Source: Digital Presentation and Preservation of Cultural and Scientific Heritage

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Location: Bulgaria

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Issue: X/2020

Citation style: Zsolt László Márkus, Tibor Szkaliczki, György Szántó, Miklós Veres, Zsolt Weisz. "Preservation and Presentation of Roland Eötvös' Scientific Heritage". Digital Presentation and Preservation of Cultural and Scientific Heritage X:149-158. https://www.ceeol.com/search/article-detail?id=902118

Preservation and Presentation of Roland Eötvös' Scientific Heritage

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Abstract. In association with UNESCO, the world's scientific community commemorated in 2019 the 100th anniversary of the death of Roland Eötvös, a world-famous Hungarian polyhistor. This paper presents various multimedia tools and services applied in the commemorative year to preserve and present his multifold scientific and societal heritage on Web and mobile platforms.

Keywords: Scientific Heritage, Physics Digitization, Mobile Applications, Web Sites, Panorama Pictures.

1 Introduction

In association with UNESCO, the world's scientific community commemorated in 1919 the 100th anniversary of the death of Hungarian polyhistor Roland Eötvös (1848-1919, in Hungarian: Eötvös Loránd, Fig. 1), a pioneer of high precision gravitational physics, founding father of geophysics and innovator of higher education. He was nominated three times for the Nobel Prize. Roland Eötvös is remembered today largely for his work on gravitation and surface tension, and the invention of the torsion pendulum.

His name is inseparable from a number of ideas, instruments and methods applied in various fields of physics. Just to mention the most important ones: the Eötvös experiment (a famous physics experiment that measured the correlation between inertial mass and gravitational mass, demonstrating that the two coincide with each other, something that had long been suspected but never demonstrated with the same accuracy) (Kilényi, 2019), as well as the Eötvös torsion balance. Scientific notions and concepts named after him include the Eötvös number, the Eötvös parameter, the Eötvös effect, the Eötvös rule, the Eötvös physical unit. His scientific talent is also preserved in the name of the Eötvös Loránd University, the Loránd Eötvös Mathematics Competition, the mineral lorándite, and the Eötvös crater on the moon.

He is also noted for his societal activities. He was educational minister, public figure, sportsman and hiker as well. The Eötvös peak in the Dolomites in Italy was named after him as a recognition of his mountain climbing and exploring achievements. Roland

Digital Presentation and Preservation of Cultural and Scientific Heritage. Conference Proceedings. Vol. 10, Sofia, Bulgaria: Institute of Mathematics and Informatics – BAS, 2020. ISSN: 1314-4006, eISSN: 2535-0366

Eötvös can be a veritable role model in numerous careers even today (Patkós, 2020), (Dobszay, Estók, Gyáni, & Patkós, 2019).

Fig. 1. Roland Eötvös

The Eötvös 100 centennial project carried out by the Library and Information Centre of the Hungarian Academy of Sciences (MTA KIK) represented the core of the whole Eötvös 100 Commemorative Year. It was initiated by the Eötvös Loránd Geophysical Foundation and SZTAKI was responsible for delivering digital tools and services. The project has been implemented with support from the National Research, Development and Innovation Fund of Hungary and about a dozen further partners participated directly in the realization. The Eötvös 100 Coordinating Committee set up by the Hungarian National Commission for UNESCO (UNESCO MNB) and operated by MTA KIK, endeavoured to coordinate the various initiatives. The success of the Commemorative Year, which went far beyond the original expectations, is due to the dynamically developing cooperation of all participating organizations.

Throughout the centenary year a series of almost 130 scientific events and exhibitions were organized, and special publications were presented in Hungary and worldwide, all in remembrance of the genius of Baron Eötvös. A central event took place in Budapest on the day of his passing away (8 April). The Commemorative Day began with the issue of commemorative coins and stamps, followed on the next day by a wreath ceremony and a thanksgiving mass. At the same time an “Eötvös 100” exhibition was opened at the 2019 Annual Meeting of the European Geosciences Union, held in Vienna. Roland Eötvös was also remembered at the General Assembly of the International Union of Geodesy and Geophysics (IUGG), an organization which also celebrated its 100th anniversary in 2019. Another “fruit-yielding” program series was related to the World Science Forum and the Hungarian Science Festival: student quiz, book presentations and an exhibition opening.

The eLearning Department of the Institute for Computer Science and Control (SZTAKI) provided digital tools and services on multiple platforms (Web and mobile)

for the support of the Eötvös 100 project. A service package was created consisting of four elements: web site, mobile application, virtual walks and eLearning solutions to support to Eötvös 100 Commemorative Competition. This paper describes the first three elements which are closely related to the presentation and preservation of the heritage of the outstanding scientist.

