A Journey to the Ancient Greek Myths

An Enhanced Educational Framework to Story-Telling with Geo-Visualization Capabilities

Emmanuel Stefanakis

Department of Geography, Harokopio University of Athens
70, El. Venizelou Ave, 17671 Kallithea – Athens, Greece
estef@hua.gr

Abstract. A prototype educational framework for modeling, analyzing and visualizing the Ancient Greek Myths has been developed. Special attention has been given to the spatio-temporal dimension of the events composing the myths, as well as to the corresponding geo-visualization issues. The Web Client Interface incorporates geographic mashups and makes the user capable to interact with the space and the places where the myths occurred. The paper presents the prototype architecture, the software packages and tools used, and the functionality of the Web Client Interface.

Keywords: Greek Mythology, Geo-visualization, Spatio-temporal Databases, Google Maps API, XML.

1 Introduction

This paper presents a prototype educational framework for modeling, analyzing and visualizing the Ancient Greek Mythology. The Greek Myths involve many heroes, characters and gods and consist of numerous parallel events. The events occur in the geographical space and, although the absolute time is missing, they are related to each other by temporal (topological) relations, inside a single myth or across myths. Additionally, apart from the myth descriptions, there is a series of multimedia items that accompany each myth, such as ancient statues and figurines, representations on the ancient vases and amphorae, as well as a series of modern paintings or poems.

In this project we attempt to model a set of Greek Myths as they are presented in the official school book compiled by the Pedagogical Institute of the Greek Ministry of Education [1]. The modeling takes into consideration the spatial, temporal and thematic peculiarities of the events comprising the myths as well as the educational requirements for the analysis and visualization of the myths content in the class.

An appropriate data repository has been set up to accommodate the myths content, while a Web Client Interface has been developed to serve the myths to the users. The Sections that follow present the data repository, the data processing and the Web Client Interface. Specifically, after introducing the motivation in Section 2, Section 3 briefly presents the software packages, languages and tools adopted to develop the prototype educational framework. Section 4 focuses on the modeling issues and the data repository. Section 5 presents the workflow towards the generation of the myths content served to the users and the Web Client Interface. Finally, Section 6 concludes the discussion by summarizing the contribution of the paper and presenting the directions for future developments.

2 Motivation

It is widely recognized that school pupils cannot easily perceive the geographical space. On the other hand, history school books are missing maps and other geovisualization content. As a consequence, it is quite hard for the pupils to locate historical events into space and recognize any geographical interactions and relations.

The prototype introduced in this paper aspires (in its current and future/revised versions) to help school pupils and other general users in getting a clear geo-spatial perception of the mythology events. This is accomplished by making use of the recent technological developments in geovisualization, web mapping and geographical mashups [2][3][4][5][6].

Additionally, it is believed that the same prototype can be easily customized to present other historical or religious content taught in the primary or secondary education levels. Notice that the development of the prototype has taken into consideration this opportunity.

Obviously, special attention needs to be given in the educational aspects of the prototype. Currently, there is a close interaction with experts in the primary education community, in order to meet the educational requirements and make this prototype a useful tool in the class in the near future. The main concerns are: (a) making the presentation of the myths attractive and pleasant to the pupils; (b) helping them recognize the geographical space, focusing on the physical geography and encouraging them interrelate the past with the present infrastructures; and (c) compiling attractive and educational quizzes and game scenarios to help pupils understand the myths and recognize their interactions and relations in space and time (in the “chorochronos”).

3 Software Systems, Languages and Tools

The proposed framework has been developed using merely Free and Open Source Software Systems and according to the specifications of the W3C Consortium, i.e., XML-based languages and tools. Specifically, PostgreSQL and PostGIS have been used in the role of the data reporitory; XML has been adopted as the basic format (language) for expressing the data extracted from the repository. XSL and Google Maps API have been used to transform the XML documents extracted from the data repository to appropriate HTML documents and Javascripts and served on the Web by the Web Client Interface. The following subsections provide a short description of the individual items.

3.1 PostgreSQL/PostGIS

PostgreSQL [7] is a powerful enterprise-level object-relational database server product and the backbone of data repositories for numerous applications and web services. PostGIS is a product developed by Refractions Research as a project in open source spatial database technology (GNU General Public License) that extends PostgreSQL (also free and open).

