

# WEB MAP PORTAL FOCUSED ON OLD MAPS AND VIEWS OF PRAGUE

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## Preamble

The paper discusses advantages of digital processing and visualization of old maps. Beyond it describes Prague cartography after famous Jüttner's map of Prague from 1816, through Hurtig's plan from 1885, up to the end of the 19<sup>th</sup> century. The last part deals with web map portal focused on Prague cartography.

## Paper vs. digital map

Endeavours to record and keep appearance, location and relations of human environment leads probably to the prehistoric ages of human beings. The media and modes have been developed step by step. From the first probable map of mammoth hunter's camp on mammoth ivory, over maps on marble stone, handmade paper maps, printed paper maps, to digital maps saved in raster or vector format completed with attributes and saved in geodatabase which can be disposable online. Evolution of maps can be seen from other points of view, e.g. way of their elaboration, from real works of art to more technical functional agent geometrically exactly describing spatial relations. With no doubt maps attract attention of more and more users and fans, including significant group of cartographers, historians, historiographers, librarians, collectors or non-professionals being interested in old maps. These maps harbour interesting information about history, former perspective of world, cartographic techniques and art, etc. Methods of map elaboration are developing and techniques of its research as well. Old maps are rare, very often have been preserved in few copies or even unique original, and their worth is often very high or even more incalculable. Hence they are commonly accessible to very close group of professionals. Their accessing to general public is in principle very complicated.

This state has been changing with digital technologies, which bring new possibilities how to handle early map. Paper maps can be digitized by scanning on large size accurate scanner. The recommended parameters of scanning depend on the map, but generally the DPI value should not be lesser than 300 DPI (better 400) and graphic format should not use lossy compression. Digital version of early map can be easily on view to any person interested around the world and original keeps safely stay in archive.

Other advantage is storing. Digital map or digital version of paper map can be duplicated without any restraint compared to its analogue edition. Therefore they can be saved and backed up in various places. It could salvage at least digital copy, when script is perished e.g. (due to fire - many maps of Prague stored in Townhall archive of Old Town burned in year 1945). Digitized old maps can be republished in digital media (CD, DVD) or made available via the Internet.

Digitizing does not only extend accessibility of early map even more enables new methods of research. The raster image of map can be examined in the similar way as in case of paper map. Cartometric research can be carried out in any graphics editing program or GIS software. Knowing the DPI of the image is easy to recount distances measured in pixel to real distances in map. Digital technologies make this research easier. The really new approach represents possibilities of transformation or vectorization. Through the network of ground control points and using transformation the raster image of map can be georeferenced. The same method can be used for map scale analysis. The isolines of scale can be calculated and depicted (e.g. in Map Analyst software). Other way of research can be found in vectorization. The full vector data model of the map can be created over the digital image. Vector data are easier to be analysed in GIS software. Spatial overlays, proximity analyses or spatial statistics can be performed. This method is described in (Cajthaml 2010).

The main disadvantage of digital version of early map is a loss of direct contact with the original. Analogous to books or painting, the digital copy of old map can not substitute real physically existing script or print which you can feel, touch and smell.

### **Prague from 1816 to 1918**

Old city maps have great historical value. They illustrate urban development of city area better and more clearly than anything else. Hence old plans are very important for research of city history and urbanism. Especially in the 19<sup>th</sup> century which was a crucial period of vehement expansion of many cities. Prague had not changed its face and extent significantly between medieval times and the end of 18<sup>th</sup> century. The following periods brought meaningful building-up, which in many respects continue up to now. The methods of town depiction developed as well, from views of town in the 15<sup>th</sup> century, through birds-eye map, to planimetric plan. Along with a progress of cartography and better precision of map, also usability of old map is growing up. A really revolutionary plan of Prague, the first plan based on practical geodetic measurement, was Jüttner's plan from 1816. Its research and earlier history of Prague cartography is mentioned in (Krejčí and Chodějovská 2009).

