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USING HISTORIC POSTCARDS AND PHOTOGRAPHS FOR THE RESEARCH OF HISTORIC LANDSCAPE IN GEOGRAPHY AND THE POSSIBILITIES OF THEIR DIGITAL PROCESSING

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Abstract

The paper analyzes basic possibilities of using old postcards and historic photographs in historic landscape research and presents basic methods of historic landscape elements analysis in geography and its related fields. The study is focused on the methods of selection of the appropriate historic images, as well as on their basic visual, formal and substantive assessment regarding geography and historical geography.
The second part of the paper deals with the possibilities of digitization and subsequent digital modeling, resp. The virtual reconstruction of the contents of historic postcards and photographs using 2D and 3D models. Primarily, the relief and its temporal changes are modeled. Computer processing of the past landscape brings new, respectively derived information, which is not found or visible within other historical (archival) sources.

Keywords: *Historic postcards (photographs), historic landscape, content analysis, computer digitizing, 2D and 3D models*

1. INTRODUCTION

Historic postcards and photographs have a significant and yet ”undiscovered” potential for the research of historic landscapes (Hronček, Hvizdák and Štrba, 2011). Technically complex glass photographs have originated in France in the 20's of the 19th century. The first specifically aimed landscape photograph was made by Louis Daguerre in 1837 in Paris. Following the turn of the 30's and 40's of the 19th century Henry Talbot introduced the first image exposed on paper in London. The process called calotype allowed to create any number of photocopies, thus making the production of photographs less expensive and more accessible. Advantages of photography in the coming decades have predicted its widespread use and have also found use in the research and especially in the military research in the late 19th century. Terrestrial photogrammetry had been used in Austria-Hungary from 1896 during the fourth military mapping to map the terrain (Sulo, 1989).

Following the development of photographic technology, postcards were already commercially issued in the last decades of the 19th century. Currently, the oldest and most numerous category of historical photographs is represented by the preserved photographs taken by terrestrial photogrammetry displaying landscape. This kind of visual historical documents allows tracking, analyze and evaluate the landscape in the local dimension for the first time in history. It allows us to analyze the temporal evolution and gradual changes based on credible visual documentation for almost 130 years of the existence of human society. A certain disadvantage of these materials is given by the fact, that they cannot repeatedly be created in the (historical) landscape (Boltižiar and Olah, 2009).

At present, the direct acquisition of digital data, that is the raster images not only from the newly-taken photographs but also from the digitized historic postcards and photographs common in the landscape research. According to the purpose for which the specific images are evaluated, we can use a variety of specialized cartographic, like CAD, GIS, and graphics software. Another possibility is use analytic software environment for the direct evaluation of orthophotographs and paired photogrammetric images (AutoCAD, Geomedia, ArcGIS, MIPS, eCognition, ImageStation, TERRA Modeler Leica Photogrammetry Suite, 3G Software & Measurement – Joint / Shape / BlastMetrix3D, Surfer, Voxler, CorelDraw, etc.).

2. THEORETICAL FRAMEWORK AND BACKGROUND

Methodological procedures of the historic postcards research for landscape research purposes, particularly regarding geography and historical geography, were dealt with quite a few authors. The first basic works can include works of M. Boltižiar and B. Olah (2009) and later works of authors who have collaborated with P. Hronček and K. Weis (Hronček and Weis 2009; Hronček, Hvizdák and Štrba, 2011; Hvizdák, Hronček and Weis, 2011; Hronček and Herčko, 2011). The first work dealing with the methodological procedures of modeling the anthropogenic influenced and changed landscape solely by historical postcards and photos emerged (Hronček and Weis, 2009). A paper that briefly summarizes the methodology of historic postcards and photographs content analysis had been published (Hronček, 2014).

While conducting research of the historic landscape and its specific elements, we need to focus on postcards that show overall views on the landscape and settlements, towns or villages, individual streets or specific buildings (Hronček, 2014). Thematically important are postcards showing technical constructions, whether the overall exterior views or views of the technical details of the equipment indoors. We cannot ignore transportation and other motives, depending on the objectives of the thematic research. We also have to look at the portraits, humorous postcards, curiosities and annual themes to maintain complexity.

Historic postcards are the most commonly available historic images that can be used in the research landscape with proper methodological procedures, although their processing requires specific methodologies and consideration of the amount of limiting conditions. The disadvantage of the historic photographs is that they usually display persons as well because they were mostly part of the family archives. These images were very often produced in the photographic studio. Thus their usefulness for landscape research is limited. Their main use resides in history primarily, as well as in ethnography and anthropology.