PostGIS [8] supports a superset of geographic objects defined by the "Simple Features" proposed by the Open Geospatial Consortium (OGC [9]). From version 0.9 on, PostGIS supports all the objects and functions specified in the OGC "Simple Features for SQL" specification. PostGIS (current version 1.3.3) extends the standard with support for 3DZ, 3DM and 4D coordinates.

Hence, PostGIS is more than a geographic data storage extension of PostgreSQL. It allows, through SQL statements, both the management and analysis (e.g., geographic overlays, spatial proximity queries) of geographic data, like a GIS system, in a server-side database solution.

3.2 eXtensible Markup Language

XML (eXtensible Markup Language [10]) is a widely accepted format for describing and exchanging data; developed and maintained by the World Wide Web Consortium (W3C [11]). XML can be seen as a standard to complement HTML (HyperText Markup Language [12]). HTML describes how data is presented on Web browsers. XML, on the other hand, describes the content (data) and ignore how this data will appear on a Web browser.

XML is a growing set of modules, which have been approved by W3C. Some of them adopted in this study are (many others exist and can be found at [11]):

- XML1.0: it is the specification that defines what "tags" and "attributes" are.
- CSS: it is the style sheet language (it is applicable to XML as it is to HTML)
- XSL: it is an advanced language for expressing style sheets.
- DTD, XSD (XML Schemas): they are specifications to precisely define the structure, content and semantics of XML documents.

Although XML has been designed to support the exchange of data through Web documents, it has many features of a database; and all surrounded technologies built to manage XML documents can be considered as parts of a Database Management System (DBMS) on the Web [13].

3.3 Google Maps API

Google Maps [14][2][4] is a Web map server (such as Mapquest or Yahoo!Maps) maintained by Google that provides high-resolution satellite imagery and aerial photography, international street-level datasets, and many map based services. Through the Google Maps API [15] the full Google Maps can be readily embedded on an external Web site for free. This API along with others and the Web 2.0 technologies lead to an expansion of the so called mapping mashups [4]. Mashup is a website or Web application that uses content from more than one source to create a completely new Web service.

The Google Maps API lets developers embed Google Maps in web pages with JavaScripts (i.e., the Google Maps code) and provides a number of utilities for manipulating maps and adding content to the map through a variety of services.

4 The Data Repository

The myths as presented in the school book have been processed and modeled into a set of interrelated sequences of events. The modeling takes into consideration the spatial, temporal and thematic peculiarities of the events comprising the myths as well as the educational requirements for the analysis and visualization of the myths content in the class.

Figure 1 presents the basic classes of the prototype in UML. The spatial dimension is compatible with the OGC proposal ("Simple Features" Proposal) [9]. As for the temporal dimension, the individual events are interrelated via a reflective association with temporal topological relationships [16].

As shown in the UML diagram (Figure 1a) a Myth (Myth) is organized into Sections (MythSection). The prototype maintains the structure of the content in the school book; i.e., the Myths and the Sections in the prototype are those of the book.

Each MythSection is composed of Events (Event). These Events have been discovered from the corresponding Sections of the school book. In other words, an attempt has been made to split the text in the book into a series of Events. This task was not always straightforward, provided that the book content is a free (not a formal) text. At the current version, the prototype accommodates the most important events of each book Section and focuses on these events with spatio-temporal descriptions.

Each Event involves several characters (Character); it is spatially described (OGC Geometry); and it is assigned a set of multimedia items (MultimediaEntity). Events are interrelated each other through temporal relations [16]. Figure 1b shows part of the Geometry class according to the OGC proposal [9].

5 The Web Client Interface

The data residing into the data repository need to be served to the users through the Web Client Interface, specifically developed for this reason. This has been accomplished through the workflow presented in Figure 2.

As shown in Figure 1, each Myth consists of Sections and each Section comprises a sequence of Events. All these items have been modeled and stored in the database and are served to the user through the appropriate frames of the Web Client Interface. As shown in Figure 2, two types of XML documents are exported from the data repository. The top XML document contains the thematic (non-spatial) information related to the Myth Events, while the bottom XML document contains the spatial information, i.e., the geographic places the event occurs as well as the temporal sequence of the events composing a Myth Section.

