

Time maps and their rendition within Esri environment

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ABSTRACT: The paper deals with issues of displaying the temporal component of data in Esri web map applications. Using maps from the Academic Atlas of Czech History, originally intended only for the printed publication, a testing of time display capabilities and conversion between GIS-prepared maps and web map applications was performed on selected existing maps. The original data, prepared specifically for the printed atlas, has been converted to Esri Story Maps templates. Selected available options, e.g. a Time slider display, the use of bookmarks for different periods of time, or animations showing the development of the area over time, are introduced. The testing was carried out with regard to the Czech Historical Atlas project of the Ministry of Culture of the Czech Republic, where the tested technology, considering results achieved, might be used for a wide range of maps.

1 INTRODUCTION

The rich history of the Czech Lands and the wider Central European region has been and continues to be the subject of scientific research by historians, art historians, individual independent researchers and the general public. Significant historical events have been regularly captured on maps and in periodical publications where maps were often included.

In the Czech environment, probably the last major printed historical atlas published in the Czech lands was the Academic Atlas of the Czech History (Semotanová et al. 2014), released in 2014. It was most likely also one of the last extensive professional atlas publications that were published as purely printed, without an accompanying digital content. A partly successor project, which is, in printed form, mainly focusing on the Czech Lands and the Central European area in the 20th century, is an atlas being created with draft name the Czech Historical Atlas, which was already introduced by (Havlíček et al. 2018). A great innovation of this work is an electronic map portal, which brings a large number of maps originally intended for the Academic Atlas of the Czech History, converted into electronic form.

2 OVERVIEW OF TECHNOLOGIES AVAILABLE

2.1 *Open-source and proprietary technologies*

Mainly due to the rapid development of Web technology and expanding broadband Internet coverage there was a natural choice to create historiographical maps via web map portal, not using obsolete and outdated form of electronic stand-alone application. Especially relatively rapidly changing, emerging and fading out technologies have resulted in the fact that it is possible to relatively easy keep going applications created in the web environment thanks to substitution and updating the technology used, but this is difficult for once already designed and to the users distributed programme mapping applications.

Several technologies, which represent only a fraction of all those available for the preparation of web cartographic works, were considered in the preparation of the web map portal as a whole (Suk 2017), partly also (Kladivová 2018).

Whereas for maps with a significant temporal content finally the Esri Story Maps technique was chosen for creating the maps, there is a wide range of other possibilities within the Esri platform, which could be utilized.

The most powerful tool is the ArcGIS Enterprise (formerly ArcGIS Server) platform, which is a map server with additional superstructure functionality. Blažek (2018) deals in detail with this platform as well as other mentioned within this paper. It is possible to create map services according to OGC standards (e.g. WMS, WMTS), as well as native map applications, which can be used in Esri products.

3 ESRI STORY MAPS

3.1 *Displaying time in maps*

The time aspect can be rendered within maps in many ways. As (Vít & Bláha 2016) show, sequential methods, which display basically static maps in a logical sequence that approximates the dynamics of the plot, can be used. Animation maps represent the second option. They can give an impression of a presentation, as it is known from many disciplines, can be a simple video (film), or they can allow a certain degree of interactivity – i.e. a possibility of influencing the flow of the presentation. The latest most comprehensive option are dynamic interactive maps, i.e., in principle, an application that allows users not only to change the progress of the time but also the content displayed, to query the content, to display additional elements etc.

Esri Story Maps represent a special synthesizing case, they use partial options of all the variants mentioned.

3.2 *Story Maps concept*

One of the first articles in which the phrase “story map” appears in connection with Esri is (Strachan & Mitchell 2014), which deals with the perception of Story maps as an effective learning aid. Here, above all, the fact that Story Maps is used to educate, inform and visualize data and is not intended for more advanced map operations and analysis is affirmed. Esri has created a set of pre-made templates that the user simply completes with modern maps, accompanying texts and multimedia features such as charts, photos, videos, and more. The creation of an application is designed to be handled by anyone without geoinformation education.

3.3 *Temporal aspect*

There are a number of Story Maps templates, but only several selected have been found to be suitable for temporal data. These include Story Map Journal, Story Map Series and Story Map Swipe/Spyglass. Generally, Story Maps templates are conceived as an interconnection of multimedia and maps, while a convenient way to incorporate a time component into the entire application is to use the TimeAware template within other templates designed directly for Story Maps.

The development over time can then be viewed in several ways. The most demonstrative way is probably a time slider (Fig. 1). It can be configured in many ways to determine the continuity of play and the way the application responds to the time moving.

The Story Map Series and Journal are useful for displaying data genesis over time, even at irregular intervals (administrative frontiers development, route rendition, etc.). It is actually a “journeying” in time and space. Timeliness can also be expressed using bookmarks created at different time epochs.