2 Digital Tools and Services

2.1 Web Page

SZTAKI created and maintained the Eötvös 100 Web site for the Commemorative Year (Fig. 2). The site (https://eotvos100.hu/) provided information about the life and achievements of Roland Eötvös, announced events and results of the Eötvös 100 project in a uniform graphic design in both Hungarian and English. The members of the Coordination Committee of the Eötvös 100 project collected the contents for the Web page, organized them in a systematic way and sent them to SZTAKI for further processing and publishing.

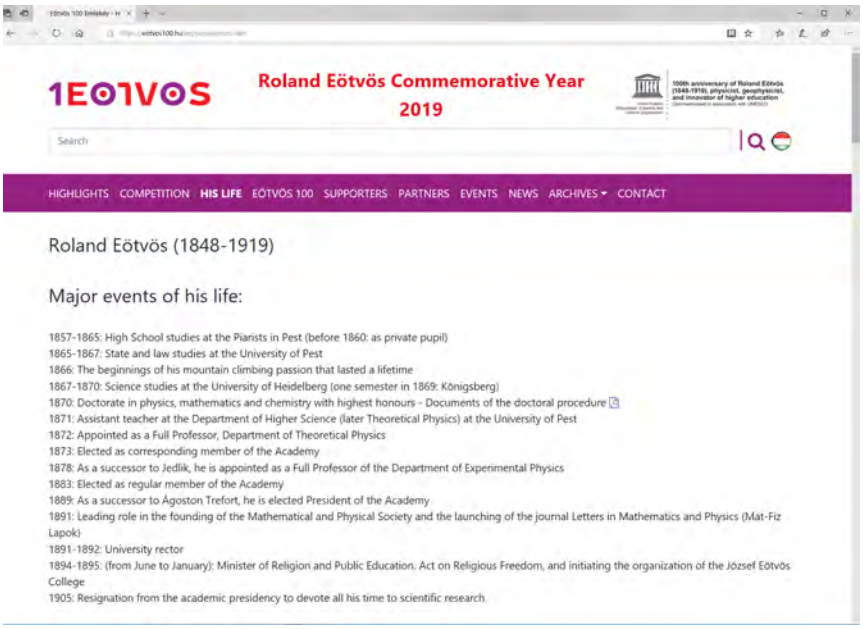

Fig. 2. Web page of Eötvös 100 project

The main menu of the Web site is composed of the following items:

- *Highlights* presenting the most important events and news on the Web site.
- *Competition* introducing the Eötvös 100 Commemorative Competition.

- *His life* presenting the time line of the major events of Roland Eötvös and milestones of his scientific activity. This section also contains a valuable collection of documents and publications related to Roland Eötvös including his scientific and science policy works, letters, poems, documents and the UNESCO: Memory of the World Register. All publications by Eötvös can be read from the Repository of the Academy's Library (REAL).
- *Eötvös 100* presenting the centennial project (co-ordination body, graphic documents, project reports).
- *Supporters* presenting the patrons of the commemorative year, the sponsors and the honorary board of the project.
- *Partners* enlisting the project partners.
- *Events* providing comprehensive information in calendar form about all commemorative events and activities.
- *News* offering a collection of news related to the Commemorative Year from all over the word.
- *Archives* containing photos, videos and documents and presentations related to the scientific heritage of Roland Eötvös. Some of the collections are as follows:
    - *Memory of the World Register*. It includes three manuscripts of Roland Eötvös registered in the UNESCO International Memory of the World Register and the corresponding nomination form.
    - *Eötvös 3D photos.* It contains 3D photos converted from the original stereoscopic photos made by Roland Eötvös. The images present Budapest and its environment, locations of his field geophysical measurements and mountains in the Dolomites. The 3D photos were produced in three different 3D formats (anaglyph, side by side, top and bottom, Fig. 3).
    - *Presentations, publications.* In 2019, a lot of studies were published about Eötvös (journal articles, complete journal issues and other volumes). Most of these, as well as video recordings and illustrations of the lectures delivered, can be directly accessed here.
    - *Videos.* This collection contains videos and movies related to the life, achievements and tours of Roland Eötvös. The oldest recording was shot on the burial ceremony of Roland Eötvös in 1919. It includes video recordings and illustrations of lectures, too.
    - *Historic Roland Eötvös sites.* It enlists sites related to Roland Eötvös. A picture and a title is assigned to each site. It includes the place of his birth, his tomb, statues, a map of the memorial sites in Hungary, etc (Kovács, Eötvös Loránd emlékhelyek, 2020).
- *Contact* containing email addresses the users can apply if they have any remarks, questions or problems regarding the content or in case of technical issues.