The many of different plans were created in later period (Hlavsa 1974). It relates with development of technology and industrial city as well. Up to 1845 Jüttner's plan was pattern of many of them. Two important works among them will be mentioned. First of

them is Pinas's plan of Prague. With no doubt its author Carl count Vasquez Pinas used Jüttner's plan as a direct pattern (Krejčí, 2006). His plan printed on 4 sheets was coloured and abundantly decorated with views of the city round the map frame, but compared to its pattern it contains factual errors. A unique transformation of Jüttner's plan is, in fact, Langweil's 3D model of Prague. It was made of paper, wood and even ivory and enlarged Jüttner's map to the scale of 1 : 480 was used as a ground-plan.

For the following period is significant creation of Stable Cadastre. Cadastral mapping was the first systematic measurement of Austrian Empire based on Cassini equidistant cylindrical projection with the origin at the trigonometric point Gusterberg (for Bohemia). After creating triangulation network mapping was done in the scale of 1 : 2,880. When the original map was done other map sheets were copied (usually by lithography). One of these copies was the Imperial Obligatory Imprint. It was colored and sent for archiving to Vienna. The Imperial Obligatory Imprints are the best source of information about Prague in 1842, because cadastral mapping in Prague was done in 1841-1842. The whole area of today's Prague is covered by over 1000 map sheets. All cadastral maps are not seamless, they are created as "islands maps" displaying just one cadastral district in defined map layout. Problem of Imperial Obligatory Imprints is that map sheets do not correspond to regular map layout of cadastral maps. The map layout of Imperial Obligatory Imprints has no regular structure and is specific for each cadastral district. In a present time there is not known general technological procedure to merge these parts of "islands maps" into one overall and georeferenced image. Creation of suitable technological procedure could be objective of incoming project. Cadastral maps were used as patterns for further plans of Prague.

Next rising of number of plans is related to the Building regulation for royal town Prague and its suburbs from year 1886 which set up the obligation to each district to elaborate planimetric plans and map any adjustments and changes. There are also plans depicting whole Prague area among these particulars plans. The important is Hurtig's plan named in scale of 1 : 10,000 from year 1885. Its name is Plan of Prague and its surroundings. Its author Alfred Hurtig was a surveyor and cartographer of Prague municipality (Pudr 1942). He also compiled individual plans of Prague I-VII (7 former cadastral districts of Prague) in the scale of 1 : 4,000. The other important is Orientation plan of royal capital Prague and nearby municipalities from 1909-1914. The plan in scale of 1 : 5,000 on 29 map sheets was set out by Prague municipality. The extent of this plan incorporates area of Grand Prague from 1920.

Appearance of Prague was not noted only on maps, but also on views. These method foreran map production, but has kept up to now more as a map completion or separately as well. Views depicted overall situation of town usually from uphill place or portrayed important places and buildings of town. The techniques of painting, engraving and lithography were replaced by photography in 2<sup>nd</sup> half of 19<sup>th</sup> century. Views and photos are together with maps important media, which complete possibilities of observing and inspecting of city appearance and way of life through the centuries.

## **Web map portal**

Together with expansion of the Internet connection came spreading of digital maps. It is related with early maps also. We considered Internet visualization of old maps as a best method how to make them accessible for general public. There are several methods of spatial data visualization, in case of old maps it is visualization of raster images. Simple integrating of raster image to html file is usually not convenient due to data volume of image. There are more sophisticated methods (Brůna and Křováková 2006, Cajthaml, 2007). For original or merged map sheets some internet raster data viewer is ideal solution. This viewer should be able to work with large raster data (hundreds of MB). As we made research on available products we recommend Zoomify application. It is Flash based application, which can work very fast with large amount of data. The data is cut into small tiles in many resolution layers and Flash application can handle with these tiles very quickly.