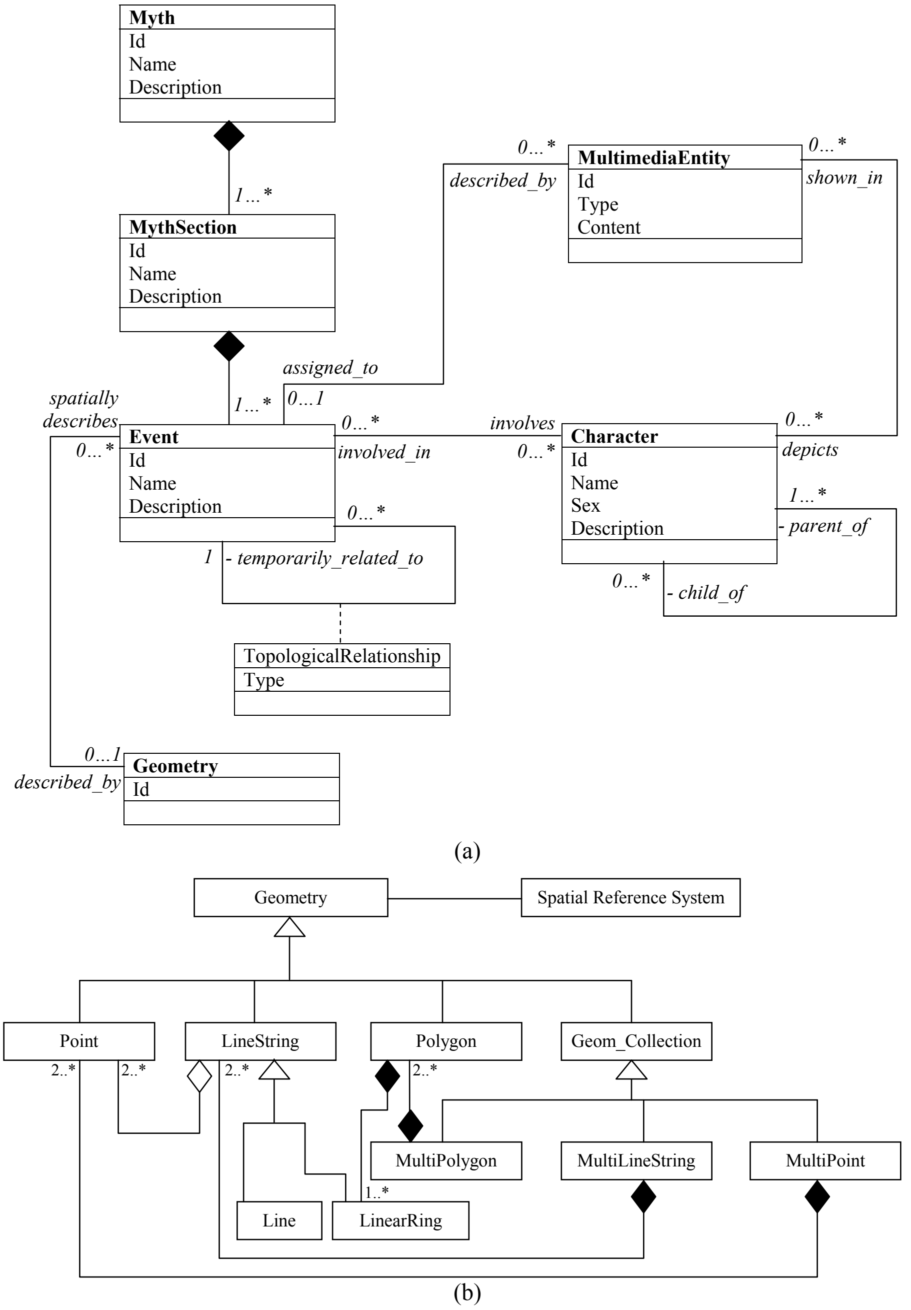

Fig. 1. (a) The basic classes of the prototype (UML diagram); (b) The Geometry class according to the OGC proposal (part of).