As we can only work with the real historic postcards and photographs in the research, this requires an individual scientific approach to each topic. Such work is associated with long time periods spent on finding the appropriate historical postcard (photograph) depicting the landscape under consideration (or the appropriate topic). The researcher must be proficient in archival historical research, which requires years of experience and a critical approach to the evaluation of historical image sources. The first step in working with historical postcards (photograph) is a reliable dating of the image, which is a prerequisite to further obtaining of the

right information. The first postcards are beginning to emerge and circulate from the 70's, and especially the 80's of the 19th century. These postcards are referred to as the so-called "Long addresses", because the whole back side was reserved only to the address and on the front of the image was a free space to write a short text. These postcards were published until 1906 when all postcards acquired a form given by the decision of the Universal Postal Union (Cmorej, 1992; Turčan, 2003). The typical postcard motifs had begun to appear after 1885. These were mainly "views" of cities, villages, spas, countryside and other interesting objects, topographic and landscape motifs. From there the established Slovak name "pohľadnica" had been derived ("pohľad" = view). The period from 1886 to 1906 is referred to as the golden age of postcards. Some authors extend this period until 1912 (Hanušin, 2005; Karp, 2008).

An experienced researcher needs to master the visual content analysis of the given material in connection with the use of historical postcards in the landscape research in geography, as well as other scientific disciplines. This requires experience and deep knowledge of the history of the investigated territory, as well as an interdisciplinary knowledge that allows the researcher to derive mutual temporal and spatial linkages from the composition displayed.

After the visual content analysis, a problem of scale needs to be solved, which can be problematic especially in mutual comparison of different time horizons. Determining the scale enables the researcher to acquire new credible information that is often absent in other historical sources. The absent scale can be detected and derived from various significant points in the landscape (mostly church, a castle, a town hall, as well as technical monuments and various historical administrative and residential buildings). Distances can be measured using modern instruments in situ, or they can be converted from large-format maps and plans. Determination of the resulting scale is heavily distorted by the perspective view and a central projection of the camera itself. Therefore it is necessary to take these facts into account, and the resulting scale should be determined only as a relative scale, and not an absolute scale in all directions.

At present, the direct topographical data collection can be made using sufficiently precise GPS device, resp. GNSS (Global Navigation Satellite System) allowing their subsequent interpretation in a software environment. Modern software allows modeling in a 3D space and the customization of the scene approximated to the original exposure (inclination, distance from objects, perspective vs. orthographic projection, etc.), as well as a comparison of different time horizons in real coordinates. Scaling of the images and the vertical and horizontal position of the original focal point should be addressed by overlapping of photographs from the selected time horizons. Determining the precise point (location) from which the original image had been photographed is the key to the correct positioning and orientation of the individual layers. In the evaluation of historical postcards, we must pay attention to the bias that might be found on the original photograph from which the postcard had been printed postcard. That is the reason why it is ideal to identify several control points whose positions can be precisely identified at least nowadays and which connectors and projections along the directions set can be used by reciprocal intersections in deriving the other dimensions of the object of interest in an image.

Therefore, in practice, it is best to choose such views of the settlements (landscape, buildings), on which a church building, respectively the main street line is visible. The church building is often an ideal and important point of reference for further digitization of postcards, but it is most important for the determination of the scale of image composition. Basic dimensions of the church building can be obtained from the Monuments Board or the local parishes, or it can be obtained by an advanced laser measuring situ. This is followed by the identification of the original focal point of the imagery and deriving of the projection dimensions based on the known dimensions of the building (the church). Subsequently, the work of CAD, GIS, and a graphic analyst, who can measure any dimension or area that is displayed on the historical postcards, follows after the digitization of images. We can identify areas of gardens, parks, roads lengths, the width of rivers, length of bridges, building

dimensions, heights of historical greenery, length of agrarian terraces on the slopes, the area of the terraced fields, positive or negative changes in volume and so on. Computer modeling may be very time to consume but can provide a large amount of new credible historical data.

Two examples of historical postcards (photographs) editing and digitization in a computer environment and the creation of outputs in a 2D form (meandering and modifications of the watercourse) and 3D output format of relief and mountainous objects modeling are presented below.