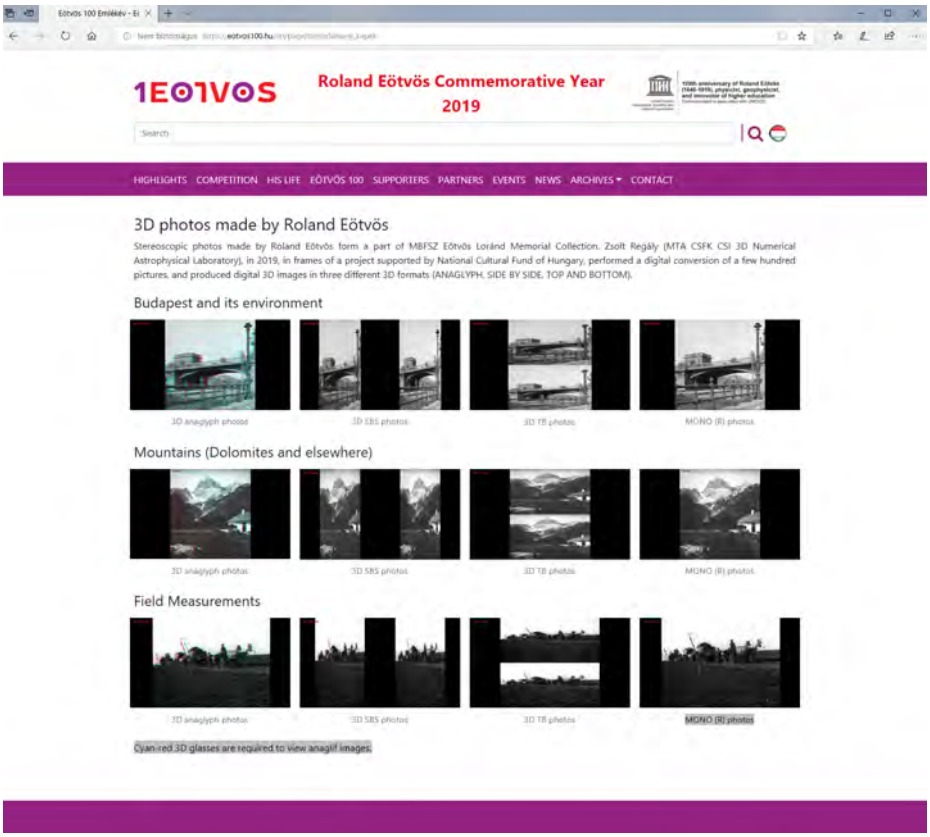

Fig. 3. 3D photos made by Roland Eötvös in the Archives menu.

2.2 Mobile Application

SZTAKI created and published the EVENT@HAND Eötvös100 smart phone application for the central event on 8 April 2019 where it was presented to the public (Fig. 4). The application presents the project and the related contents on mobile devices both in Hungarian and English. It is available on iOS (iPhone, iPad) and Android platforms. The contents provided by the system can be downloaded prior to use, therefore, they can be retrieved without Internet connection. A map was integrated into the application which could help to find the location of the events. Further useful services include the list of favorites, event reminder, receiving push notification, etc. Although the Commemorative Year is over, the application still can be downloaded from the application stores and it can be used to get information on the achievements of Roland Eötvös and on the Eötvös 100 project. To download the Eötvös 100 application to your mobile, see https://guideathand.com/hu/downloads/eotvos100 or use the QR code in Fig. 5.

The application belongs to the GUIDE@HAND mobile application family developed by the eLearning Department of SZTAKI (https://guideathand.com/). The appli-

cation family can meet a wide variety of demands and trends of the present life. It consists of more than 60 multilingual offline applications running on smart phones and tablets and provide tools and interactive services for mobile exploration of places, events, organisations, cultural objects, etc. The content of the applications can be uploaded, stored, managed and maintained with the help a Web-based Administration System (Márkus & Wagner, 2011).

a) b) c)

Fig. 4. Screenshots from the mobile application a) Opening screen b) Main menu c) Project partners

The main menu of the application contains the following items:

- *Eötvös 100* presenting the life of Roland Eötvös, the Eötvös 100 project, graphic documents and the Eötvös 100 Commemorative Competition.
- *Partners* enlisting the project partners, patrons, sponsors and the honorary board.
- *Media* containing three subitems: manuscripts and documents from the UNESCO Memory of World Register, stereoscopic photos made by Roland Eötvös and some presentations held during the Commemorative Year.
- *Events* containing full information about all commemorative events and activities.
- *News* containing news related to the Commemorative Year from all over the word, similarly to Web site.
- *Contact* containing email addresses to contact in case of any issues, similarly to Web site.

