Recoding the Nautical Archaeology: Virtual Museum of Underwater Cultural Heritage in Turkey

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Abstract

The preservation of underwater cultural heritage (UCH) requires availability and access to data produced by nautical archaeology alongside tools for analysis, visualization and communication. Although numerous archaeological surveys and excavations have been carried out in the past decades in Turkey, there is no publicly available information system integrated to nautical archaeology. This paper proposes a framework of a virtual museum of UCH. For the creation of this framework, a data collection methodology for underwater surveys has been formulated and a web-based information system has been designed to store the collected data. This paper explores the methods of analysis, visualization and communication embedded in this online system towards the development of a virtual museum.

Virtual museum (VM) incorporates the practices of collection, preservation, research, visualization and exhibit, thus offering new approaches to the preservation of cultural heritage. In this paper, a web-based information system has been developed for a model of a virtual museum using the data collected during underwater surveys conducted on the coastal region of Kaş, Turkey in 2007-2010. Divers from a variety of professional backgrounds followed the practice of i*n situ* preservation. They collected visual, geographical and descriptive data using structured datasheets. Through the analysis of these non-destructive methods, an open-content information system is designed aiming the contribution of all interested parties in a collaborative manner. The system currently contains information on 22 sites in the form of sketches, measurements, drawings, photographs of finds. Combined with Google Maps, the database illustrates the initial technological steps towards the development of a virtual museum.

Divers, archaeologists and other interested users of this information system participate in the musealization of information through separately applied analysis, visualization and communication tools by open software programs. These initial steps demonstrate the methods for the automation of data analysis and visual documentation, the visualization of information and the communication of this knowledge. Futuristic concepts of automated, immersive and interactive design redefine the virtual museum of UCH as well as offer different approaches to the discipline of nautical archaeology.

Keywords: nautical archaeology/ underwater cultural heritage/ database/ digital/ virtual museum/ information system /*in situ* preservation/ museology/ Kaş.

Research aims

The research responds to the lack of systematic methodology for the collection, preservation and dissemination of data in cultural heritage studies. Although numerous underwater archaeological surveys and excavations have been carried out in Turkey since the 1960's (Bass 2005), there is no publicly available information system for nautical archaeology. This work comes within the context of research conducted as part of the Ph.D. thesis entitled "Recoding the Nautical Archaeology: Virtual Museum of Underwater Cultural Heritage" (Varinlioglu 2011). The author proposes the creation of a virtual museum, in other words, a framework of a digital repository of underwater cultural heritage. Within this framework, a data collection methodology for underwater surveys has been formulated. Data collection using this

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methodology is stored in a web-based information system specifically designed for this purpose. Furthermore, the methods of analysis, visualization and communication are explored to enable the development of a virtual museum in the second phase of the project. The virtual museum is not in place yet, however, basic information on the field studies called Kaş Archaeopark Projects is publicly online on www.sanalmuze.org.tr. In the near future, a model of the system is expected to be online on this webpage.

Introduction

The widespread use of information technologies brought new challenges to the preservation of cultural heritage as well as to museology. A new concept of virtual museum has emerged from a need to acquire, store, research, communicate and exhibit the digital heritage data. Drawing parallel lines between the virtual and underwater environments, this paper aims to explore the conceptual framework for a virtual museum of underwater cultural heritage. The objectives of the study are to formulate a framework for the collection of data on underwater cultural heritage using the non-destructive process of *in situ* preservation methodology and documentation, and explore the methods of transferring, storing and sharing the collected data in the digital domain. The information system is designed to store various types of data and also allows collaborative analysis, visualization and communication. Furthermore, at a conceptual level, the digital technologies of the future are explored to promote a framework of a virtual museum and to develop a tool for the archaeology.

Theoretical framework

This paper questions the so-called “brick and mortar” (Schweibenz 2004:3) museum and its practices. The International Council of Museums (ICOM) founded in 1946 defines the museum as a “non-profit, permanent institution in the service of society and its development, open to public, which acquires, conserves, researches, communicates and exhibits for the purposes of education, study and enjoyment” (ICOM 2010). These activities of musealization include the collection, conservation and research of museum objects through exhibition for better communication with the public. Separated from its context, however, is isolated from its meaning; the cultural heritage is enclosed in a single place, which may be termed a heterotopian space (Foucault 1998:178). Once an object is detached from its original context and placed in a museum environment, the archaeologists categorize, classify, and derive meaning in order to impose a new order on artifacts.

As an alternative to this decontextualization, a virtual museum is proposed as a product of the revolutionary changes in digital reproduction, which led to the emergence of new definitions in the field of museology (Kalay 2008). The digital reproduction of the heritage is one of the most attractive ways in which computer technology can be employed in the field of archaeology (Forte 1997). The use of this technique allows visual reproduction of the data through representation, modeling, and display. These methods of display allow the creation of virtual exhibitions in the web environment. The virtual domain, unlike the “brick and mortar” museum, is a flexible medium for sharing information in various formats, such as digital images, video recording, hyperlinked texts, etc. Moreover, the digital domain recodes the way the information is displayed in such a way to move it from a passive to a more interactive style.

