Storytelling, Spatial Standards and Cultural Heritage Management

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ABSTRACT

The paper presents the project "Non-linear Digital Storytelling for the Battleship Georgios Averof" that currently takes place under the integrated action program between the German Academic Exchange Service (DAAD) and the Greek State Scholarship Foundation (I.K.Y.). The methodology applied, the objectives that the research focuses on and the first outcomes of the project are described.

1. INTRODUCTION

The battleship "Georgios Averof" was a legendary warship of the Greek fleet during the first half of the 20th century with an active history in three wars (Balkan, World War I and II). Nowadays, "Georgios Averof" is a museum operated by the Greek Navy, and the world's only surviving heavily armored cruiser of the early 20th century.

The research project "Non-linear Digital Storytelling for the Battleship Georgios Averof" was launched in 2009 and is a collaboration of the Department of Geography at Harokopio University of Athens and the Informatik 5 at RWTH Aachen University. The project aims at the promotion and enrichment of the museum archives for cultural heritage management using storytelling technologies. A framework has already been developed by the former partner for the management of the museum archives in a past project entitled "Promotion and enrichment of the museum archives of the Battleship Georgios Averof". The main goal of the current project is to focus on the analytical functionality of that framework in order to (a) present the social, cultural and spatio-temporal history of the ship to students; (b) empower and share the historical knowledge for the battleship Georgios Averof; (c) explore its role in the Greek History; and (d) find new ways for the museum archives management and presentation.

Multimedia storytelling has been adopted since it is a successful method for knowledge management and sharing. Museum archives can be used as multimedia content on a certain topic forming a story that can be accessed, shared and even enriched by interested parties (communities of practice). The multimedia metadata outlined by the MPEG-7 (Moving Picture Experts Group–7) standard (Manjunath, 2002) can be combined with the spatial and non spatial metadata of the already developed system of the museum "Georgios Averof", setting an interesting research objective and a new framework for searching and retrieving information from museum archives.

The paper is organized in four main sections. The first section (Section 2.1) describes the system developed for the museum of the battleship. The second (Section 2.2) is about the main objectives of the current project while the third section (Section 2.3) stresses the reason for using storytelling technologies for the promotion of museum archives. Finally, the forth section (Section 2.4) sets the subjects that are studied, the methodology applied and the first outcomes of the project.

2. STORYTELLING FOR THE PROMOTION AND ENRICHMENT OF MUSEUM ARCHIVES WITHIN A SPATIAL CONTEXT

2.1 The project of the museum "Battleship Georgios Averof"

The research project "Promotion and enrichment of the museum archives of the Battleship Georgios Averof" was launched in spring 2007 in the Department of Geography at Harokopio University of Athens. During this project, the development of the following systems and tools, focusing in the spatio-temporal dimension of the history of the ship, was completed (Stefanakis & Kritikos, 2008):

- **An Image Database**
  The historical photographs of the museum archives (about 1000 in number) were scanned in high resolution and stored in digital files with appropriate metadata provided by the museum personnel while some have already been associated spatially and temporally. The PostgreSQL/PostGIS open source software package has been adopted for the implementation, provided that apart from the alphanumerical metadata (caption, theme, keywords, etc.), the photographs have spatio-temporal descriptions, i.e., the location and the date the photo has been taken.

- **A Web Photograph Gallery**
  The gallery presents the photographs on the Web in a slide show form, where the photograph captions are also visible.

- **A Spatial Database of the Ship Decks**
  The initial paper plans (dated in the first decade of the 20th century) of the shipbuilding company have been digitized, vectorized and stored in a spatial database implemented in ESRI ArcGIS software package. A separate shapefile has been generated for each deck, with polygonal features for all cabins, rooms and open-air spaces and the associated attribute tables have been populated with the corresponding equipment, machines or arms.

- **A Series of Virtual Visits**
  A series of virtual visits to the museum were generated by loading the content of the spatial database of the ship.

- **A Series of Web Mapping Applications**
  A pilot application to present the most important events of the battleship using mashups has been implemented in the Google Maps Application Programming Interface. Based on the records of the battleship diaries and maps of naval battles, a spatio-temporal database have been developed in PostgreSQL/PostGIS open source software package in order to efficiently support the spatiotemporal analysis of the history of the ship.

- **A Geographic Catalog Server**
  The server diffuses all the digital content on the Web, using widely accepted standards for services and protocols (such as those proposed by the International Organization for Standardization Technical Committee 211 - ISO/TC211 and the Open Geospatial Consortium - OGC), transforming the digital repository to a spatial data infrastructure. The software package adopted is the GeoNetwork Open Source Server. The appropriate metadata (in XML format under the specification of ISO19139) for the digital content (i.e., digital photographs, deck plans and battle plans) and the applications generated under this project are stored in the server.

