

Priljeno: 7.7.2023.

Prihvaćeno: 19.7.2023.

DOI: <https://doi.org/10.36506/av.66.6>**István Kenyeres**

Budapest City Archives

Budimpešta, Mađarska

*kenyeresi@bparchiv.hu***THE BUDAPEST TIME MACHINE**

UDK: 910:004.65

528.235:528.8

004.65:930.25(439Budapest)

Pregledni rad

The paper presents the history of the development of the Budapest Time Machine (www.hungaricana.hu/en/budapest-time-machine), which started from the vision of the Venice Time Machine, despite the fact that it was never realised, but was the basis for the European Time Machine Initiative. The Budapest Time Machine was a visionary phenomenon from the moment of its debut, and it has maintained this position ever since: one of the flagships of the international Time Machine initiative from the very beginning. The development was launched by the Budapest City Archives in 2017. The background database of the Budapest Time Machine is the Hungarian public collection portal called Hungaricana, on which the Budapest City Archives continuously publishes a large amount of digitised archival sources (maps, blueprints, notarial deeds etc.). The interface of the Budapest Time Machine – whose first version was developed in 2017 provides digitized and georeferenced maps of Budapest, synchronized with each other using GPS coordinates, and vectorised historical maps of the city's development in five different time sections (1837, 1872, 1908, 1916, 1938). The platform also allows browsing through historical documents related to the buildings, their owners or their former inhabitants: building plans, land registry inserts showing the owners, notarial deeds showing legal and administrative transactions of the period and the network of the inhabitants. Archival photographs and postcards are also easily searchable, either by address or by browsing the map. The

Budapest Time Machine was completely renewed at the end of 2022. The advantage of the new version is that, unlike the previous version, it provides a single interface for accessing the data, and the maps can now be viewed in 3D. An important innovation is the publication of 3D historical reconstructions of some 30 buildings in cooperation with the University of Óbuda. The Budapest Time Machine is an example of collaboration between public collections and academic research, and we plan to include data created by NGOs in the future.

Keywords: *archives; time machine; digitization; geo-referencing; vectorising; geocoding; building historical geographic information systems*

1. Introduction

The aim of this paper is to present the background of the development of the Budapest Time Machine, its steps and its possible directions, in the context of the European Time Machine vision. The Budapest City Archives launched the Budapest Time Machine online software application in 2017.¹ In 2023, on the occasion of the 150th anniversary of the unification of Budapest, the Budapest Time Machine was completely renewed. From the very beginning, it was an important goal to make the Budapest Time Machine accessible to anyone without a thorough knowledge of history, to stimulate interest in local history and family history, but we have always kept in mind the historical use of the Time Machine.

2. The vision: the Venice Time Machine

The project followed the vision of the Venice Time Machine, outlined in 2012, to be a pioneering scientific venture in the field of digital humanities, launched by the Polytechnique Fédérale de Lausanne (EPFL) and the University of Ca' Foscari in collaboration with the State Archives of Venice. The idea was to use state-of-the-art IT tools to illustrate the historical development of Venice, publishing digital files on digitized maps, linked to specific points on the map, with information on the history of the buildings and the people who once lived there. The project planned to use machine learning, automatic handwriting recognition, indexing, automatic recognition of image sources, etc. They also planned to create 3D models of the historical buildings, their evolutionary phases, paintings and other visual resources of the city, all in different time frames. The Venice Time

¹ "Budapest Time Machine: Introduction," *Hungaricana*, accessed September 13, 2023, <https://www.hungaricana.hu/en/databases/budapest-time-machine/>.

Machine project ended in 2019 without any substantial results, but the time machine vision had a significant impact on the digital cultural-scientific sphere.²

3. The European Time Machine Initiative

From 2019, the international European Time Machine Initiative (Time Machine Organisation) has been launched, formally operating as an association with more than 600 institutional members. The Time Machine Initiative's vision is to revive European history using the "big data of the past". The project's declared aim is to combine Europe's rich past with state-of-the-art digital technologies and infrastructures to create a collective digital information system that maps Europe's economic, social, cultural and geographical development in different time-frames. The idea is that digitizing cultural sources is only the first step in a long process of processing, including understanding and describing documents. The stated aim is to complement the digitised objects with augmented/visual reality (AR/VR) applications, and simulations of hypothetical spatial-temporal 4D reconstructions are also envisaged.³ The Time Machine has therefore been defined as a new kind of cultural-scientific product, based on information technology and implemented with innovative tools, which processes and publishes information from public collections and offers new opportunities for scientific research and for industries and disciplines.