Some general functions can be accessed through the top-right icon of the screen. The most common functions include:

- *Update*. Although the application looks for a content update at the start the user can manually check for updates from this menu.
- *Select language.* The user can select a language at the first start, this setting can be changed here.
- *Favourites*. Users can label any event or places as their favourite in the application. They can see the list of the favourites in this function.
- *Notifications*. If a reminder is set for an event the user receives a notification before the event.

Fig. 5. QR code to download Eötvös 100 application

2.3 Virtual Walks

SZTAKI created virtual walks to the Eötvös Loránd Memorial Exhibition of Hungarian Mining and Geological Survey (MBFSZ) and to the Ság Hill near the Hungarian town Celldömölk (Márkus, 3D virtual presentation of the MBFS Eötvös Loránd Memorial Collection, 2019), (Márkus, In the footsteps of Loránd Eötvös 3D photography, 2019). Virtual walks represent the newest service of the eLearning Department which can be applied to present, virtually walk around and interactively explore real spaces and special environments. High-resolution, real 3D and 360° spherical panorama pictures are taken of the target locations to be explored. These pictures are postprocessed by a content editor developed by SZTAKI and can be accessed via a multiplatform (Web, mobile, VR) player on various devices.

The service can be used both with 2D and 3D display devices. Although 2D displays are more widespread the virtual tour is especially spectacular on 3D displays. Even 5-6 rooms/parts can be nested together to accommodate the virtual walk whereas an interactive map can facilitate the orientation. The movement between the rooms and the interaction within a room is determined by the control facilities of the applied display. In case of computers, the control is represented by the keyboard and the mouse. Hotspots can be assigned to specific areas which can deliver further information after selection.

The 3D virtual walk to the Eötvös Loránd Memorial Exhibition was first presented to the participants of the central event. This demonstration was closely related to the topic of the central commemoration ceremony since the participants could see the 3D photos made by Eötvös and his coevals just before the demonstration. Both the 3D photos (https://eotvos100.hu/en/page/tomorlatvany_kepek) and the virtual walk (https://eotvos100.hu/en/page/emlekgyujtemeny) can be accessed online on the project Web site. They can be viewed online with anaglyph glasses or on 3D TV, even in stereoscopic form (Fig. 6).

Roland Eötvös has performed field measurements on Ság Hill, Western Hungary (Kovács, Tiszteletadás Eötvös Loránd Ság hegyi gravitációs méréseinek, 2020). SZTAKI created panorama pictures on the scenes of the original measurements and created a virtual walk using these photos. The result is a sample virtual discovery tour for outdoor environments (http://files.elearning.sztaki.hu/Escape3D/Sag-hegy).

Fig. 6. A shot from the virtual tour to the Eötvös Loránd Memorial Exhibition. Anaglyph glasses are required to see it in 3D.

3 Conclusions

An astonishing conclusion of the Commemorative Year is that the name “Roland Eötvös” is an even more valuable brand in international science than it was thought a year ago. Roland Eötvös was an exceptionally visionary researcher. His experimental results survive any theory. In gravitational physics, the famous Eötvös experiment has become a focal and reference point again. Roland Eötvös can be a veritable role model for young people. A concise summary of his oeuvre was published in poster versions as well. The poster photo can also be viewed in 3D.

One of the tangible results of the Commemorative Year is that from now on all publications by Eötvös can be read on the Web site. The popularity of electronically downloadable documents was also due to the uniform appearance of all Eötvös 100 documents. The Web site provides collection of archive photos and videos as well to preserve the scientific heritage of Roland Eötvös. Users can get the information through their own devices (smartphones or tablets) anywhere and anytime. Virtual guided tours to the MBFSZ Eötvös Loránd Memorial Exhibition and to the Ság Hill near Celldömölk were completed.

Acknowledgements

Support of the National Research, Development and Innovation Fund of Hungary (no. ED_18-1-2018-0011) is gratefully acknowledged. We highly appreciated the contributions of all other partners including the Library and Information Centre of the Hungarian Academy of Sciences (MTA KIK), the Eötvös Loránd Geophysical Foundation and the Eötvös 100 Co-ordination Committee.

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Received: June 10, 2020
Reviewed: June 23, 2020
Finally Accepted: July 12, 2020