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## Web georeference of historical maps

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### *Summary*

The creation of an application to perform the geo-referencing of a digital image file of a historical map has proved that it can help the study and comparative analysis of those important cultural and cartographic heritage artefacts. Also the possibility to use a free tool for the manipulation and geo processing of large image files will intensify the use of geo-referencing on the historical maps.

### Introduction

The existence of Google Earth and the corresponding site [maps.google.com](http://maps.google.com) has set very high standards for all the web applications and websites dealing with high resolution/high accuracy geographical feature content. It is unlikely to be created either by individual developers or developer groups another major tool that could compete with the capabilities and inventiveness of Google Maps. Fortunate in the case of Google is the possibility of using the Maps through an API (Application Programmable Interface) that can be embedded in stand-alone but also in web applications. The programming environment of Flex SDK and the corresponding scripting language Actionscript v3.0 embedded in Adobe Flash CS3 has enabled the use of the geographic Google Maps library in Flash Applications. So, anyone who is aware of the ActionScript programming language and is able to exploit the excessive flow of geographic information through the Internet can take into advantage high speed Internet connections and create either complex or simple, but valuable, Web geo-referencing applications. However, significant disadvantage, that seems almost insurmountable, is the large digital images of historical maps that need georeference. The solution to this problem comes with the use of another standalone application+module linked with Adobe Flash CS3.

The environment of Adobe Flash for many years is a development platform for local and network applications. As such it has attracted many companies beyond Macromedia (initial creation company) and Adobe to create modules and libraries for the integration of many functions and mandates to further enrich the repertoire of commands and capabilities for the processing of mainly multimedia data (images, sounds etc). One such tool is the Zoomify of Zoomify Inc. enabling information fragmentation of a large image file into small segments/tiles. The combination of Adobe Flash platform with the libraries of Google Maps API and Zoomify is amazing and is the ultimate solution for:

- Fast geo-referencing of images of historical maps
- Quick view of vast imaging data via internet
- Integration of the high performance graphical and geometrical tools of Google maps.

### Programmable Environment of Adobe Flash

The Adobe Flash can work either in the form of a graphical environment and/or in the form of a programming (IDE) Object Oriented Environment using internal or external libraries of commands. The user of the platform is acting as a film director who is assigning specific roles to the cast by bringing them in the foreground or the background or by directed them to perform some certain operation according to a predefined scenario. The subjects-actors can also interact with the user and react with them in accordance to the scenario.

Items of the cast in the film/project can be as simple as lines, circles and graphical objects or interaction buttons that are able to perform more complex actions. These complex graphic items can be listoboxes, comboboxes, movie windows, images, hyperlinks, html formatted text, etc. The assignment of specific

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actions on any object can be applied to the project timeline by using graphical methods. E.g. a subject can appear for a few frames and move through time. The location of the object on the first frame and its displacement from the last will define its movement and the duration of every frame will define its velocity.

