6 MULTIMEDIA ELEMENTS

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6.1 INTRODUCTION

Multimedia have become a characteristic part since modern information technologies have come. They consist of the interaction of various types of computer-based media (Cartwright, 1999). Generally, multimedia includes texts, pictures, photographs, animations, maps, charts, graphics, sound, video and other media. Digital media bring a new dimension to the expression of information that has so far failed to make paper maps difficult to convey.

Multimedia elements appear in the atlas in various forms, mostly as a map symbol, as well as a text, picture or photograph situated outside the map field, supplemented with sound, animation or video. All multimedia elements (ranging from simple textual links to virtual reality scenes) significantly improve the information content of a map and make the transfer of information towards the user more efficient. Multimedia maps, maps with an essential role of multimediality, are more attractive, more likely to capture the user's attention and maintain it for a longer period of time. Using multimedia elements to underline the map's content makes it easier to read and understand information on the map. Multimedia can transform an atlas into a powerful interface for other data (other maps, texts, databases, websites, etc.). A special type of multimedia maps is the concept of "story maps". It combines different multimedia elements with the aim to describe a spatial topic by the more attractive way.

One of the biggest assets of multimedia elements in cartography is their "aesthetic value". Nevertheless, the aim and purpose of the map must always be respected and multimedia elements must always remain appropriate, in terms of their number and design, so that the map and the whole atlas are easy and pleasant to read.

Multimedia elements play several roles in an atlas:
- higher graphical content in a map,
- higher information value of a map,
- simpler and quicker transfer of information from a map,
- higher attractiveness,
- capturing users' attention,
- emphasis on selected content,
- more intensive use of a map,
- interface for further information.

These are the main multimedia elements:
- text,
- pictures,
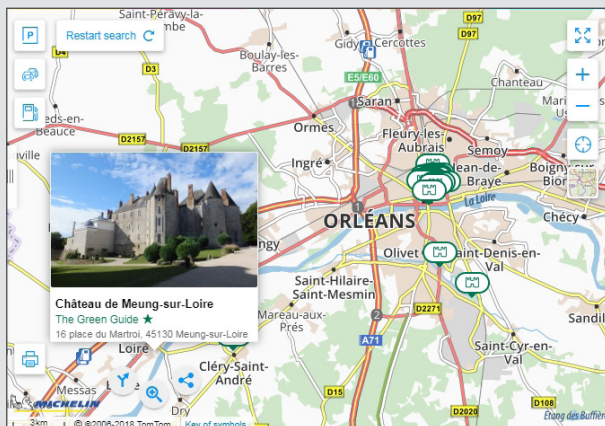- sound,
- animations,
- video,
- virtual reality.

6.2 TEXT

Although the text is not typical multimedia, it is one of the most frequently used elements in digital atlases. Text can be used to describe various situations in a map, a complex graph or a diagram. It can specify details (that could easily be missed by the user) and basic spatial arrangement of the represented phenomena that are challenging to interpret.

Text mostly consists of a hyperlink leading to a

FIGURE 6-1:

TEXT PROVIDES DESCRIPTIONS AND LINKS TO FURTHER INFORMATION

FIGURE 6-2:

PHOTOGRAPHS AS A MULTIMEDIA ELEMENT

map or a specific map symbol, a page in an atlas, a table, graph or picture, a video or sound recording, etc. Multimedia character of text can also be used for descriptions in the map.

It is not suitable to overuse text in atlases because it can make readers lose their concentration. It is therefore recommended to use short and simple textual information. Sentences should be short and to the point and a text segment should not be divided into several blocks placed in different parts of the map. Often, it is more suitable to use text in the form of lists or overviews.

Differing colour makes it clear that a text is a multimedia text. The colour is selected with respect to the colour of the background so that the text is easily distinguishable and readable. The reader's attention can be captured by repeated colour change (flashing text). Font size, type, style, decoration (underline, shadow, halo), transformations (rotation, effects, animations, transparency) and spacing is chosen according to cartographical rules.

Due to the fact that a multimedia atlas can be displayed by a variety of devices (desktop monitor, laptop, tablet, smartphone, etc.) with different specifications (screen size) and technology used (LCD, LED, OLED, TFT) there are no generally applicable recommendations that would ensure that the text in maps will display correctly in all cases.

6.3 PICTURES

Pictures are likely the most widely used multimedia element in atlases. They emphasise and specify details in the map or illustrate particular phenomena. Pictures make interpretation of the information in an atlas faster and easier than textual elements, thus speeding up the process of transfer of information from a map.