2.2 Analytical functionality of the system

The next step in order to make the best use of the system components - described in Section 2.1 - resulting to a historical repository, is to focus on its analytical functionality. Our main objectives, regarding the three major aspects of the promotion, enrichment and historical analysis of the museum archives, are (*Figure 1*):

- **Presentation of the social and cultural aspect of the history of the ship**
  To visualize, based on photographs and personal descriptions (diaries of the crew), the everyday life at the ship from different points of view, at different time periods and for different aspects (social, cultural, religious etc).
- **Enhancement of the spatio-temporal history of the battleship**
  To link the various positions of the ship in space and time with appropriate material (maps, images, documents, events) and to establish the ability of users to pose queries on metadata items with thematic, spatial and temporal predicates.
- **Sharing of historical information and experiences**
  To share information for various historical events and learn from the real personal experiences of the sailors who participated in these historical events conveying the emotional aspect of their descriptions.
- **Empowerment of historical knowledge**
  To find new methods for analyzing and visualizing historical knowledge
- **Archives enrichment and management**
  - To gather scattered sources and materials related to the history of the ship
  - To organize and manage the diversity of multimedia archives regarding the format (photographs, documents, videos, etc), the time period, the location they refer to and their origin.
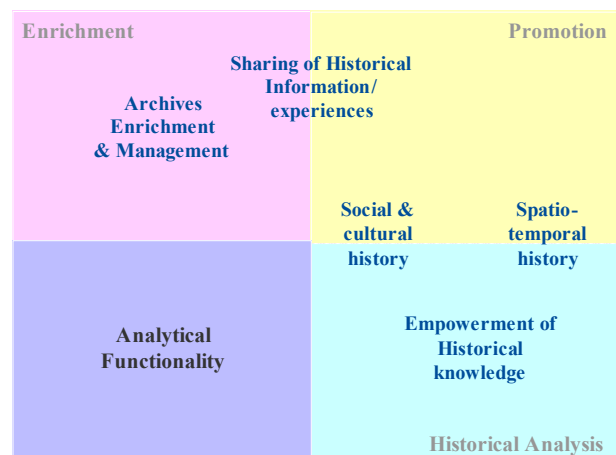

Figure 1: Objectives for the analytical functionality of the system components

2.3 Non-linear digital storytelling for the promotion and enrichment of museum archives

In order to answer the before mentioned needs (Section 2.2.), storytelling techniques are currently studied as a potential solution.

Digital storytelling combines narrative with digital content such as photos, streaming videos and recorded sounds and produces digital stories. Nonlinearity is introduced in order to tell more complex stories, since different points of view could affect the normal flow of a story or conflicts interests could alternate parts of a story having as a result, stories with non-linear characteristics (Klamma, 2009).

Multimedia storytelling can be a successful method for collaborative knowledge management for teams of common interest, combining powerful concepts like communities of practice and emergent metadata. Storytelling platforms are a kind of recommender systems to deliver proper multimedia content on a certain topic. The media can tell stories which involve personal experiences and emotions while storytelling is an effective and entertaining approach to pass and embed certain meaning and certain purposes to multimedia content (Klamma, 2009).

Furthermore, since a special focus is given to the spatio-temporal history of the ship, storytelling can be empowered by maps visualization. Telling a story requires detailed and thorough knowledge that emphasizes both the story and the geographical patterns within the data. The use of Geographical Information Systems (GIS) in storytelling can combine the ability of an information system to manipulate spatial and attribute information and the ability of a map to present this information in an understandable manner. Thus, while GIS is a technology concerned with structuring, integrating, visualizing and analyzing spatially referenced data, the map is the most readily accessible way of communicating the data held within the GIS and the results from any GIS analysis (Gregory, 2007).

Consequently, the integration of storytelling techniques, spatial information and GIS can be a method for the promotion and enrichment of the museum archives.

2.4 Methodology and current development

The objectives that arise and are currently studied are:

- **Mapping between multimedia and geographic information standards**
  The collaborative approach that this paper suggests integrates geographic and multimedia information in a single information model. Since each type of information conforms to different official standards (ISO/211 & OGC for the geographic information and MPEG-7 for the multimedia description), a way should be found for the mapping of these metadata profiles. Current research aims at integrating these in a comprehensive geographic hypermedia system for cultural heritage management. Various standards from different domains and various standards from one domain can represent data in a cooperative way through mappings among standards. An example of mapping between multimedia and geographic information is the "GML in JPEG 2000 for Geographic Imagery" (GMLJP2) specification of the Geography Markup Language (GML) of OGC. GMLJP2 represents multimedia data with maps as the content and supports the encoding of OGC coverages within JPEG 2000 data files. The specification defines how to use GML for geographic images, the packaging mechanisms for including GML and the specific GML application schemas. In turn, MPEG-7 standard includes Visual Description Schemes and Audio Description Schemes which are particularly interesting for geographic information systems since they provide descriptors for visual and audio media to describe spatiotemporal information respectively (Klamma, 2006).