3. RESULTS

3. 1 Reconstruction of the river Hron river bed as the major axis of historical landscape in the geographic territory of Brusno – Lopejská Basin using 2D digital outputs

The reconstruction of the natural riverbed the river Hron was carried out upon systematic archive research of documents, and the subsequent analysis of historical maps and historical photographs (Figure 1, 2, 3). The information obtained has been verified during field research. The research results have been visualized using computer technology and modeling. The scale was obtained from the existing maps. The result is a comparison image with two overlaying layers showing the current riverbed of the river Hron in the form of the underlying Google Earth satellite image with a secondary embedded original riverbed of the Hron river bed before modifications. The accurate georeferencing of the original riverbed comes from the map of the III. Military mapping from 1879, which enabled us to obtain the exact dimensions of the riverbed width in any section, the length of the bridge, dimensions of the river islands, river bends and meanders, the length of riverside vegetation, etc. (Figure 4)

New information about Hron river bed in the second half of the 19th century (in 1879), which cannot be obtained from other archives, have been acquired. When entering the current cadastral area of Brusno at the mouth of the Bukovský stream, the width of its natural riverbed was approximately 42 m. The width of the stream at the location of the wooden bridge was approximately 38 m. Two river islands could be initially found in the watercourse of the river below the wooden bridge. The smaller one was 72 m long and 45 m wide, and the larger one was 170 m long and 52 m wide. Both islands were covered with successional scrub vegetation. The riverbed had the biggest width below the larger island that reached up to 70 m. Under this island, on the right side, was the new “Ondrejské” raft haven. Further, the river Hron flowed in the space of the today's Okružná Street, part of which is built on a filled up riverbed of Hron. The river created a big bend with a radius of about 275 meters in the location under the "Rock" and then rotated in a western and north-western direction creating several volatile river channels and gravel alluvial benches – Sihoť islands. Hron had a width of approximately 45 m under “Kráľovná,” where it left the cadastral area. In 1938, the original riverbed of the river Hron in the village was regulated and partly transferred to the newly built riverbed. Its flow was straightened and shortened, while the original riverbed had been gradually filled with sediments. The destruction of the original riverbed is visualized on historic photographs from the early 50's and the early 60's of the 20th century.

Figure 1. The original river bed of the river Hron on a historical postcard from around 1900. Existing church building helps determine the scale. We have identified the point where the image was made (it is not possible to make the same photo nowadays because the entire slope is overgrown by mature forest. We deduced that the present slope of the Domlyn hill was a clear-cutting, respectively, had been overgrown only by a very young forest at the turn of the 19th and the 20th century).

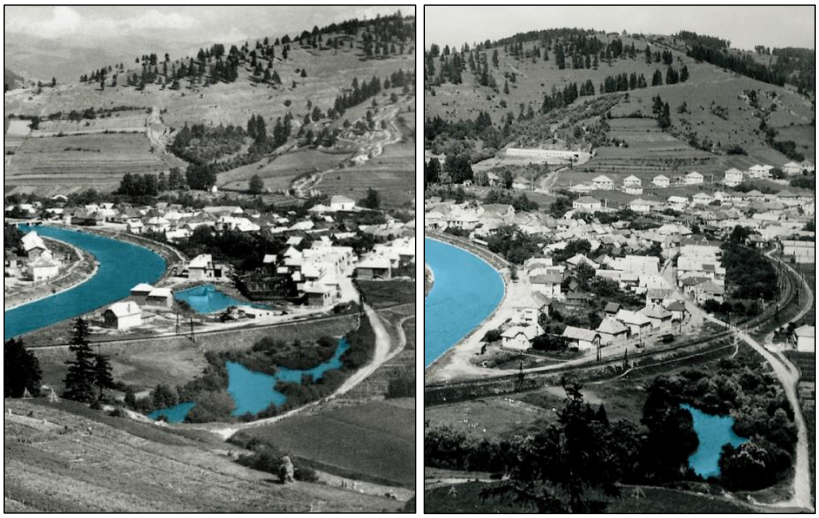

Figure 2, 3. Visualization of the river Hron transformations using existing historic photographs. Historic photographs come from the early 50's of the 20th century (left figure) and the early 60's of the 20th century (right figure).

Figure 4. Visual comparison of two layers: a natural riverbed (from the map of the 3rd military mapping from 1879) with it's modified and a partly newly built riverbed by an orthophoto layer by Google Earth free map

3. 2 The 3D digital model generated from historical postcard an example of the clay pit at Opatová, current local part of Lučenec

We have worked with photo-postcard from the Czechoslovak Republic period, which is dated by the postmark from 28 May 1935 (Figure 5). The scale of the postcard was obtained during the field survey, when the basic dimensions of the existing Prónay mansion building, which dominates the top of the postcard, had been measured using a laser. The mansion was built in 1856. Architecturally it is a block building located on the flat terrace, which is in the middle rizalit opened by pillarloggia. The mansion exists even today, but it is heavily devastated.