4. The beginnings of the Budapest Time Machine: from the archive portal of Hungary to the Hungaricana databases

The Budapest City Archives, having been familiar with the Venice Time Machine project and having joined the international time machine initiative, realized that it had the right basis for implementing a time machine-type IT solution. It was supposed to have a large number of topographic data, databases, digital holdings and considerable online publishing experience, thanks to its database construction and digitization activities, which have been consciously carried out for decades. Among its former IT implementations, the archives has developed and operated its own archival database system (LEAR) between 2006 and 2011, which has been used to develop its own databases and to process and publish online more than one and a half million metadata records based on archival processing. This has subsequently greatly assisted the Budapest City Archives' digitisation projects, as metadata for the digital publication of hundreds of thousands of documents were produced during this period. In 2007, the Budapest

² "In Brief," *EPFL*, accessed September 13, 2023, <https://www.epfl.ch/research/domains/venice-time-machine/inbrief/>.

³ "Explore the history of Time Machine," *Time Machine*, accessed September 13, 2023, <https://www.timemachine.eu/about-us/>.

City Archives organised the creation of the database system of the archival portal of Hungary (*archivportal.hu*),⁴ which was able to publish the databases of about a dozen archives in a uniform structure, and to start publishing digital images of documents on a large scale, and also to publish online cadastral maps and military surveys in georeferenced form (i.e. mapped to spatial coordinates) for the first time.

A georeferenced digital map has been tied to a known coordinate system, users can determine where every point on the map is located on the Earth's surface. During geo-referencing historical maps, the raster file is overlaid on an already georeferenced base map using a few defined points in the geographic information software. For these points on the map to be georeferenced that are compatible with the points on the georeferenced base maps, for example, churches or other important public buildings which, because of their prominence, are called triangulation points.⁵

This system became the basis for the Hungaricana Portal (*www.hungaricana.hu*), launched in 2015. Hungaricana was a huge step forward in many respects. On the one hand, it has unified museum and library content alongside archival content, and on the other – and this was the key point for the Budapest Time Machine – it also functions as a Historical Geographical Information System (HGIS) for many of its databases.⁶

⁴ István Kenyeres and András Sipos, "Hungarian Archives Portal – a collaborative solution for publication of digitized archival content and databases," in *Archive im Web: Erfahrungen, Herausforderungen, Visionen*, eds. Thomas Aigner, Stephanier Hohenbruck, Thomas Just, and Joachim Kemper (Wien: St. Pölten, 2011), pp. 72–81.

⁵ The most significant collection of historical georeferenced maps has been created by the Hungarian Arcanum Ltd. in cooperation with several archives - among them the Hungarian National Archives, the Budapest City Archives, the Military History Institute and Museum, Budapest, the Austrian State Archives, the Croatian State Archives, etc. The project was previously called MAPIRE and is currently available at <https://www.arcanum.com/hu/maps/>. For georeferencing of historical maps see: Ian N. Gregory and Paul S. Ell, *Historical GIS: Techniques, Methodologies and Scholarship* (New York: Cambridge University, 2007), pp. 47–49; Gábor Timár et al., *Digitized maps of the Habsburg Empire: The map sheets of the second military survey and their georeferenced version* (Budapest: Arcanum, 2006), DVD, pp. 1-59; Gábor Timár, "Possible Projection of the First Military Survey of the Habsburg Empire in Lower Austria and Hungary (Late 18th Century): An Improvement in Fitting Historical Topographic Maps to Modern Cartographic Systems," *ISPRS International Journal of Geo-Information* 12, no. 6 (2023): p. 220, <https://doi.org/10.3390/ijgi12060220>; Előd Biszak et al., "Cartographic heritage of the Habsburg Empire on the Web: The MAPIRE initiative," in *9th International Workshop on Digital Approaches to Cartographic Heritage*, eds. E. Livieratos and M. Pazarli (Thessaloniki: International Cartographic Association, 2014), pp. 26–31.

⁶ Methodology for historical geographic information systems: Ian N. Gregory, *A Place in History: A Guide to Using GIS in Historical Research* (Oxford: Oxbow, 2003); Gregory and Ell, *Historical GIS*; Jordi Martí-Henneberg, "Geographical Information Systems and the Study of History," *Journal of Interdisciplinary History* 42, no. 1 (2011): pp. 1–13; *Toward Spatial Humanities: Historical GIS and Spatial History*, eds. Ian N. Gregory, and Alistair Geddes (Bloomington: Indiana University, 2014).