- **Definition of the role of space and maps in the storytelling procedure**
  Space and maps are important in storytelling since they set the geographical context and convey any underlying spatial information of a story. If the story is about historical events it is necessary to visualize the historical regions that are reported in the story in a temporal geographical background. Therefore, there should be a way of visualizing the spatial relationship between the old regions and the modern ones on the maps in order to relate history with the world of today (Kauppinen, 2008). The integration of maps and storytelling, in result, can be a way to narrate and visualize history and to better understand the correlations or the reasons for various historical facts.

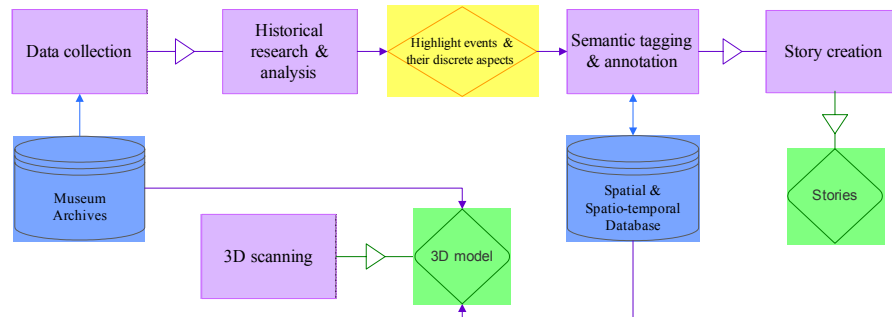The steps of the methodology applied are described as follows (*Figure 2*):

Figure 2: Steps of the methodology

- **Data collection**

  The appropriate material that refers to a specific event is selected from the museum archives. The material can include photographs from the image database, related videos, diaries of the crew members, plans of the ship of the spatial database etc. The event can be either a historical fact or a typical process of the daily life at the ship.

- **Historical research and analysis**

  The next step is the research and analysis of the event in order to:
  - deliver the background and the historical context
  - set the exact storyline
  - highlight the most crucial moments
  - clarify any ambiguities or fill any missing parts in the description of the event
  - form alternative / what if scenarios

- **Semantic tagging and annotation**

  The selected multimedia is semantically annotated with tags representing place, event, time or agent in the "New Media Viewer (NMV)" platform. The "NMV" is a community-oriented MPEG-7 multimedia tagging system which supports free text tagging, MPEG-7 standard based semantic tagging and community based tagging to enhance semantic multimedia search and retrieval (**Figure 3**). The metadata already assigned to the material will be used or enriched especially after the previous step of the historical research. The multimedia has also spatio-temporal descriptions, stored in the spatial and spatio-temporal databases (Section 2.1) that will be used in the visualization of the movement of the ship and history through time based on spatio-temporal operations.

- **Story creation**

  The next step is to create stories based on the selected multimedia in "YouTell" platform developed in Informatik 5 (Klamma, 2009). "YouTell" is a multimedia based non-linear digital storytelling system that contextualizes multimedia artifacts with regard to multimedia semantics and problems addressed by users. The stories are generated based on the Movement Oriented Design technique (Sharda, 2005). Currently, a story about Lemnos Island naval battle in 5th January 1913 (**Figure 4**) and several stories about the coal loading of the ship - emphasizing in different aspects of the process (**Figure 5**) - were created by the project community.

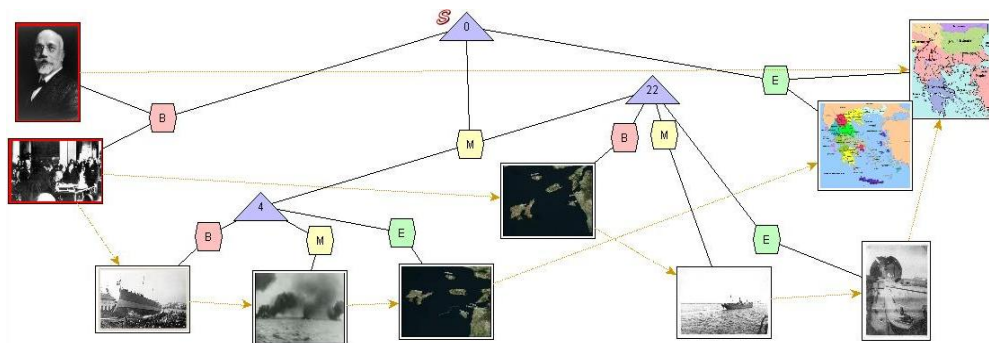*Figure 3:* Semantic tags of images in NMV platform