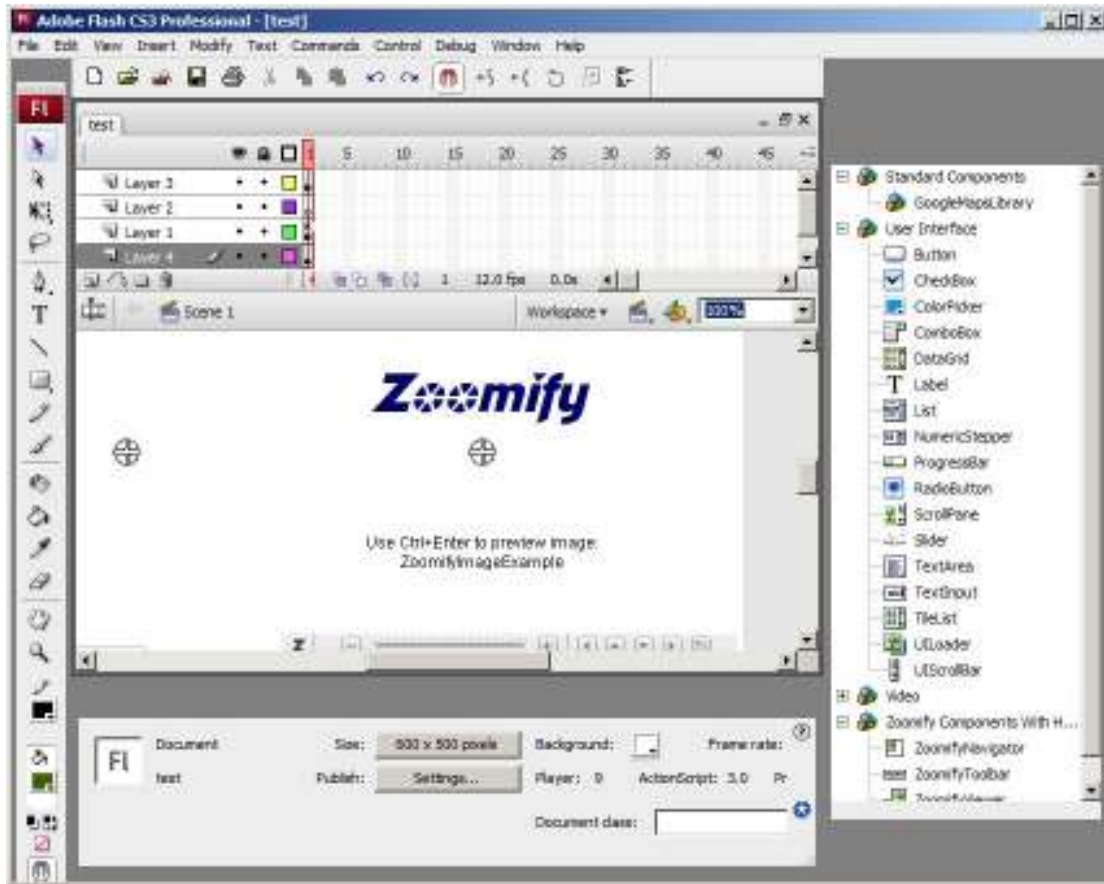


Fig. 1. The graphical interface of Adobe Flash CS3

The ActionScript programming environment is an IDE that uses a C-like programming language to accomplish actions on objects and perform basic data management and information processing. It is a fairly rich programming language that has all the necessary control structures to manipulate data such as numbers, text, tables and more complex such as movies, images, html text, etc.

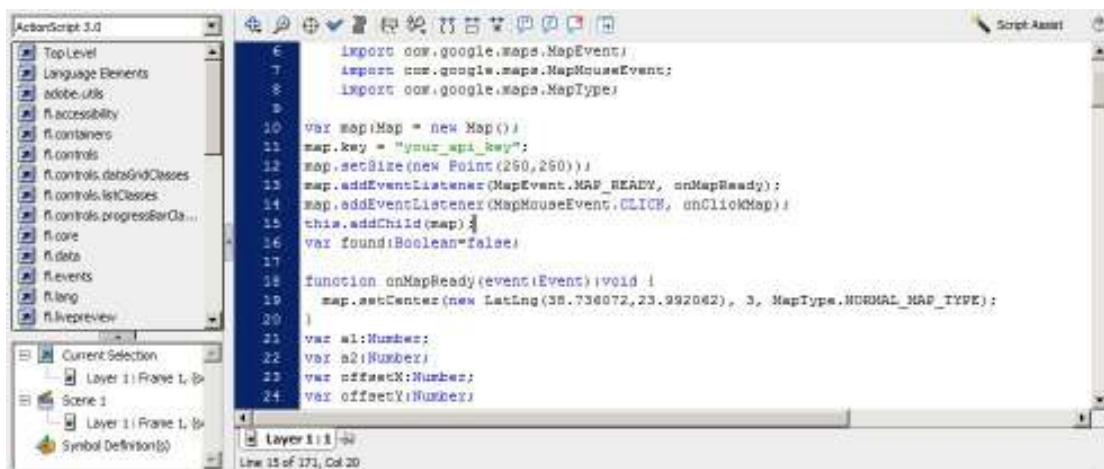


Fig 2. Actionscript IDE window.

More complex data structures to be processed by Actionscript commands can be found in Google maps and zoomify modules/libraries. The data structures are identified as components and are installed using special

setup programs or they can be manually placed in a special folder that holds all the Adobe Flash CS3 component libraries. The integration of components on the stage is as simple as the drag-and-drop operation of the mouse. The linking of the source data together and with the appropriate commands and functions accompanied by its corresponding module is relatively simple. The programming is very easy for an experienced user and is fairly easy for a new user, while there are many examples that can help the learning of the programming modules (<http://www.zoomify.com> and <http://code.google.com/apis/maps>).

### **The implementation of our application**

The concept of the application is relatively simple. The user through two windows (Guerra and Boutoura, 2001) is directed to make a correspondence of two common points between the modern map (coming from google maps) and the historical map (in tiles provided by zoomify) (Figure 3). The google map window looks similar to any HTML google maps-plugin region embedded on any Internet page providing web mapping service application and technology from Google Maps. The zoomified file, on the other hand, is created very easily using the application tool distributed freely by the manufacturing company. The application can operate either locally or through the Web. The user can give the link to the site and folder containing the zoomified image information (Figure 3). The folder holding the zoomified image of the historical map can be uploaded using FTP or any other web transfer application of large files, to a server that will project its pictorial information or it may be stored on a folder of the operating PC's local disk.