In the first stage, postcards,⁷ the documents of Maria Theresa's urbarial census,⁸ and the blueprints of the Building Committee of the Royal City Pest (1861–1873)⁹ were available. This was conditional on the map surface to be displayed being georeferenced and the historical data to be placed on it having a suitable geocode, i.e. coordinates that could be identified in space.¹⁰ The integration of digitised documents and archival records into a geographic information system has enabled historians to gain a new layer of information, as these documents, records and data are now more spatially interpretable and can be studied on maps from different periods, which can be georeferenced and compared with modern maps and satellite images using a slider. In the case of the manorial tables of the urbarial census,¹¹ for example, it is possible to display not only the villages included in the tables, but also the layers of census acres, peasants, and unvetted serfs as vector layers (i.e. graphic and descriptive layers). It is also possible to automatically compare the manorial situation and historical geography of a given settlement in the three time periods of the military surveys (1763–1787, 1806–1869, 1869–1887).

The geocoding of the blueprints (app. 6,000 items) of Pest Building Committee¹² has made it possible to study the impact of the spatial location of buildings on the cityscape and to visualise the projects of builders and developers in different time frames: the online system offers 29 maps of the capital from the end of the 18th century to the first third of the 20th century, as well as aerial photographs of Budapest in 1944 as a base layer. This was the first geocoded geographic information project of the Budapest City Archives. Subsequently, the digitisation of blueprints of Budapest continued at a high rate, with the digitisation of all blueprints – i.e. about 20,000 – before 1873, as well as the complete blueprints collection of the famous architect Miklós Ybl (1814–1891),¹³ more

⁷ “Gallery,” *Hungaricana*, accessed September 13, 2023, <https://gallery.hungaricana.hu/en/>.

⁸ “Urbarium of 1767,” *Hungaricana*, accessed September 13, 2023, <https://archives.hungaricana.hu/en/urberi/>.

⁹ “Maps,” *Hungaricana*, accessed September 13, 2023, <https://maps.hungaricana.hu/en/>. The aim of the decree issued by Maria Theresa in 1767 was to assess and uniformly regulate the serfs' levies. The situation of the peasantry was assessed by means of a nine-point questionnaire. The tables of the landlords, the names of the landlords, the peasants and the tenants, the size of their plots, etc. The application contains the complete archival documentation which have survived. This represents some 300,000 pages for 43 counties.

¹⁰ The range of historical data that can be geocoded: in the case of a building plan, the exact street and house name and parcel number of the plot of land in question, and in the case of any other document, the locality, street, house number and parcel number mentioned in the document.

¹¹ HU MNL OL C 59.

¹² HU BFL XV.17.b. 312.

¹³ HU BFL XV.17.f.331.

than 6,000, and the digitisation of the so-called Plan Collection of Construction Departments of Budapest (1873–2000s)¹⁴ before 1920, also started.

Another important preparatory step was the processing and publication of topographic data on the Buda and Pest inner districts. The latter was completed by organising the topographic indicators produced in the archives of the capital from the 1970s onwards, published in book form in several volumes,¹⁵ into a database, which was first published on DVD in 2007,¹⁶ where topographic data on individual plots could be searched and displayed in combination with georeferenced maps. Topographic data is a key element in the creation of an urban time machine, as it is the data that establishes the link between the different time scales at the level of the individual parcel. These books already then essentially prepared as a database, constitutes the historical and archival predecessor of the Budapest Time Machine, so we can say that the staff of the Budapest City Archives, had already started to lay the foundations of a city time machine in 1976, without their knowledge.

These projects were followed by databases that provided the organic basic data for the Budapest Time Machine: primarily the databases of the land register entries (1850–1870s to 1921–1926) and the census of Budapest from 1944.

The land registers of the capital's real estate, which form the basis of the modern land register system, form the basis of almost all research on buildings, but they also provide essential data for the transformation of Budapest into a metropolis, as they contain authentic and complete information on the ownership of real estate, changes in it, and the charges and loans entered against it.¹⁷ These sources thus provide the economic and social background to the development of Budapest, and, as the official records of construction works can usually be traced back to the name of the owner at the time, they are also an indispensable basis for any research into the history of architecture, local history and other aspects of real estate. At the launch of the Budapest Time Machine, digital copies of the land register of Pest and Óbuda were available on Hungaricana in HGIS.

¹⁴ HU BFL XV.17.d.329.

¹⁵ Published volumes of the Pest City Topographic Index series by the Budapest City Archives: *Pest Város topográfiai mutatója 1: Belváros, Lipótváros*, ed. Vera Bácskai (Budapest: Budapest Főváros Levéltára, 1976); *Pest Város topográfiai mutatója 2/1: Terézváros 2/2: Terézváros*, ed. Vera Bácskai (Budapest: Budapest Főváros Levéltára, 1982); *Pest Város topográfiai mutatója 3: Ferencváros*, ed. Vera Bácskai (Budapest: Budapest Főváros Levéltára, 2000). Published volumes of the Buda City Topographic Index series: Ibolya Felhő and Éva Gál, *Buda város topográfiai mutatója: 1: Vár, Krisztinaváros* (Budapest: Budapest Főváros Levéltára, 1980).

