selector (the exhibition is bilingual: Hungarian and English). The globe models appear on the left side, while the corresponding descriptions on the right.

The usage of the system is extremely simple. The users can switch between globes by clicking on the items of the globe list. The globe models can be rotated by the mouse, and the language of the interface and the descriptions can be changed at any time by clicking the flag at the top right corner.

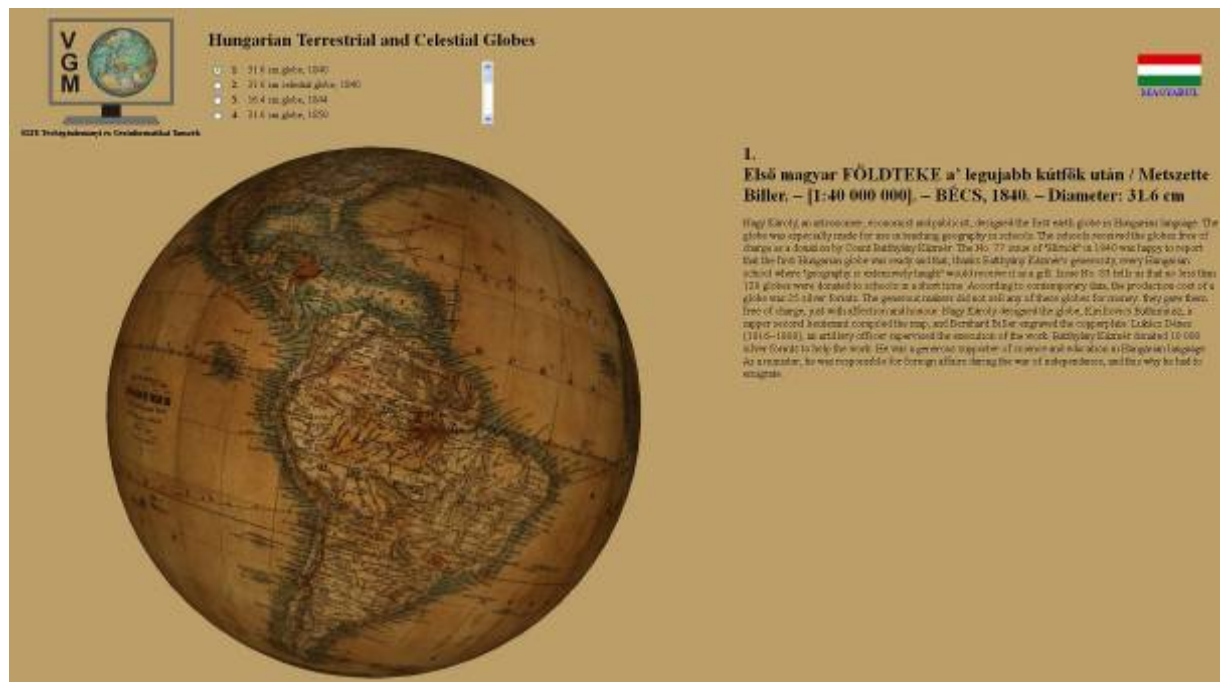


Figure 9: Screenshot of the virtual exhibition.

### Peculiarities



Figure 10: Two parts of the detachable structural Earth model.

Most of the models are simple spherical objects, but there are two exceptions: the 40 cm detachable physical-structural Earth model of Cartographia (Figure 10), and a “combo globe”. While the two parts of the detachable globe were modelled separately, the model of the combo globe is very similar to the original object: clicking the button of the lock on the outer sphere will open the earth globe like a shell revealing the inner sky globe. Naturally, the whole object can be examined from every angle regardless it is opened or closed, and the sky globe can be rotated around its axis independently of the outer earth globe (Figure 11). This special object takes advantage of the animation and scripting possibilities of the VRML language.



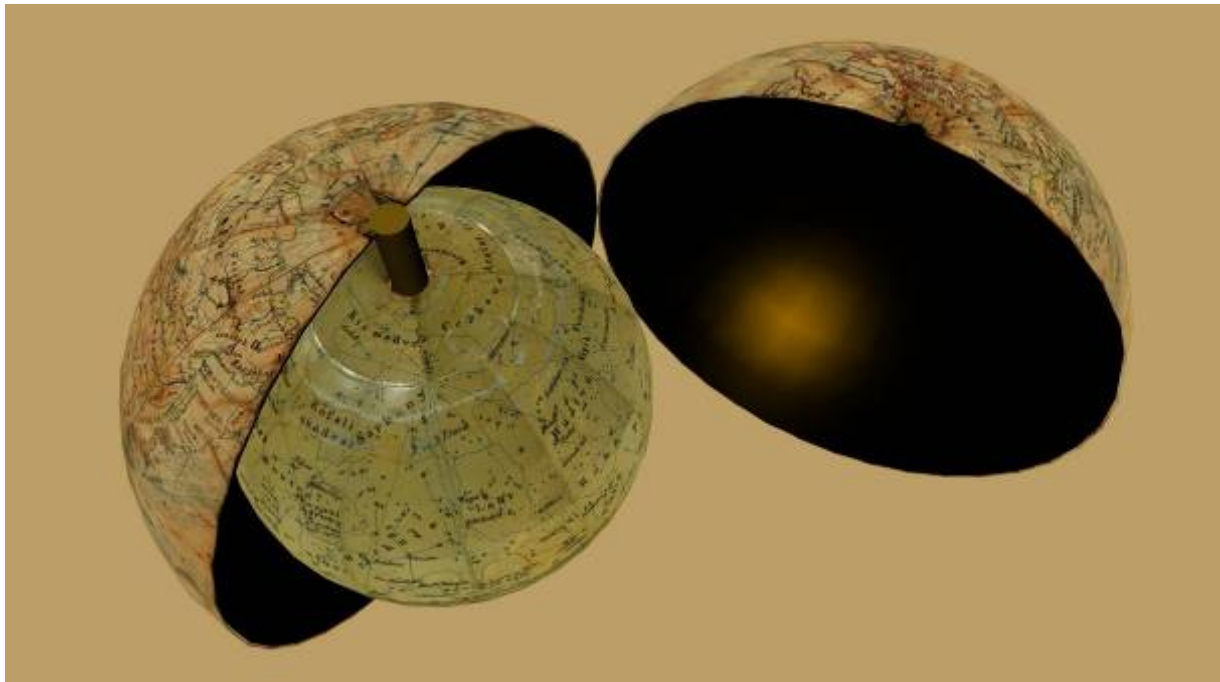


Figure 11: Model of the combined terrestrial and celestial globe.

### Feedback and plans

According to the guestbook of the library, visitors loved this digital “extension” of the exhibition. During the “Open Days”, when the exhibition could be visited free of charge and additional museum-pedagogical workshops were organized, even the youngest generation (children in the age of 8) enjoyed that they could “play” with the virtual models. The older visitors who were not used to computers also found it usable and interesting.

Due to this popularity, the Map Collection of the library plans to make the virtual exhibition available on the Internet after closing the exhibition and to create a DVD version as well.

### Acknowledgements

The European Union and the European Social Fund have provided financial support to the project under the grant agreement no. *TÁMOP 4.2.1./B-09/1/KMR-2010-0003*.

The author thanks Mr. Zoltán Nemes for the professional photos.

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