CO-184

SPACE AND TIME MAPPING OF HISTORICAL FACTS

GIGAND J.F.
Université Paris 7 Diderot - UFR GHSS, PARIS, FRANCE

INTRODUCTION

History has a fundamental importance within the culture of a society. As a synthesis of the past, it stands as the collective memory of the people. By carrying its values, it is an essential component of its identity.

Hence does the education system of a State give a particular care to the teaching of history and seeks the most appropriate means to convey it through the manuals and classes whose content is planned by the education programme.

The key facts of the history of a nation are highlighted by commemorations to maintain their memory and the honour of their characters.

Museums and historical monuments open to the public are also great vehicles for the dissemination of the cultural heritage. They are often built in a place meaningful for the related period of history, and use physical mediums to convey the memory, be they physical objects, media, or the building itself.

Those museums, school manuals and various multimedia aids are all tools which are used by a State's ministries of culture and education as well as numerous non-profit associations in order to improve citizens awareness for history.

Therefore, these organisations seek to improve those tools to let the cultural heritage be accessible as easily as possible to the people.

Internet, as an interactive medium increasingly used, is obviously studied for the service it can give to the mission of spreading historical knowledge. Indeed, it is commonly used to expose practical information for museums as well as virtual tour of their galleries and documents such as texts, photos and videos.

Numerous static and animated historical maps are available, free of charge or not. But interactive maps, although widely spread for many kinds of applications (topographic maps, satellite imagery, cadastres...), seem to stay outside of historical uses.

The project presented here is about a Web application meeting the need for representing periods of history while offering to the user the possibility to navigate through the maps, change the scale and filter the data to be shown.

Similar essays have been written already (Oliveira Barros, Santos Decanini, 2009). This one will focus on an interactive time line control and the making of automatic presentations. Other aspects of the visual interface, for instance the interactive navigation, are inspired from the classical approach from the most well-known web mapping applications (Nivala, Brewster, Sarjakoski, 2008).

This study is centred upon the user experience with a focus on the interactive features enabling the user to learn history. Aspects such as the data model and the technical architecture are omitted. These topics are covered by more specialized studies (Tyler Mitchell, 2005).

BASE MAP

According to the historical study conveyed by the map, the base map can be a topographic plan or satellite imagery. In either cases, it can be up-to-date with the present time, or older, if it represents the territory as it was at an earlier time.

This choice depends on what observation is sought. When considering history as itself, it is preferred to have as the base map a topographic plan where administrative units match the represented period of history. For example, a representation of the unfolding of World War II needs a base map showing the country borders and cities as they were on that time.

On another hand, in a try to link the present topography of the territory and administrative units with the historical facts which created or modified their shape, a present base map is preferably chosen, since the correlation of the two different times is illustrated by the overlaid representation of the past facts above the present map.

The choice can also target topographic plans from another time, anterior or posterior to the represented facts. A satellite imagery as for it is better suited to study the facts in their environmental context. Although imagery may only be available for quite a recent period (the first aerial photo was made in 1858), showing an imagery up-to-date with the historical period is more relevant.

Aerial photos matching the studied period of history, if available (for example, photos taken from planes during World War II), can overlay the base map, adding richness to the presented historical content. Similarly, old local plans can be added, through geo-localisation and possible needed warping to match the map projection. New perspectives can be looked up then, about shape vectorisation and automatic label recognition, for a huge potential of added interactivity (Rumsey, Williams, 2004).

MAPPING THE HISTORICAL FACTS

The vector layer containing the historical facts is overlaid above the base map. In its most basic version, it is a set of point markers corresponding to the historical events whose geographical extent is restricted enough with regard to the display map scale. This extent can hence be simplified as a point without harming the relevance of the representation.

A fact which happened on a geographical extent whose apparent size at the current scale exceeds half an inch, however, would be better represented as a polygon.

To represent a stream (for instance, the move of troops or population), an arrowed line can be used.

STYLE & INTERACTIVITY

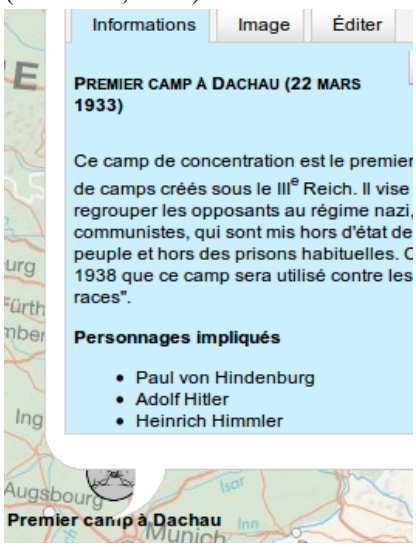
The style used to represent the geometries, be they points, polygons or lines, follows the rules of graphical semiology for the type of the related historical phenomenon, taking the application target into account (Bertin, 1967). For instance, a battle is typically represented with an irregular star.

From a data model point of view, the style applied to a geometry thus depends on the object attributes.