¹⁶ *Buda és Pest történeti topográfiaja georeferált térképekkel* (Budapest: Budapest City Archives, 2007), DVD ["Historical topography of Buda and Pest with georeferenced maps"].

¹⁷ HU BFL XV.37.a.,b.,c.

The other initial digitised collection of the Time Machine is the Budapest flat data sheets from 1944, which were found on an adventurous journey in 2015.¹⁸ On 30 May 1944, the deputy mayor of Budapest ordered a census of all Budapest flats and tenants within 24 hours, which meant filling in some 36,000 forms. The forms issued had to be filled in by the owner of the house or the building inspector: they had to indicate all the apartments in the property, their rent, room number, street or courtyard location, and whether the owner or tenant was Jewish or non-Jewish, or more correctly, the question: ‘Can you be considered Jewish according to the legal provisions?’ In 2015, more than 6,800 data sheets were recovered from an apartment in Kossuth Square, where they had been professionally filed away in a filing system.¹⁹ Within almost a year, the Budapest City Archives had the records de-acidified, restored, digitised and processed in a database with all the data (properties, owners, tenants), so that the digitised records containing the data of 12,256 property owners and 34,098 tenants were geocoded and mapped and uploaded to Hungaricana in February 2017, and soon became a layer of the Time Machine. As a result of the geocoding, the map visualisation made it clear that the data sheets of districts XI–XIV were only found.

5. The Budapest Time Machine 1.0

Launched in 2017 and expanded in 2018 as part of a World War I project, the Budapest Time Machine presented geocodable data on four interfaces:

1. Interface with georeferenced map bases

This provided access to the data sheet for a given plot of land, linked to a parcel number, through which the following types of data could be accessed: topographic data of the plot, land registers, blueprints, flat data sheets of 1944, and, if the Hungaricana contained photographic material with geocodes relating to the plot or its surroundings, from the collections of the Budapest City Archives and other institutions that publish postcards and photos. All plots in Budapest before 1950 have a plot number and a data sheet, but of course not all plots have a data sheet with all the listed source types (*Figure 1*).

2. Vectorised maps

Initially, the development of the town was studied in 4 time sections: 1837, 1872, 1908 and 1937. These vector maps were drawn up by vector re-

¹⁸ “Holocaust documents trove unearthed in Budapest apartment,” *The Guardian*, November 21, 2015, accessed September 13, 2023, <https://www.theguardian.com/world/2015/nov/21/holocaust-documents-trove-unearthed-in-budapest-apartment>; “Nazi holocaust documents found: 6,300 files discovered behind wall of Budapest apartment,” *The Telegraph*, November 21, 2015, accessed September 13, 2023, <https://www.telegraph.co.uk/news/worldnews/europe/hungary/12009564/Nazi-holocaust-documents-found-behind-wall-of-Budapest-apartment.html>.

¹⁹ HU BFL IV.1420.r.

drawing on the basis of the original georeferenced maps, and the processing included the naming and extent of the streets of the period, as well as the outlining and description of the main objects of interest on the maps (churches, administrative buildings, hospitals, schools).²⁰ This also resulted in the creation of a database of street names in Budapest of the period, which is also essential for documents that can be identified with such data. In the framework of the World War I project, the 1916 vector map was completed in 2018, which has no real historical precedent, but was created by enhancing the 1908 map. This map contains most of the geodata: in cooperation with the Szabó Ervin Metropolitan Library, the street number data for each plot, the data of the house owners, certain institutions and businesses (schools, hotels, restaurants, cafés, etc.) have been added (*Figure 2*), and for each building the data of the 1916 address register published in the Hungaricana with the names of the inhabitants have been included, the latter by running an automatic search. An innovation, however, was the possibility to link the address data of 99,000 persons in the more than 61,000 notarial documents²¹ from 1914 to 1918 to the notarial documents already published in large quantities in Hungaricana, using the contemporary street name and house number database. An impressive feature of the vector map display was a slider that allowed quick and visual switching between the different time layers.

3. 1944 aerial photos

In April 1944, a few days after the first major Anglo-Saxon bombing raids, the Royal Hungarian Air Force photographed the hit districts of Budapest from a low altitude (800–1,200 m). Not all of the shots have survived, and until recently the negatives of the 550 or so aerial photographs were available for research in the Military History Archives. Some of the missing shots were partially replaced from an earlier survey from an altitude of 2,000–2,500 m. These images have been added to the Hungaricana (and thus the Time Machine) interface by precision assembling, cutting out redundancies, reduction of deformations and georeferencing.²²

4. 1956 database

The geo-database of the victims of the 1956 Revolution and Freedom Fight, which displays the data of about 1,700 people who died violently in Budapest from 23 October 1956 to spring 1957, most probably in connection with

²⁰ A vector map is a graphical representation of geographic information in which map elements (such as roads, rivers, and buildings) are represented by geometric shapes, such as lines and polygons.