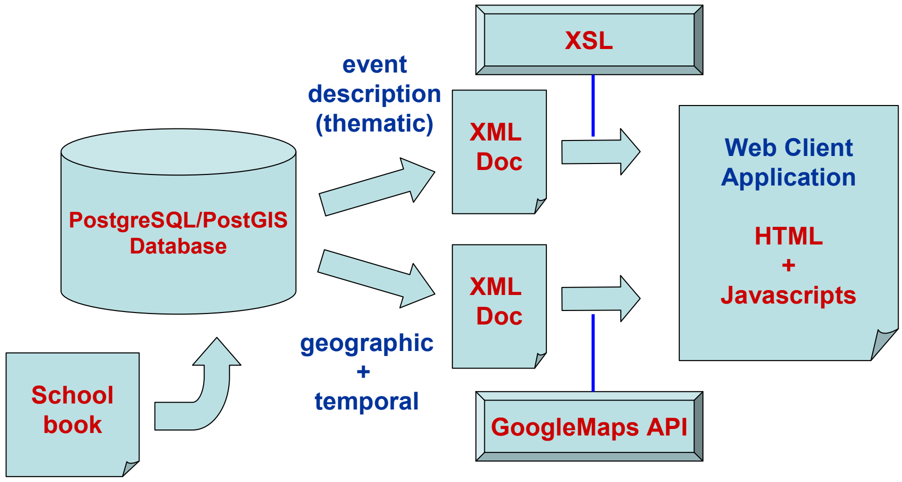

Fig. 2. The workflow towards the generation of the Web Client Interface.

Figures 3 and 4 show two samples XML documents (part of) as extracted by the data repository. The document in Figure 3 contains the thematic information. Specifically, it shows the Section "Birth of Hercules", which is part of the Myth "Hercules". Two Events are shown in the Figure. Each Event has three nested elements, i.e., <description>, <image> (file path), and <img_descr> (image description).

The document in Figure 4 contains the spatial and temporal information. Specifically, it spatially describes the places on earth, where the myth events take place through a series of markers. Each <marker> element has a list of attributes, i.e., the name, a description, the longitude and the latitude. The latter two are expressed in WGS'84 spatial reference system as they have been stored in the data repository. The coordinates have been derived from the GeoNames geographical database [17]. Additionally, this XML document describes the course occurred through a sequence of movements from marker to marker (<course> element).

The top (thematic) XML document is transformed through an XSL [18] transformation (see Figure 2) to an HTML frame to be included in the Web Client Interface. On the other hand, the bottom (spatio-temporal) XML document is transformed through another XSL transformation (see Figure 2) to an HTML with Google API Javascripts [15] to be also included in the Web Client Interface and provide the geo-visualization functionality to the Web Client Interface.

The Web Client Interface consists of a set of frames devoted to accommodate the appropriate content, according to the user's selections. Figure 5 presents the configuration of the frames and their content. Figure 6 presents an example screen of the Web Client Interface. In this example, the user has selected to see the following:

- Myth: Hercules
- Myth Section: The birth of Hercules

```xml
  <?xml version="1.0" encoding="UTF-8" ?>
- <section>
    <title>Η γέννηση του Ηρακλή.</title>
  - <event>
      <seq>1</seq>
      <description>Ο Αμφιτρύωνας και η Αλκμήνη, κόρη του βασιλιά των Μυκηνών, βρήκαν καταφύγιο
        στη Θήβα. Η Αλκμήνη γέννησε τον Ηρακλή, που ήταν γιος του Δία, και τον Ιφικλή.</description>
      <image>../images/math_1_50_img_64.jpg</image>
      <img_descr>Ο Ηρακλής - γιός του Δία</img_descr>
    </event>
  - <event>
      <seq>2</seq>
      <description>Ο Δίας έστειλε τον Ερμή να φέρει τον Ηρακλή στον Όλυμπο και να πιει το γάλα της
        Ήρας ώστε να γίνει αθάνατος.</description>
      <image>../images/math_1_50_img_59.jpg</image>
      <img_descr>Η δημιουργία του Γαλαξία</img_descr>
    </event>
  - <event>
```