In order to help the visual comprehension, a text label is added to the representation of each geometry, permanently visible, to let the user quickly identify what historical event it is about.

At a given scale, if the representation of some geometries graphically overlap because of they spatial proximity, a visual clustering method should be used. This method is about aggregating the markers (icons, surfaces) through a another, bigger icon. Such an icon must be chosen so that the user can easily guess that it hides smaller geographic objects available at a closer scale. A click on the aggregation icon increases the scale until the hidden objects get visible.

Aside from aggregation, another approach to manage scale-related issues is the graphical generalisation (Molenaar, 1996).



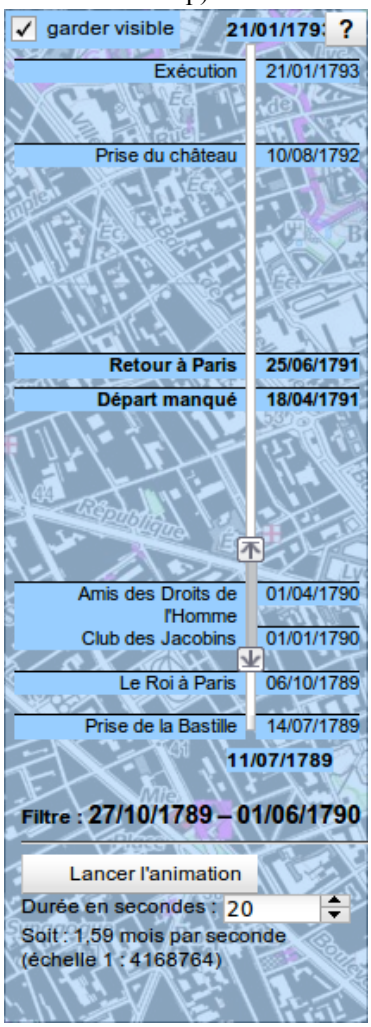
The graphical representations of geometries react to mouse hovering: as the mouse cursor goes above it, the marker (icon, line or polygon) is highlighted. For example, the size can be increased, or the colour can be changed. User experience is thus enhanced by the quick understanding that the marker is clickable.

The effect to mouse hovering is not only nice, it is useful. In addition to highlighting the marker, a small tip showing a summary of the hovered feature is displayed close to it, without overlapping. This summary would typically concatenate the title and date of the historical fact.

When the user clicks over the representation of a historical fact, a contextual bubble with detailed information pops up next to it. It concentrate as much information as possible about the fact. It would contain, for example, the complete description of what happened, along with photos, videos and links to external resources to learn more about the topic.

TIMELINE

On a corner of the map, or next to it, is displayed a timeline bar. It is an area containing a vertical segment proportionally representing time. Historical facts visible on the map (that is, present on the displayed extent of the map) are listed along the segment through their date and title label.



In other terms, every historical facts are represented in two different ways: on the map, through the chosen graphical semiology – which locate it in space –, and also on the timeline bar – which locate it in time –. This provides the user with the freedom to choose either way to read history: geography or chronology.

When a historical fact is hovered on the map, it is highlighted on the timeline bar (for example, the font gets bold) in addition to the marker highlighting as described previously. Reciprocally, hovering a fact on the timeline bar would instantly highlight its marker on the map.

Clicking on a historical fact through the timeline bar makes the contextual bubble with detailed information pop up as described previously, in the same way than if the fact's marker had been clicked on the map.

In general, the timeline bar has a fixed size. However, when the user moves the map, new historical facts appear while others, going out of the visible extent, disappear. The timeline bar needs to remain up-to-date with the visible facts, in a synchronised way. Since the height of the bar is fixed, its minimum and maximum dates adjust depending on the visible historical facts. This change of proportionality of time relatively to the height of the bar implies an adjustment of the visual position of every facts.

If the timeline bar uses too much space from the screen area, it can be initially minimised, and would switch automatically to its full size when hovered by the mouse. This way, the minimised version could only show the dates of the facts with no title label. The user should be free to keep the bar maximised permanently, with an appropriate mean such as a check box.

TIME FILTER

On the same timeline bar lie two cursor buttons which are initially positioned on the minimum and maximum date, respectively. The user is free to move these buttons, that define the minimum and maximum dates for the time filter.

Then, historical facts whose date is anterior to the minimum date of the filter, or posterior to its maximum date, are hidden from the map. According to the chosen design, instead of making them invisible, the geographical representation of these facts can change to another marker, or become half-transparent.

Instead of applying just a different style for filtered facts, a style property such as the opacity or the size can evolve proportionally to the minimum gap between the date of the respective fact, and the minimum or maximum date of the filter.

TIME ANIMATION

A module for animating the time can be joined to the timeline bar. With it, the user can define a restricted maximum date for the time filter, close enough to the minimum date, and define the duration of the animation.

By clicking on a button, the user triggers the start: the minimum and maximum dates of the filter evolve linearly for the duration of the animation, until the maximum date of the filter reaches the maximum date of all facts present on the map visible extent.

The automatic appearing and disappearing of each historical fact the map, respectively, allows the user to see the selected historical period unfold virtually above the base map.