The geo-referencing using two common points can lead to the calculation of the transformation from the modern to the zoomified map. The conformal transformation consisting of four unknown parameters is used to switch from the modern to the old map (Figure 3) and is also used to calculate the geographical coordinates of any point on the zoomified image. Through the geo-referencing, similarities of the old map to the modern one can be recognized not only in planimetry but also on other thematic information and geographic content (relief, and building activity). The most important is the use of the geo-referencing tool through the Internet allowing people and scholars to perform and exchange experiences and knowledge from georeferenced historical maps.

### **Functionality**

The geo-referencing can be an important tool to help the study of historical maps. The most basic and simplest action is to compare the location of points of modern times with the historical map and the implementation of measurements especially on those maps lacking scale and precise geocoding information. Any movement of the central reference point of the modern map window leads to a relative movement of the central point on the historical zoomified map window. The operation is performing in high speed even in low bandwidth internet connections and with no loss of the dense pictorial information of the historical map thanks to the use of zoomify application and products.

It is even possible to create virtual navigation on the historical map using the guidance tools of Google Maps. The directions can use toponyms, addresses and other keywords applicable on Google Maps. This feature is not yet implemented but it is within the future research aims. The tool will be able to guide and visualize the navigation path on the historical map and also to record the path in a text file as waypoints.

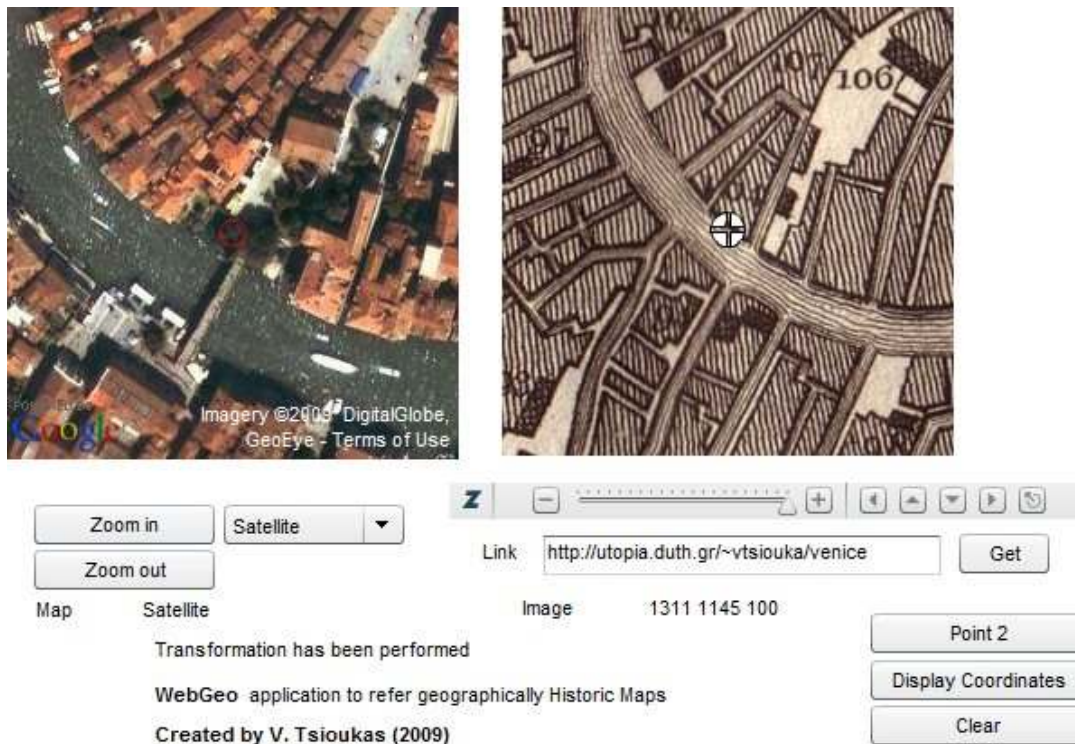


Fig. 3. Comparison and transformation of a location from the modern map on the historic one.

### Conclusion

The implementation and use of geo-referencing that can easily be performed by anyone with only prerequisite simple Internet skills was the target of this research. Although the application is quite simple and seems to perform only basic image processing of historical maps, high-end algorithms that can navigate within large amounts of image and geographic information, support it.

The main advantage of the application is:

- The web enabled performance
- Its simplicity
- The freeware concept
- Its speed
- Its productivity when combined with Google Maps.

Its only drawback is the inability to provide a precise georeference on very old low accuracy historical maps due to the use of the conformal transformation. However, in all the cases the produced result will be able to provide a relatively good result.

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