Fig. 3. Description of the Events and images in XML.

```xml
- <H>
  - <H1>
    - <markers>
        <marker name="ΟΛΥΜΠΟΣ" descr="Το βουνό του Ολύμπου" lat="39.9883" lng="22.3479" type="H1" />
        <marker name="ΘΗΒΑ" descr="Η πόλη της Θήβας" lat="38.3158" lng="23.3196" type="H1" />
        <marker name="ΔΕΛΦΟΙ" descr="Το μαντείο των Δελφών" lat="38.4721" lng="22.4924" type="H1" />
        <marker name="ΜΥΚΗΝΕΣ" descr="Η πόλη των Μυκηνών" lat="37.7288" lng="22.7588" type="H1" />
      </markers>
    - <courses>
        <course suc="1" from="ΘΗΒΑ" to="ΟΛΥΜΠΟΣ" type="H1" />
        <course suc="2" from="ΟΛΥΜΠΟΣ" to="ΘΗΒΑ" type="H1" />
        <course suc="3" from="ΘΗΒΑ" to="ΔΕΛΦΟΙ" type="H1" />
        <course suc="4" from="ΔΕΛΦΟΙ" to="ΘΗΒΑ" type="H1" />
        <course suc="5" from="ΘΗΒΑ" to="ΜΥΚΗΝΕΣ" type="H1" />
      </courses>
    </H1>
```

Fig. 4. Description of the placemarks and movements (trips) in XML.

As a result the Myth Section Events frame shows details of the events composing the selected Section, while the Map Interface frame highlights on top of Google Maps (map type: Satellite) the places where the events took place, i.e., Thebes, Mycenae, Delphi and Olympus. Additionally, the courses of movements that Hercules made according to the events are drawn on the map (white lines). The user may interact with the map through a set of controls as shown in Figure 6 (map frame), such as zoom-in/out and pan, switch on/off the placemarks/paths/labels, etc. S/he may also make an icon (here the white little figure) move along the drawn paths and simulate the spatio-temporal movements as described in the corresponding myth section.

6 Discussion

The paper introduces a prototype educational framework for modeling, analyzing and visualizing the Ancient Greek Myths. It presents the prototype architecture, the software packages and tools used, and highlights the functionality of the Web Client Interface.

<table>
<tr><td colspan="3">Header Frame…</td></tr>
<tr><td rowspan="2">List of myths…
(the user selects here the Myth of interest)</td><td>Myth Sections…
(the user selects here the Section of interest)</td><td rowspan="2">Map Interface…
(the google map enriched with Myth Section details, i.e., placemarks and paths, is visualized here; the user may interact with the map content through a set of map controls)</td></tr>
<tr><td>Myth Section Events…
(the user reads here the events composing the selected Myth Section)</td></tr>
<tr><td colspan="3">Footer Frame…</td></tr>
</table>

Fig. 5. The Frames of the Web Client Interface and their content description.

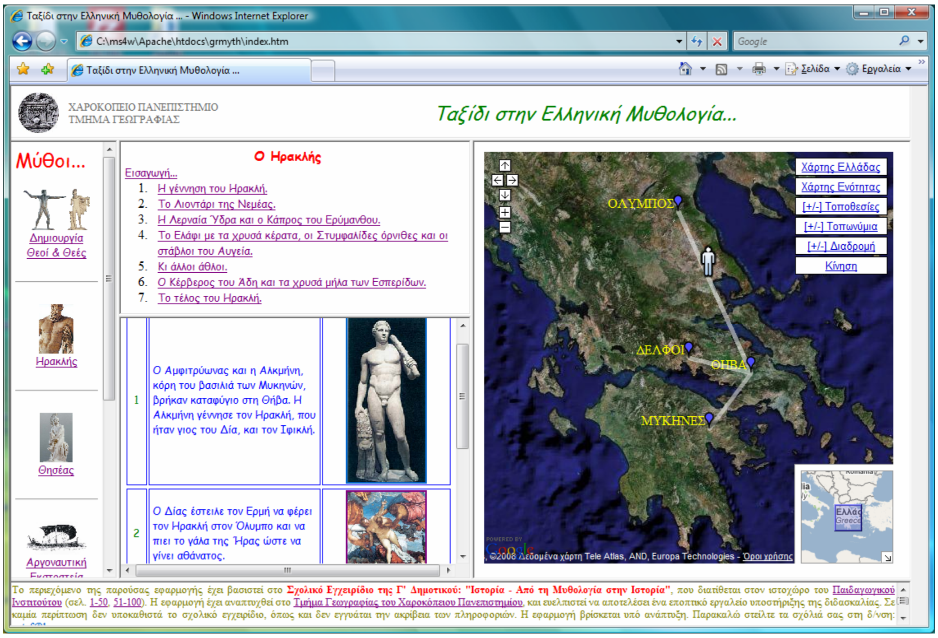

Fig. 6. An example screen of the web client application.