²¹ HU BFL VII. 151–280.

²² Gábor Molnár, Gábor Timár, and Előd Biszak, “The advantage of publishing intermediate products of historical air photos.” In *12th ICA Conference Digital Approaches to Cartographic Heritage, Venice, 26–28 April 2017*, ed. Evangelos Livieratos (Venice: University IUAV of Venice, 2017), pp. 339–342.

the revolutionary events. The database displays the exact location of the victims' deaths in a searchable format on maps.



Figure 1. The Budapest Time Machine 1.0 starting page with the four interfaces is no longer available today



Figure 2. Budapest Time Machine 1.0 – vector map display (1916 restaurants as a vector layer)

So most of the data in the Budapest Time Machine, launched in 2017, were available through two interfaces: a vectorised and a geocoded map system, the researcher had to know which type of data were available on which interface, and the two connecting databases – 1944 aerial photos, 1956 database – were a kind of complement to the Time Machine.

6. The Budapest Time Machine 2.0

At the end of 2022, the Time Machine was completely renewed with the support of the Budapest Municipality. What are the main new features of Budapest Time Machine 2.0 (*Figure 3* and *Figure 4*)?

The most significant improvement was that all data is now displayed on a single interface instead of the previous four. The new map interface is 3D in itself (in a similar way to Google Earth). The new interface is also fully optimised for mobile phones, so when walking down the street with a smartphone, users can instantly find themselves on the map and see what data is available for the building they are standing in front of. Another innovation is that the public buildings, churches, schools, etc. highlighted on the original vectorised maps have been automatically highlighted in 3D (by creating a cube), so that the image of the city can be observed as it changes. These are automatic 3D highlights, block representations. The data can be displayed through different layers in the new interface:

1. historical maps: these include first the highlighted georeferenced maps (base maps from 1837 to 1937), followed by vectorised map layers from the same time period, and finally 29 additional maps from the 1740s to 1945, as well as aerial photographs from 1944.

2. data: here you can set which vectorised base data you want to display: all parcel numbers, or optionally parcel numbers with land registers, housing archives, plans or notary records.

3. 3D buildings: an important innovation, which is linked to the original designs of the Venice Time Machine, is the inclusion of real 3D building models on the Time Machine. In recent years, the Budapest City Archives has established a co-operation with the Ybl Miklós Faculty of Architecture of Óbuda University, whereby the archival blueprints are used for teaching the 3D digital building modelling course, and the models produced are also added to the archives' holdings. The 3D models, based on the original plans, will significantly enhance the information value of the Time Machine and bring a new level of user experience, and will in the future serve as the basis for a scientifically based virtual reconstruction of the contemporary city, which is becoming one of the leading approaches to cultural heritage processing. In collaboration with architecture students from the Ybl Miklós Faculty of Architecture at Óbuda University, a pilot project has produced 3D building reconstructions based on the original archival plans pre-

served in the Budapest City Archives, 31 of which are published on the Time Machine platform.

In addition to the selection of layers, the new interface will of course also allow comparisons with today's vector maps and satellite images. The system offers two types of search windows: in the top centre, you can search for parcel numbers, old street names and categories of institutions, while on the right, a modern address finder helps you navigate. Below this, there are zoom in or out options and a "find my location" button.

In parallel with the renewal of the Time Machine, we have also sought to expand the data. We have mentioned the importance of the land register records: the initial Time Machine published the records of Pest and Óbuda, and now the Buda land register records have been published on Hungaricana: 16,781 records (the number of land register records published and georeferenced) and 63,298 records have been published, which are also available on the Time Machine.

The number of plans available on the Time Machine has also increased. The 52 years of work of the Building Committee of the Free Royal City of Pest (1808–1860) have resulted in more than 12,000 plan sheets, which have already been digitised.²³ The complete material is available on the Electronic Archives Portal,²⁴ but the material, organised by archival reference, can be consulted using traditional records, as a multi-searchable database similar to that of the Building Committee (BPC) for the period 1860–1873 has not yet been created. First of all, the plans of József Hild, a prominent and highly productive architect of Hungarian Classicism, who was a fundamental influence on the city's image, were published in the Hungaricana series and geocoded on the Budapest Time Machine.