Literature Review

In the field of heritage preservation, five digital repositories stand out with their applications of the practice of virtual repositories: Historical American Building Survey (HABS) dealing with acquisition of building documentation data in the US (Burns 2004); Turkish Archaeological Settlements Project (TAY) focusing on the conservation of archaeological data through archival documentation of publications in Turkey (TAY 1998); Nautical Archaeology Digital Library (NADL) designed as a research tool on multilingual manuscripts in Texas A&M University, Nautical Archaeology Program (Castro 2006); Institute for the Visualization of History (VIZIN) projects about visualization of the artifacts discovered in various archaeological excavations (VIZIN 2003); and Virtual Museum of Canada (VMC), a user-centered virtual museum network of the Canadian museums (CHIN 2009). These digital projects illustrate the diverse applications of cultural heritage management.

The digital repositories focusing on three main types of underwater remains, namely anchors, amphoras, and sites are respectively Big Anchor (NAS 2008), Roman Amphorae (Keay 2005) and VENUS (2006) projects. Although none of these three examples can be considered within the category of virtual museum, it is worth mentioning that these three are the most prominent information systems on nautical archaeology. Their assessment is a useful exercise to conceptualize the information system for the virtual museum of underwater cultural heritage.

A digital cultural heritage repository of a virtual museum is a medium that allows the heritage professionals to preserve, manage, and make the data accessible to the public. Even though the digitization of the repositories challenges the heritage professionals in technical terms, these issues are being gradually solved with technological progress. The construction of knowledge in virtual space involves hyperlinks between different types and aspects of information, which is, in essence, groups of data. Within this general framework, a model in virtual space illustrates the concept of the museum as an interactive, recurrently re-interpretive, and experimental experience. The aim here is to form a platform of knowledge building through the collaboration of multiple authorities with different backgrounds and a variety of interests. In order to achieve this aim, the initial stage of operation is forming a web-based information system.

Information System

The deficiencies and drawbacks of information systems currently used in the field of cultural heritage are related to the establishment of databases for archaeological sites using collection methods other than in situ preservation. Currently, there is no information system satisfying the needs of this data collection methodology. Furthermore, the analysis and visualization of the collected data through a collaborative method necessitated an online system of data storage and sharing. The idea was then to propose an information system for underwater cultural heritage, which aimed notably to avoid the difficulties mentioned before. By the help of three computer programmers, a tool was developed for the management of the data collected during the surveys conducted since 2007. Essentially an online database for systemic data collection, description, and interpretation, the system currently contains information on approximately 600 finds through sketches, measurements, drawings, and photographic entries of individual finds, in addition to regional descriptions and observations made by divers. Combined with the GPS locations of sites and findspots, the result of integrating the database with Google Maps illustrates the distribution of

sites along the Kaş shoreline. The process of gathering and recording data for the Virtual Museum has been interactive and continually increasing.

Figure 1. Screenshot from the information system showing the distribution map of the findspots (G. Varinlioglu based on Google Maps)

Field Studies

The field surveys were preceded by the introductory training of the divers on the survey and documentation methodology to be followed. After this brief introduction, divers from a variety of disciplines were assigned various tasks in order to fill datasheets, test the database, and collect visual data. These field surveys were followed by primary data analysis. This was the first interaction between divers and archaeologists. As a result of this evaluation, datasheets and database were modified according to user needs. Following the data produced by field surveys, the information system was designed and developed. As a result of the comprehensive research on and study of available tools, financial and technological contingencies, the information system was selected to be used as a tool for the virtual museum implementation.

With the participation of almost one hundred divers, the author and her team developed a data collection system for recording, preserving, sharing, presenting and analyzing the underwater cultural heritage in the coastal region of Kaş (Varinlioğlu 2011). Considering the costly nature of research on the sea and underwater, the project intends to rely on a team of divers using simple and standard tools for scanning the bottom profile and recording underwater features in datasheets.

While using these data collection methods, the main concern was the *in situ* preservation. The constraints of *in situ* preservation without dislocating the material culture helped to develop optimized solutions to data collection methodology (UNESCO 2001). These constraints are considered as challenges for the design and realization of a unique archaeological survey all along Kaş coastal area.

A Model of Virtual Museum

As mentioned before, the virtual museum is not in place yet. However, basic methods necessary for the creation of the virtual museum are investigated as well as the methods that are followed and the examples that are created by online users working in collaboration. Thus, the users of this information system participated in the musealization of information through independently used open source analysis,

visualization and communication tools such as Gimp, QCAD, Picasa, Hugin, SketchUp etc. The first step in the data analysis is the definition of the sites and finds, the analysis of the collected data, the distribution maps of the finds and the statistical study of these maps.

Figure 2 Panoramic view of a cargo site discovered during the surveys (G. Varinlioglu based on Hugin software)

Once meaningful information is driven from these analyses using different software programs, the data was visualized. The drawings and 3D models were driven from the measurements and typological data. The images were created using digital darkroom that is processing and enhancing photographs through digital photo editing programs. In addition, photogrammetric, panoramic and photomosaic images were generated from of the photographs. The last step was the communication of data through geo-referenced maps.