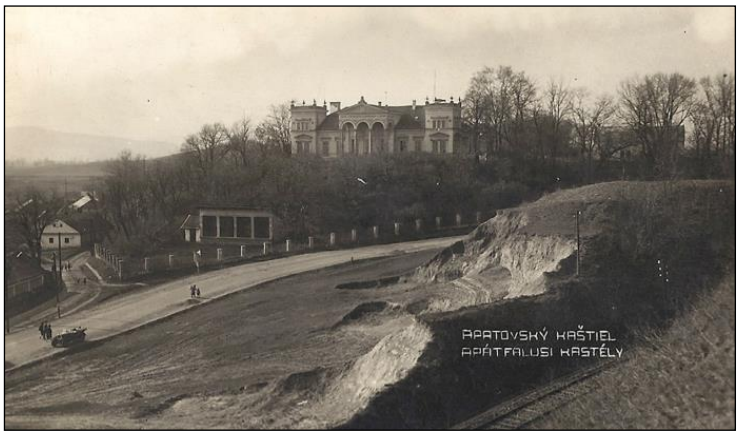

Figure 5. Clay pit in Opatová near Lučenec on a historical postcard from 1935

The postcard shows the landscape in the surroundings of the mansion, where the foreground is dominated by the clay pit wall, which exists no longer nowadays. On the right side of the postcard are a road and rail notch. After identifying the location of the original focal point and deriving of the projections of individual dimensions based on the known dimensions of the mansion on the postcard, a digital model of the clay pit was created together with the calculation of its approximate dimensions. In the mid 30's of the 20th century, the clay pit had three mining notches along the longer axis oriented in an NNW – SSE direction with an overall length of 140

m and a width of 35 m. The farthest mining pit had an approximately circular diameter with a radius of 10 m. The central mining pit (the largest one) had a radius of 16 m, and the nearest pit which was limited by the extension of the railway line had the shape of an ellipse with the longer axis a = 30 m and the shorter axis b = 16 m. The depth of the remote mining excavations was approximately 9 to 10 m; the nearest one had the depth of 6 m only. The total area of the quarry was approximately 4930 m^2, which is approximately 0.49 hectares.

Next, it is possible to insert various other geographical features into the 3D model of the landscape near the clay pit that can bring us a lot of new information about the transformed anthropogenic landscape in the 30's of the 20th century. The model can be further supplemented by point, line and surface elements and objects, so that it resembles the composition from the old postcards as close as possible.

In addition to the primary directly visible and measurable parameters of the clay pit obtained by visual modeling and composition, it is possible to derive secondary parameters, invisible on the postcard, from the digital model. The basic morphometric characteristics of relief (Figure 6) are often considered in the geographic research, including hypsometric analysis (Figure 7), dynamic vector (the tendency of surface flow formation) (Figure 8), slope analysis (Figure 9), analysis of slope orientation (Figure 10), etc.

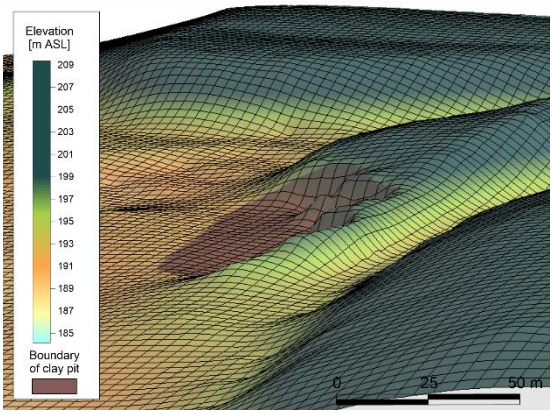

Figure 6. Digital model of the clay pit in Opatová near Lučenec (reconstruction of the 1935 state)