*Figure 3. Budapest Time Machine 2.0 home page
(1916 vector map)*

²³ HU BFL IV.1207.b. HU BFL XV.17.b.311.

²⁴ "Digital Archives Portal," Eleveletar.hu, accessed September 13, 2023, <https://www.elevertar.hu/>.



Figure 4. 3D historical building reconstructions on the Budapest Time Machine

7. Conclusion

If we want to summarize the number of documents and data available on the Budapest Time Machine interface, we are in a difficult situation, since the Time Machine itself is a geospatial display and query interface of the Hungaricana database, so the database of the Time Machine itself essentially contains vector geospatial data, street names, house numbers, parcel numbers. At the same time, the Time Machine interface currently contains about 52,000 land register entries, 61,000 notarial documents, 6,800 flat data sheets from 1944, 26,000 blueprints, 12,000 topographic data on parcel numbers and 41,000 Budapest address and housing register data at the parcel level. The number of photos retrieved and offered by the Time Machine for each property is at least 60 thousand. It is clear from the list that the Time Machine can be built by mass processing of archival and library data, by decades of systematic database building and digitisation. Another condition is the construction of vectorised map systems, which is the key to the mass, automatable display and retrieval of geocodable data.

The Budapest City Archives has concrete ideas and plans to further build and develop the Budapest Time Machine. The next logical step after the publication of the land register entries is the publication of the land registers covering the previous period, which are still kept in the form of volumes, and therefore we would like to expand the Time Machine with the data of the land and registration books of Pest between 1852 and 1878, which means about 7,400 land records with about 18,000 entries.²⁵ We are also planning to publish the ancestor entries of the land register, which will provide information on the period after the land register entries, i.e. from the 1920s onwards. The digitisation of planning

²⁵ HU BFL IV.1324.a.

material and other sources relevant to the development of the Time Machine is also under way. The geocoding of more than 900,000 notarial documents available on Hungaricana and their publication on the Time Machine are also planned. Further progress would also be needed to extend the data of the towns and villages annexed to Budapest in 1950, and of the peripheral areas. In order to publish more and more data in a wider time span, it is necessary to extend the current vectorised map databases. Therefore, we plan to add vector maps for the period after 1950, and we would also like to add a street-number database to the already published vector maps, which is only available for the 1916 map. Once these basic data are available, it will also be possible to process the data of the Budapest address and housing directories already published on the Hungaricana between 1880 and 1928, mainly with data on land owners and the most important institutions, companies, hotels, restaurants, etc.²⁶ The processing and publication of data on tenants in a database could of course also be considered, but this would require the recording of millions of records for each year. There is also the possibility of crowdsourcing the processing of handwritten land registry entries, i.e. involving users, and the use of increasingly developing artificial intelligence-based handwriting recognition software.

Finally, the question may arise to what extent can the Budapest Time Machine be considered a historical research tool? As I mentioned before, a fundamental objective in the construction of the Time Machine has always been to make the interface easy to use for users without any knowledge of history, while at the same time supporting scientific research has been a priority. The construction, visualisation and integration of historical data, documents and historical building models into a historical spatial information system help professional users to identify new contexts, while at the same time ensuring the rapid display, processing and interpretation of large amounts of data, providing an infrastructure for modern urban history research that was almost unimaginable a decade ago, and Budapest is now a European leader in this field.

REFERENCE LIST

Archival sources

Budapest City Archives

HU BFL IV.1207.b. Pest Város Szépítési Bizottmányának iratai. [Budapest City Archives. Documents of the Building Committee of the City of Pest.]

²⁶ “Budapesti Czim- és Lakásjegyzék 1880-1928,” *Hungaricana*, accessed September 13, 2023, https://library.hungaricana.hu/hu/collection/fszek_budapesti_czim_es_lakasjegyzek/.

HU BFL IV.1324.a. Pest város telekkönyvi iratainak gyűjteménye. Telek- és betáblázási könyvek (1852-1878) [Budapest City Archives, Collection of land registry documents of the city of Pest. Plot and registration books]

HU BFL IV.1420.r. Budapest Székesfőváros tanácsi majd polgármesteri ügyosztályainak gyűjteményes iratai. 1610/1944. ME. rendelet végrehajtásához felvett adatszolgáltatási ívek. [Budapest City Archives, Collected documents of the council and mayoral departments of Budapest. Data sheets recorded for the implementation of Decree 1610/1944 ME.]

HU BFL VII. 151-280. [Budapest city Archives. Collection of notarial deeds.]