One question that the reader is expected to pose is: why google maps? The answer is rather simple and naïve: because they are available for free! Google Maps API is very handy. Developers may easily built up tools with geo-visualization capabilities. On the other hand, the users may locate the events into the contemporaneous earth map and see for instance that: Hercules on the way to Mycenae has passed near my house! Obviously, the prototype needs to incorporate as an optional background image a digital map of the Greek Mythology compiled for the application needs. This is one future extension.

Although the first reactions from various user communities, i.e., pupils, parents and teachers are positive; the interface must be elaborated and enriched as regards to its functionality [19].

Some extensions are: (a) the overlay of diagrams, 2-d and 3-D maquettes and plans of the archaeological places on top of Google Maps; (b) the enrichment of the content with other multimedia items, such as sound and videos; (c) the development of quizzes and game scenarios for pupils to both test and assist their understanding/knowledge; and (d) the translation of the content in other languages (e.g., English, German, Spanish, etc.).

By cooperating with experts in the primary education community, we aspire to meet the educational requirements and make this prototype a useful tool in the class in the near future. Additionally, one of our scopes in all phases of development is to make this prototype readily customizable to other application domains that involve spatio-temporal events in their scenario (e.g., historical, religious, etc.).

References

1. Hellenic Pedagogical Institute, http://pi-schools.gr/ [last visited August 1st, 2008]
2. Brown, M.C., 2006. Hacking GoogleMaps and GoogleEarth. Wiley.
3. Mitchell, T., 2005. Web Mapping. O'Reilly.
4. Young, M., 2008. Practical Google Maps Mashups with Google Mapplets, GeoRSS and KML. Wiley.
5. Andrienko, N., and Andrienko, G., 2005. Exploratory Analysis of Spatial and Temporal Data: A Systematic Approach. Springer.
6. Stefanakis, E., 2008. Web Services for Mapping. Tutorial. The 3rd International Conference on Internet and Web Applications and Services (ICIW 2008). Athens, Greece. Available at http://www.dbnet.ece.ntua.gr/~stefanak/WebServMap_Stefanakis.pdf [last visited August 2008]
7. PostgreSQL, http://www.postgresql.org/ [last visited August 1st, 2008]
8. PostGIS, http://postgis.refractions.net/ [last visited August 1st, 2008]
9. OGC, http://www.opengeospatial.org/ [last visited August 1st, 2008]
10. XML, http://www.w3.org/XML/ [last visited August 1st, 2008]
11. W3C, http://www.w3.org/ [last visited August 1st, 2008]
12. HTML, http://www.w3.org/html/ [last visited August 1st, 2008]
13. Abiteboul, S., Buneman, P., and Suciu, D., 2000. Data on the Web: From Relations to Semi-Structured Data and XML. Morgan-Kaufmann.
14. Google Maps, http://maps.google.com/ [last visited August 1st, 2008]
15. Google Maps API, http://code.google.com/apis/maps/ [last visited August 1st, 2008]
16. Allen, J.F., 1983. Maintaining knowledge about temporal intervals. Communications of the ACM. Vol. 26, pp. 832-843.
17. GeoNames, http://www.geonames.org/ [last visited August 1st, 2008]
18. XSL, http://www.w3.org/Style/XSL/ [last visited August 1st, 2008]
19. Stefanakis, E., 2008. Interactive Visualization and Analysis of the Ancient Greek Myths. GeoVisualization of Dynamics, Movement and Change Workshop. AGILE 2008 Conference, Girona, Spain, May 2008. http://geoanalytics.net/GeoVis08/ [last visited August 1st, 2008]