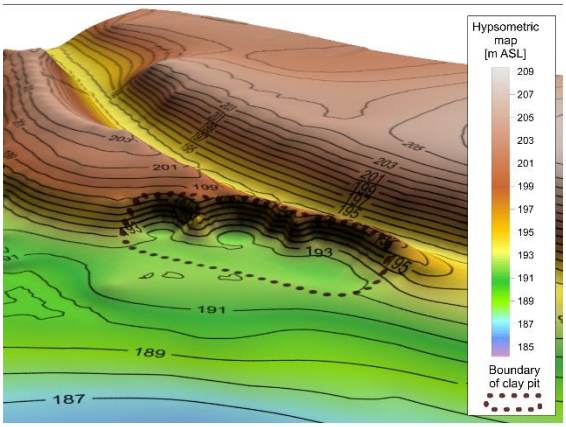

Figure 7. A 3D model of hypsometric degrees

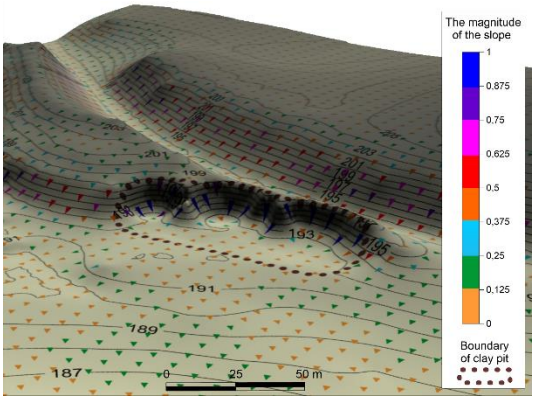

Figure 8. A 3D shaded relief model with gradient vectors

Much other information can be obtained only by transferring to the GIS environment and the use of its analytical tools. Information acquired in the form of map outputs help us to understand the dynamics of natural changes of relief, or the rate of their tendency to the selected risk factors, such as the formation of rainwater ridges, gullies, and ravines, landslides, erosion and soil losses.

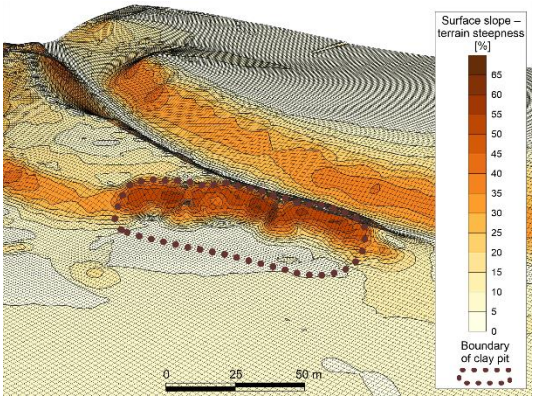

Figure 9. A 3D model of slope angles

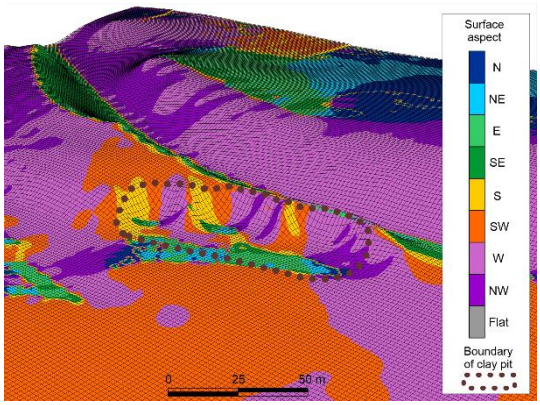

Figure 10. A 3D model of slope orientation

The information mentioned above may also reveal the negative effects of human activities. The information helps to reduce the natural landscape's ability to eliminate the negative consequences of anthropogenic impacts (modeling of pollution spreading, natural filtering in the riverside area, discovering of hidden illegal landfills and minimizing their impact on the

quality of the environment...). By comparison and mutual subtracting of the modeled relief – using old postcards or historical photographs, or old maps, before the waste disposal and exact terrain measurements – terrestrial or by photogrammetry after the disposal of waste, an approximate volume of the stored waste and a more accurate estimation of the necessity of landfill remediation and its actual cost can be provided.

4. CONCLUSIONS

The results of landscape analysis in geographical research based upon the processing of historic postcards and photographs find their application in the educational process as well. Their digitally processed and space-viewable form, often in a 2D or a 3D projection allows us to better understand the spatial relations in addition to the presentation of the historic landscapes, historic buildings, architecture and ethnology itself. Significant support of the imagination and spatial orientation (Čižmárová and Škodová, 2016), obtained by the form of the 3D landscape view, often accompanied with possibilities to interactively preview the selected optional composition (rotate, zoom in, zoom out, overflight...) has to be mentioned.

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