HU BFL XV.17.b.311 Pest szabad királyi város tervei. Szépítőbizottmány tervei (1804–1861) [Plans of the Building Committee of the Free Royal City of Pest]

HU BFL XV.17.b. 312. Építő Bizottmány (1861-1873) [Budapest City Archives, Collection of blueprints of the Pest Building Comitee]

HU BFL XV.17.f.331. Ybl Miklós hagyatéka, tervek és iratok (1844–2005) [Budapest City Archives, Collection of blueprints of the architect Miklós Ybl]

HU BFL XV.17.d.329. Építési ügyosztályok tervtára (1873–2006) [Budapest City Archives, Plan Collection of Construction Departments of Budapest]

HU BFL XV.37.a. Telekkönyvi és ingatlannyilvántartási iratok gyűjteménye. Budai telekkönyvi betétek (1855-1924) [Budapest City Archives, Collection of land and property registry documents. Buda land registers]

HU BFL XV.37. b. Telekkönyvi és ingatlannyilvántartási iratok gyűjteménye. Óbudai telekkönyvi betétek (1855–1924) [Budapest City Archives, Collection of land and property registry documents. Óbuda land registers]

HU BFL XV.37. c. Telekkönyvi és ingatlannyilvántartási iratok gyűjteménye. Pesti telekkönyvi betétek (1878–1930) [Budapest City Archives, Collection of land and property registry documents. Pest land registers]

Hungarian National Archives

HU MNL OL C 59 Departamentum urbariale. [Hungarian National Archives, Central Statearchives, Budapest, Documents of Magyar Királyi Helytartótanács / Royal Hungarian Council of Governors, department of urbarial affairs]

Bibliography

Biszak, Előd, Hannes Kulovits, Sándor Biszak, Gábor Timár, Gábor Molnár, Balázs Székely, Annamária Jankó, and István Kenyeres. “Cartographic heritage of the Habsburg Empire on the Web: The MAPIRE initiative.” In *9th International Workshop on Digital Approaches to Cartographic Heritage*, eds. E. Livieratos, and M. Pazarli, pp. 26–31. Thessaloniki: International Cartographic Association, 2014.

Buda és Pest történeti topográfiája georeferált térképekkel, DVD. Budapest: Budapest City Archives, 2007. [“Historical topography of Buda and Pest with georeferenced maps.”]

“Budapest Time Machine: Introduction.” *Hungaricana*. Accessed September 13, 2023. <https://www.hungaricana.hu/en/databases/budapest-time-machine/>.

“Budapesti Czim- és Lakásjegyzék 1880–1928.” *Hungaricana*. Accessed September 13, 2023. https://library.hungaricana.hu/hu/collection/fszek_budapesti_czim_es_lakasjegyzek/.

“Digital Archives Portal.” *Eleveltar.hu*. Accessed September 13, 2023. <https://www.eleveltar.hu/>.

“Explore the history of Time Machine.” *Time Machine*. Accessed September 13, 2023. <https://www.timemachine.eu/about-us/>.

Felhő, Ibolya, and Éva Gál. *Buda város topográfiai mutatója: 1: Vár, Krisztinaváros*. Budapest: Budapest Főváros Levéltára, 1980.

“Gallery.” *Hungaricana*. Accessed September 13, 2023. <https://gallery.hungaricana.hu/en/>.

Gregory, Ian N. *A Place in History: A Guide to Using GIS in Historical Research*. Oxford: Oxbow, 2003.

Gregory, Ian N., and Paul S. Ell. *Historical GIS: Techniques, Methodologies and Scholarship*. New York: Cambridge University, 2007.

“Holocaust documents trove unearthed in Budapest apartment.” *The Guardian*, November 21, 2015. Accessed September 13, 2023. <https://www.theguardian.com/world/2015/nov/21/holocaust-documents-trove-unearthed-in-budapest-apartment>.

“In Brief.” *EPFL*. Accessed September 13, 2023. <https://www.epfl.ch/research/domains/venice-time-machine/inbrief/>.

Kenyeres, István, and András Sipos. “Hungarian Archives Portal – a collaborative solution for publication of digitized archival content and databases.”

In *Archive im Web: Erfahrungen, Herausforderungen, Visionen*, eds. Thomas Aigner, Stephanier Hohenbruck, Thomas Just, and Joachim Kemper, pp. 72–81. Wien: St. Pölten, 2011.

“Maps.” *Hungaricana*. Accessed September 13, 2023. <https://maps.hungaricana.hu/en/>.

Martí-Henneberg, Jordi. “Geographical Information Systems and the Study of History.” *Journal of Interdisciplinary History* 42, no. 1 (2011): pp. 1–13.

Molnár, Gábor, Gábor Timár, and Előd Biszak. “The advantage of publishing intermediate products of historical air photos.” In *12th ICA Conference Digital Approaches to Cartographic Heritage, Venice, 26–28 April 2017*, ed. Evangelos Livieratos, pp. 339–342. Venice: University IUAV of Venice, 2017.