AUTOMATIC PRESENTATIONS

To leverage the functionalities detailed so far, a module is added to let the user compose automatic presentations. These presentations are made of sequences of basic actions such as “move the map to such and such a location”, “change the map scale”, “change the time filter for such and such limits”, “display such and such text”, “pause for such and such seconds”.

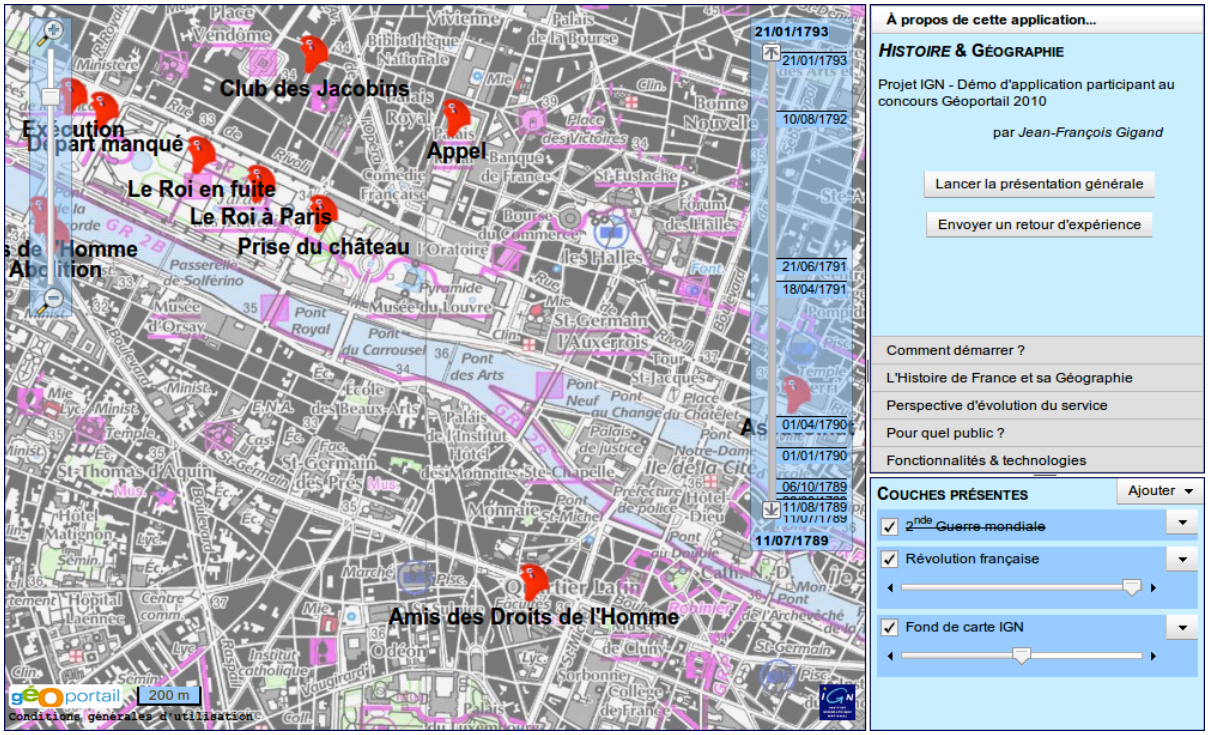
Through an intuitive interface, the user defines the actions and organises them in a given order. Then, the presentation can be run: actions get executed in order. Some actions yield the display of text, others require a manual click to continue.

This way, the user sees a long automatic animation of the related historical period, with a high pedagogic value since it is animated through map moves, scale changes, time changes, all extended with texts explaining the events taking place.

It is quite a live presentation of a piece of history. This kind of presentation are typically built by users for other users, for a teaching purpose, for instance.

PROOF OF CONCEPT

The concepts presented in this paper are illustrated through an application named “Carthistoire”, which is freely available at: http://icc2011.histoire.cartapatate.net/.



This application was submitted to the "concours Géoportail 2010", a competition of web mapping applications organised by the French National Geographical Institute (IGN). To this occasion, it won the second award of the "Tourism & Culture" category [http://www.ign.fr/partage/api/concours2010/index.html].

CONCLUSION

Within the sphere of education, such an application allows history teachers to build maps out of the historical knowledge they mean to teach. Using the tool, the students are free to visualise the content while interacting with the maps and its scale, in both space and time dimensions.

The complete set of historical facts represented on the map, containing detailed information and multimedia resources, is a very pedagogical way to convey historical knowledge. Such an application would be particularly suited for primary, secondary and superior education (Petchenick, 1987, Castner, 1987).

As part of a thesis work, this tool can be used by the Ph.D. student to represent a scenario of history corresponding to the study.

With regard to culture and heritage, this kind of application is also well suited for museums needing to organise virtual visits through the section of history they present, letting them compose virtual presentations out of the digital version of their galleries.

The uses are numerous, in other spheres as well. The study exposed here focused on managing time the same way than space, and link both in an intuitive interface.

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