The more advanced method based on map server is suitable for georeferenced data. In map server data can be very easily viewed, inspected or compared with other geodata such current data layers. The web information system for a visualization and comparison of old city maps and views of Prague is based on popular open source UMN MapServer and OpenLayers interface. This application allows: publish georeferenced old map raster images, connect data published through the Web Map Services by other institutions, query of layers, etc. Georeferencing significantly improves possibilities of comparing a map with other one or with the present situation (Krejčí 2009). The georeferencing technique of using control points within the topographic content of maps is suitable when maps have no co-ordinates or geographical grid marks. The corners of important buildings which remain standing are suitable to be used to provide the set of control points for such a map as city plan. An affine transformation is proper because it is partially eliminating shrinkage of the paper, but it is not corrupting the image data too much. Processed raster images of the early maps are added to the MapServer and relevant information about history of map is provided. Simple overlapping of historical and current layers and setting of their transparency is clear visual demonstration of development of Prague urban area or cartographic techniques.

Jüttner's plan of Prague was chosen as a base historic layer. Other old plans (e.g. Pinas's, Hurtig's) support observation of subsequent development of Prague. Data from geoportals of the Czech Environmental Information Agency and the Czech Office for Surveying, Mapping and Cadastre were joined through WMS. Semi-transparent layers of present orthophotomap and cadastral map offer very easy comparison of the historical and present situation on maps. For example urban changes among years 1816, 1885 and present can be seen on Figure 1.



Fig. 1 – Border of New Town and Vinohrady districts on Jüttner’s plan 1816 (left), Hurtig’s plan 1885 (middle) and present orthophoto (right)

There are many of old views of Prague. Several of them were added to the application. Their relation data are saved in a database. The new queryable layer displaying location and orientation of views was created and added to the map server. Views and information about them can be displayed. Present photo made from similar place as view allows see differences between historic and present appearance of Prague. See Figure 2.



Fig. 2 – Historic view and present photo of Malostranská bridge tower and Charles bridge

## Conclusions

Modern digital methods bring new possibilities of cartographic analyses and processing of old maps. Publishing of maps on the Internet makes them accessible to academics and to the general public. Moreover, georeferencing allows synoptic comparison of the map with the present situation. There was not any project dealing with old Prague

cartography and this project has for object to fill up this gap. Project will be developed onward in the future and works will be focused on improvement of information system functionality and on its enrichment by more old maps and views.

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## References

Krejčí, J.; Chodějovská, E. 2009: Jüttner's map of Prague of 1816 - research, cartometric analysis and visualization. In proceedings of Symposium on the history of cartography, Portsmouth.

Krejčí, J. 2006: Vizualizace a kartometrická analýza historického plánu Prahy z let 1842-1845 [Visualization and cartometric analysis of the historical map of Prague from 1842 – 1845 (in Czech with English summary)]. Diploma thesis, CTU, Prague.

Krejčí, J. 2009: Methods for georeferencing early maps, In Bulletin of Society of Cartographers, vol. 42.

Cajthaml, J. 2010: Vector data model of the Müller's map of Bohemia. In Acta Geodaetica et Geophysica Hungarica, vol. 45: accepted for publication, Akadémiai Kiadó, Budapest.

Hlavsa, V. 1974: Plány města Prahy a okolí 1801–1918 [City maps of Prague and its surroundings from years 1801-1918 (in Czech)]. In Sborník archivních prací. Roč. 24, s. 135–259, Archivní správa ministerstva vnitra ČSR, Praha.

Pudr, J. 1942: Zeměměřiči ve službách obce pražské [Surveyors in service of Prague municipality (in Czech)]. In Zeměměřičský obzor, čís. 9 a 10, roč. 3/30, Praha.

Brůna V.; Křováková K. 2006: Staré mapy v prostředí GIS a Internetu [Old maps in the GIS and Internet environment (in Czech with English summary)]. In proceedings of GEOS 2006 - 1st International Fair of Geodesy, Cartography, Navigation and Geoinformatics. Praha.

Krejčí, J. 2008: Old city maps and views of Prague. In Proceedings of EGU General Assembly 2008, Vienna.

Cajthaml, J. 2007: Nové technologie pro zpracování a zpřístupnění starých map [New Technologies of Processing and Visualization of Old Maps (in Czech with English summary)]. Doctoral thesis, CTU, Prague.