Figure 4: Tree view of the story of Lemnos Island naval battle. Every story has a beginning (B), can have several middles (M) and an end (E) according to each storyline (non-linearity). Mediums are attached to each of them.
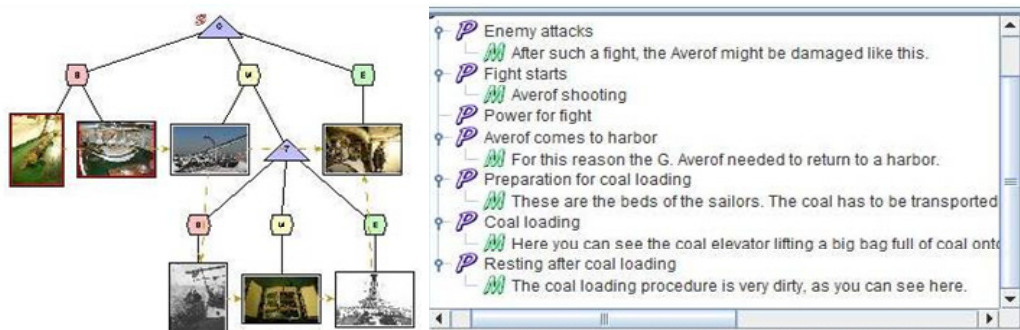
Figure 5: Tree view of the story and the problem of coal loading addressed. For each part of the problem-P, a medium-M is attached.

- **3D scanning of the ship**

  A 3D model of the ship is currently being developed based on 3D scanning technology (a first result in *Figure 6*). The 3D model gives a consistent presentation of the ship where multimedia will be allocated to the various parts of the ship. The spatial database of the decks of the ship will be combined with the image database so as to associate the images with their location both in space and time. Our future intention is to use the model to assist the generation of numerous virtual presentations of the daily life on the ship, a rather worthy tool for the historical research.
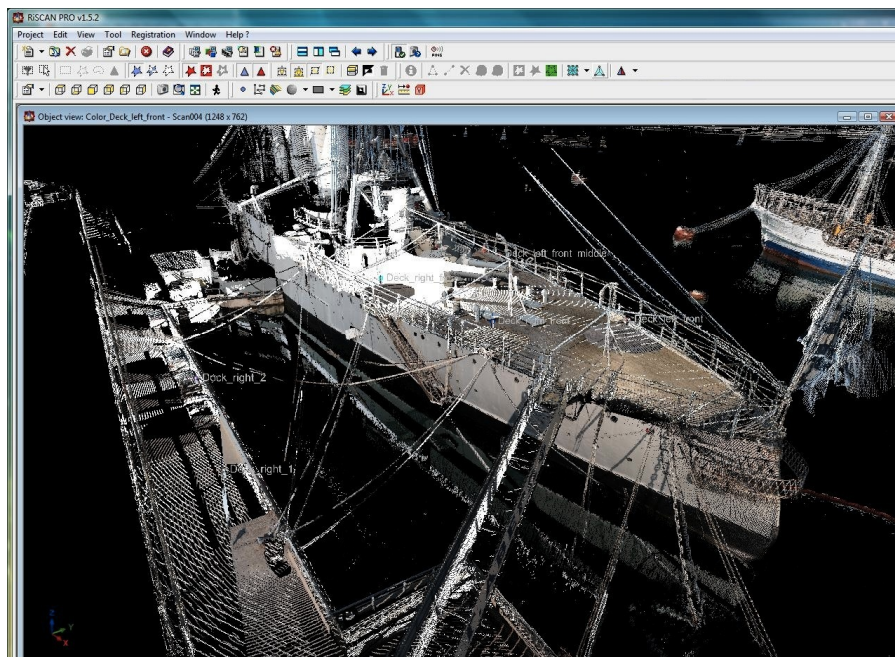

Figure 6: The 3D model of the battleship Georgios Averof

3. CONCLUSIONS

This paper presents the steps and the current development for the promotion and enrichment of the museum archives of the battleship "Georgios Averof". Our first goal is to achieve the analytical functionality of the system within a spatial and historical context. Our second goal is to suggest a methodology based on the integration of storytelling and geographical information technologies in order to be used in the cultural heritage management.

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