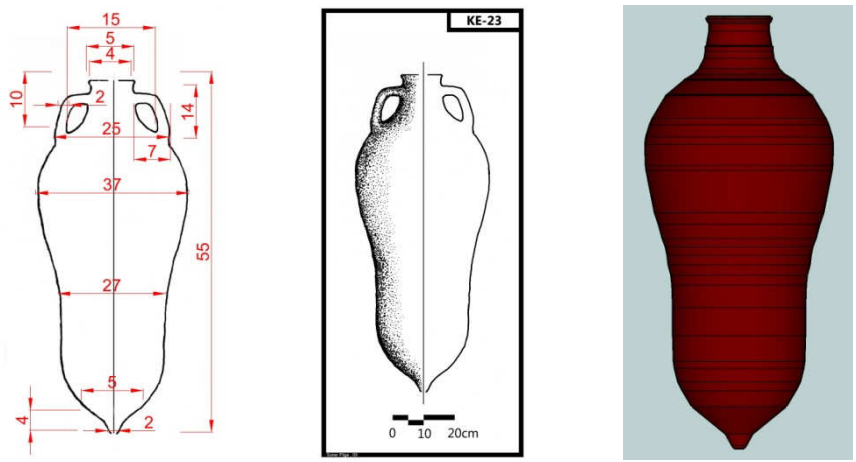

Figure 3 Solid modeling of an amphora (G. Varinlioglu based on Google SketchUp software and handdrawings).

Analysis of the systematically collected data is a necessity for further research in the field of archaeology. As analysis tools are not yet integrated to the system, the analysis is driven manually from the information system. The archaeological questions answering the distribution map of the findspots and of the find types, some statistical approaches to distribution maps and to dating of the artifacts, description of the sites, environment, and finds should have adequate query mechanisms.

The comments of users showed that collected data should be displayed on the same page. As the system stores and displays all the collected data, there are inconsistencies between the measurements and observations of different users. Archaeological measurements have discrepancies related to the skills of divers measured objects and measurement tools. As separately stored entities, these ambiguities and inconsistencies should not be eliminated, but rather, a statistical mechanism should be integrated to standardize the data. Similarly, the visualizing of

the data should have some automated tools for producing drawings, for enhancing photographs, and for stitching images to create the photogrammetric representation of the sites and objects.

The application of visualization tools to archaeological data is part of both analysis and exhibition of the artifacts. Initially the applications are implemented by computer-knowledgeable interested parties. Advances in experimenting with these tools show that archaeologists tend to replace the traditional conventions with new recording strategies. As the ease of use of adequate software programs is taken into account, these tools would be largely used not only for visualization but also for analysis and interpretation. Automated 3D tools, as well as panoramic and photomosaic, would enhance the level of interaction with the depicted objects.

To date, there is no exhibition tool integrated to the information system. The Google Maps, listing tools, and preview images of the visual materials such as photographs, images, sketches, and drawings are used as the main navigation pattern in the information system. However, a variety of exhibition strategies should be added to the system, coupled with an interactive interface that will attract the attention of the users from different backgrounds.

Conclusion

The survey on the Kaş shoreline followed closely the principles of *in situ* preservation, which prohibits the dislocation of material culture. This constraint introduced challenges in designing and conducting an archaeological survey. Hence, it necessitated the development of optimized solutions for data collection, which led to the creation of a unique methodology. The survey relied on a team of recreational divers rather than archaeologists. For this reason, during the project, most of the developed techniques were quotable by different groups of divers. Keeping the methods simple helped to cover more nautical miles along the coast. The participation of recreational divers and the local people living in Kaş raised the awareness about cultural heritage. This will ensure the sustainability of the project for the preservation of the underwater cultural heritage.

The information system discussed in this paper was the first web-based collaborative and open-content platform for raw data of nautical archaeology in Turkey. In this respect, it was a pioneering and unique project for local underwater cultural heritage preservation. Based on the analysis of the datasheets and later the database, this information system met the majority of the needs of archaeologists; hence the possibility of its use should be considered by the Ministry of Culture and Tourism of Turkey (MoCT), which aims to put a regulation similar to the currently available information systems into practice. Thus, the archaeological data collected during the surveys can be used to prepare an official underwater archaeological repository of Turkey. Although the components of the information system were designed according to the material remains found in Turkey, with little modification it can be adapted to other remains of material culture in different countries.

Users of this information system participated in the collaborative process by using a limited number of open source software programs that are not integrated to the information system. In visualizing the data, the emphasis was on photogrammetry because of its ease of use and availability. The 3D modeling was done at a basic level, as “blank” models. However, three-dimensional digital models are required in applications of inspection, navigation, object identification, visualization

and animation. In 3D modeling, photogrammetry has limited use. Therefore, in addition to reconstructions, archaeological documentation data and the photogrammetric depictions should be included in the system.

The interactive user interface that will be designed in the future should include all these features. Further research will include these applications of advanced technology for modeling and immersion tools for an interactive user interface. Once a fully integrated system is created, the user analysis should be evaluated for the impact of the system on the users.

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