In contrast, Story Map Swipe/Spyglass is a pair of analogous templates that allow users to browse and compare a pair of time moments at different time periods, either with a swiper or a magnifying glass – representing a hole in to the other time epoch.



Figure 1. Time slider when creating an application.

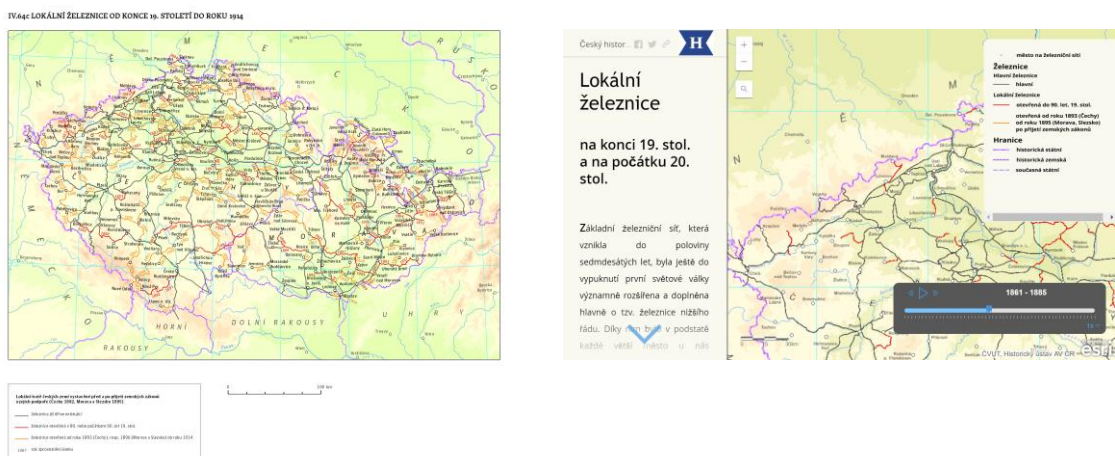
4 THE CZECH HISTORICAL ATLAS – UTILIZING EXISTING DATA

A rather limiting factor in the selection was the fact that major part of the maps intended for the electronic portal had previously been created and cartographically tuned in ArcMap software. For this reason, the possibilities of transferring the current state into the web environment were explored in particular (Suk 2017).

4.1 Techniques to convert maps into the Story Maps form

Since the maps were prepared in the form of MXD projects, it was necessary to find a way to make the publication as easy as possible, while preserving the highest possible degree of fidelity and similarity to the original map at the same time with the least number of other necessary modifications.

There is a need to load two services / web maps – with underlying data and with the dynamic temporal component. In the “Time settings” tab, the basic time component settings are available, such as instant data updates, epoch markers, time run controls, time units’ format and others. An example of the appearance of the Story Map test application and the original map created for the Academic Atlas of the Czech History can be seen in Figs. 2a, b.



Figures 2a, 2b. Original map of local railways construction (left) and its appearance after publication as a Story Map (with a slider set to limit the depiction of railways to those built before 1885)

Unfortunately, many options can not be set, but it is possible to use ArcGIS Online Assistant and customize the application by modifying the JSON files. The other option is to edit the source code of the application. These modifications require knowledge of HTML5, CSS3, JavaScript, API (Dojo Toolkit) and the appropriate JavaScript libraries: jQuery, Bootstrap.

5 CONCLUSION

The platform named Czech Historical Atlas introduces the history of the Czech Lands, including the relation to the Central European space, and brings a comprehensive portal summarizing the historical research of the Academy of Sciences of the Czech Republic.

One of the problems encountered was generally the time aspect of maps and conversion of their static symbology to dynamical one for use in the web environment. Partial results of this issue are introduced within the paper. The Story Maps and Esri web mapping applications in general are an intermediary for making easy-to-use applications, where many things can be created automatically and for a few clicks with wizards and ready-to-use templates.

The completed maps can thus include a timeline (either the content changes or stays displayed while adding new objects) or the dynamics can be solved using sliders or other technical tools to compare two or more time levels. Since historiographic maps are very often genetic, their presentation in electronic form calls for the use of an interactive and illustrative representation of the temporal aspect of the subject, especially for events that are noticeably dynamically changing.

A great part of the intended functionality is not available in application builders, even though they often represent essential functions, for example, to limit the map window pan. These deficiencies can be resolved by editing source JavaScript files using a compiler, which means an action not for everyone, requiring advanced programming skills, but may add a welcome extension and improvement of the whole map application.

ACKNOWLEDGEMENT

The research has been financially supported by the grant of the Ministry of Culture of the Czech Republic, NAKI II programme, project No. DG16P02H010.

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