“Nazi holocaust documents found: 6,300 files discovered behind wall of Budapest apartment.” *The Telegraph*, November 21, 2015. Accessed September 13, 2023. <https://www.telegraph.co.uk/news/worldnews/europe/hungary/12009564/Nazi-holocaust-documents-found-behind-wall-of-Budapest-apartment.html>.

Pest Város topográfiai mutatója 1: Belváros, Lipótváros, ed. Vera Bácskai. Budapest: Budapest Főváros Levéltára, 1976.

Pest Város topográfiai mutatója 2/1: Terézváros 2/2: Terézváros, ed. Vera Bácskai. Budapest: Budapest Főváros Levéltára, 1982.

Pest Város topográfiai mutatója 3: Ferencváros, ed. Vera Bácskai. Budapest: Budapest Főváros Levéltára, 2000.

Timár, Gábor, Gábor Molnár, Balázs Székely, Sándor Biszak, J. Varga, Annamária Jankó. *Digitized maps of the Habsburg Empire: The map sheets of the second military survey and their georeferenced version*, DVD. Budapest: Arcanum, 2006.

Timár, Gábor. “Possible Projection of the First Military Survey of the Habsburg Empire in Lower Austria and Hungary (Late 18th Century): An Improvement in Fitting Historical Topographic Maps to Modern Cartographic Systems.” *ISPRS International Journal of Geo-Information* 12, no. 6 (2023): p. 220. <https://doi.org/10.3390/ijgi12060220>.

Toward Spatial Humanities: Historical GIS and Spatial History, eds. Ian N. Gregory, and Alistair Geddes. Bloomington: Indiana University, 2014.

“Urbarium of 1767.” *Hungaricana*. Accessed September 13, 2023. <https://archives.hungaricana.hu/en/urberi/>.

Sažetak

BUDIMPEŠTANSKI VREMENSKI STROJ

U radu je predstavljena povijest i razvoj projekta Budimpeštanski vremenski stroj (Budapest Time Machine: www.hungaricana.hu/en/budapest-time-machine), čija se ishodišta nalaze u ideji o Venecijanskom vremenskom stroju (Venice Time Machine), projektu koji nikada nije zaživio, ali je potaknuo Europsku inicijativu o vremenskom stroju (European Time Machine Initiative). Budimpeštanski vremenski stroj ima karakter vizionarskoga fenomena od samoga početka te je jedan od najistaknutijih projekata Europske inicijative o vremenskom stroju. Razvoj projekta započeo je 2017. godine u okviru Gradskoga arhiva Budimpešta, a krajem 2020. projekt je u potpunosti obnovljen. Za oblikovanje projekta najprije je korištena zbirka dokumenata prikupljena i prezentirana u okviru portala *Hungaricana*, na kojem Gradski arhiv Budimpešta kontinuirano objavljuje velike količine digitaliziranoga arhivskoga gradiva (karte, nacrti, javnobilježnički dokumenti i dr.). Sučelje Budimpeštanskoga vremenskoga stroja, čija je prva inačica razvijena 2017., sadržavalo je i predstavilo digitalizirane i georeferencirane planove grada Budimpešte, međusobno povezane korištenjem koordinata Globalnoga položajnoga sustava (GPS), te vektorski obrađene urbanističke planove koji prate razvoj grada u 5 vremenskih odsječaka (1837., 1872., 1908., 1916. i 1938.). Platforma je omogućila pretraživanje povijesnih dokumenata koji se odnose na zgrade, njihove vlasnike i stanare. To uključuje nacрте zgrada, zemljišne knjige s podacima o vlasnicima, bilježničke dokumente s podacima o pravnim i administrativnim postupcima i transakcijama te podacima iz kojih se može rekonstruirati mreža stanara protokom vremena. Dostupnima su postale i arhivske fotografije i razglednice, pretražive prema adresama, ali i unutar planova grada. Obnovom stranice iz 2022. stvoreno je jedinstveno sučelje, preko kojega se pristupa podacima, a planovi grada i pojedini objekti vidljivi su trodimenzionalno (3D). Važna inovacija publiciranje je trodimenzionalnih rekonstrukcija tridesetak zgrada u suradnji sa Sveučilištem Óbuda. Budimpeštanski vremenski stroj primjer je suradnje između javnih arhiva i akademskih ustanova, a ubuduće se planira i suradnja s nevladinim organizacijama.

Ključne riječi: arhiv; vremenski stroj; digitalizacija; geo-referenciranje; vektorizacija; geokodiranje; izgradnja povijesnih geografskih informacijskih sustava

Prevela Rajka Bućin