Pictures include photographs, drawings, schemes, diagrams and graphs. Multimedia pictures can have the form of a stand-alone map symbol or an advanced layout element. Both can serve as a link to other multimedia sources.

Photographs, both black and white and colour, serves as a strong communication tool. They stand closest to reality and significantly increase the at-

las attractiveness. Panoramic (360°) photographs are also used. Previews, i.e. smaller photos of unified graphics (dimension, size, caption) provide a link to photographs of higher resolution or further information about the locations.

Drawings and *symbols* are usually less realistic than photographs but they can serve as an effective supplement to text or its substitutes. Generally, any drawing or symbol can be used. Apart from conventional cartographic symbols, many specific pictures can be applied, e.g. widely known logos and icons.

Diagrams and *graphs* are used in the case it is not possible to provide information in the form of a text or picture, e.g. figures. They are suitable to

compare statistical values or to follow trends or make correlations. The multimedia nature of graphs is often supplemented with interactivity - when moving cursor over the graph's pie, line or column section the appropriate statistical data or additional information appears. Graphs often make use of autoscroll.

The format in which a picture is stored (raster or vector) denotes its basic parameter. Quality of raster pictures makes its limitations; the more you zoom in, the worse quality. On the contrary, zooming vector pictures keep quality. Vector formats (e.g. SVG, JSON, PDF, EPS, CDR, AI) also offers the advantage of low data volume and the same quality during zooming in. Raster formats (e.g. JPG, TIFF, WEBP, BMP, PNG and GIF) make it possible to show more complex originals (photographs).

Picture quality depends on its size (height x width, usually in pixels), image resolution (number of pixels per inch) and colour depth. Minimum resolution to be displayed on a PC screen is 72 dpi or 150 dpi. The resolution 300 dpi and higher is recommended for printing. Colour depth, which specifies the range of colours per pixel, influences the number of colours. It is recommended to use 24bit. Apple introduced a Retina display which provides a screen with higher pixel density – the user is not able to recognize pixels at viewing distance.

Symbol size depends on the level of detail in the picture and the readers' ability to discern and interpret the symbols. Symbol animation often appears, usually based on a change in shape, size, transparency, fly-effects, transition, rotation, colouring and shading. The user finds these effects attractive and if they are used within certain limits they have a positive impact on the legibility of the map.

6.4 SOUND

Sound (speech, music, ambient sound effects) is an effective means to present an important part of the information or to induce emotions or capture the user's attention. When combined with other multimedia elements sound transforms the map into an enhanced tool to present spatial information in an unusual and interactive way. Sound creates a positive atmosphere that leads to optimum perception. However, there is only a thin line between the right volume and sound choice to induce positive perception and an unpleasant and disturbing sound.

Short sound tracks are used to *capture* the user's

attention and make them focused on the map, animation or the selected element. They are no longer than a few seconds.

Background sound (often music or ambient sound) creates a *pleasant atmosphere* for map perception. Positive perception of visually transmitted information can also be enhanced by sound effects that have no relation to the theme of the map.

Sound as a multimedia element expresses *sound attributes* of the phenomena. Sound effects that are activated when selecting a symbol or moving

FIGURE 6-3:

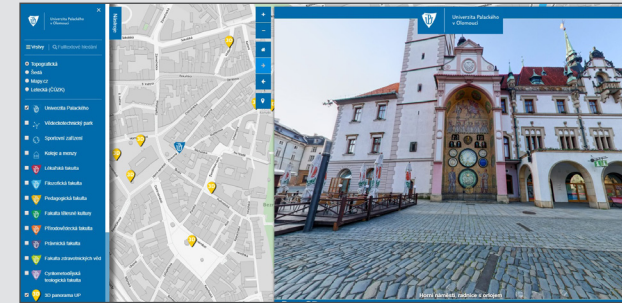360° PANORAMA PHOTOGRAPH PROVIDES HIGHER INTERACTIVITY (HTTP://MAPY.UPOL.CZ/)

FIGURE 6-4:

STREETVIEW BY GOOGLE MAPS COMBINES 360° PANORAMA PHOTOGRAPHS WITH AUGMENTED REALITY

FIGURE 6-5:

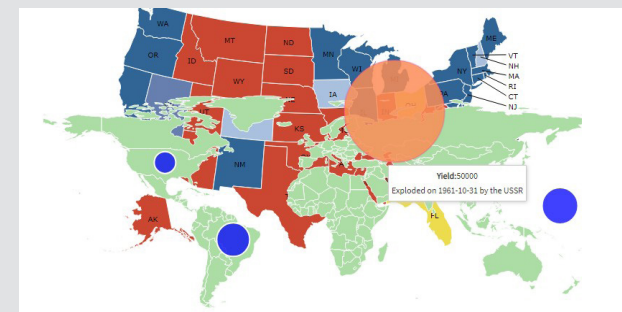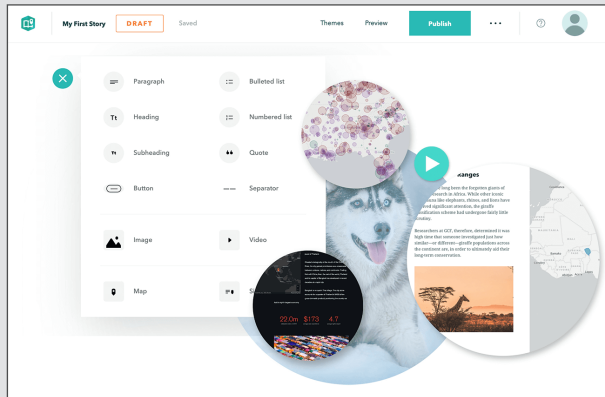VISUSALISATION OF ATTRIBUTE DATA IN A GRAPH (D3.JS)

FIGURE 6-6:

ATLASES USUALLY COMBINE VARIOUS IMAGE ELEMENTS
(GRAPH, PHOTOGRAPH)

Sounds play the following role:
- attract attention,
- induce a pleasant atmosphere,
- represent sound attributes,
- support map navigation and orientation.

Sound types:
- music, melody,
- speech,
- ambient sound effects (e.g. noise, hum),
- specific sounds (e.g. bell, blast).

the cursor over can include applause (for theatres), fan cheering (for stadiums), a plane taking off (for airports), ocean wave splash (for beaches) or crowd noise (for marketplaces). Greetings in dialects or national anthems when moving the cursor over the European regions is very popular.

The sound might express quantitative attributes, e.g. water level in hydrological maps by water gurgling with a different intensity or earthquake magnitude by a more or less intensive volcano eruption din. In such cases, sound provides redundant information but enhances the knowledge of the phenomena in the map and intensifies the visually transmitted information.

Sound can assist the reader to *navigate* when selecting an object in the map. A sound signal indicates the route toward the object (e.g. "move northwards") or indicates the object's location in a territory and provides easier *orienting* in the map (e.g. "Dresden, state of Germany, Land of Saxony, Elbe river").

Using sound in the above-mentioned cases must go hand in hand with enabling the user to set the volume via controls. The standard sound set-up must make the sound easy to hear but not too loud or disturbing so that a contrary, negative reaction is avoided. Low volume limit tends to be 15dB (background sound), high volume limit is usually 55 db (main topic related sound). The volume of longer sound tracks (background music) tends to be lower and the user is given the possibility to turn the volume up or down as preferred.

When using speech the sound quality must be high enough to make the speech clear and the words easily recognizable on various sound devices. It is because different speakers (especially in cheap laptops and netbooks) can significantly distort the audio output. The length of spoken information should not exceed several sentences (maximum of 45-60 seconds); otherwise, the reader's attention noticeably decreases. It is important to keep in mind that users perceive sound as a secondary source of information, only after visual perception.

Quality of sound, which influences whether it can or cannot be used for multimedia maps, is determined by sample rate and sample size. Sample rate defines the number of times per second when the sound sample is perceived. The frequency of 44.1kHz is sufficient for common applications. Sample size defines the number of values in one sample (8bit for 256 values, 24bit for 16 million). Both in the case of sample rate and sample size, we can say that the higher the values, the better the sound quality (and file size).

There are few ways to save audio data – Waveform Audio (digital audio), Musical Instrument Digital Interface (MIDI), MP3 or MP4. Waveform Audio saves sound in a data file as a digitalised sound track. The sound is composed of samples taken at regular intervals of the sample rate. Multimedia formats MP4 and MP3 become the most commonly used digital audio formats. MIDI is a standard exchange format originally developed for the music industry. It contains "encrypted" information needed to reproduce the sound (volume, length, frequency, etc.) but not the sound as such.

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