

E-Culture: The Digitalization of the Cultural Heritage

3D MODELING OF A GREEK ANCIENT MONUMENT

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Thessaloniki, January 2008

Publication of this report is supported by:



Education and Culture

Leonardo da Vinci

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use that may be made of the information contained therein



Acknowledgement

I would like to thank Dr. Athanasios Styliadis for his support during the creation of the final year project and Dr. Kerstin Siakas, for giving me the opportunity and motivation to conduct this work.

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Abstract

The word culture in its current form, meaning the context that enables humans to become social beings, occurred perhaps unexpectedly late in the history. Its first use is located in Western Europe at the end of 18th century and the beginning of the 19th century. The ethnologists Alfred Kroeber and Clyde Kluckhohn, trying to record the different meanings of this word, discovered 164 different definitions. However, a majority of the definitions relate to a system where a number of independent individuals become interrelated citizens with concrete duties, obligations and rights aimed at protecting the society from external dangers, at guaranteeing smooth living together and the achievement of better living conditions.

One of the most important objectives of e-culture is the projection and maintenance of the cultural heritage. In the last twenty years the spread of computers and more specifically the internet has created challenges. Never before did humankind have so great an opportunity of emphasizing the diversity of each population including its cultural heritage. This can be achieved within the Information Society by digitalization of cultures or e-culture. The presentation of cultural elements with the use of multimedia has created new possibilities and challenges. For example the creation of web pages and educational material containing archaeological or modern monuments with user interaction is an efficient way to provide different stakeholders with information they can utilize according to their needs and without much effort. Finally, the creation of 3D models, which can range from objects of size of a pin to the representation of spaces and cities, constitutes the acme of this effort.

In this chapter the growth of such undertakings in Greece is presented together with their recognition by Greeks and the rest of the world. Also, certain proposals of improvement and enlargement of the undertaking are made. The original contribution of this paper is the results of a cultural digitalization of a Greek monument, which does not exist today. The implementation was carried out by the creation of 3D models and single-photo-modeling from old existing pictures and documents. The results are presented in an on-line application¹.

Keywords

3D models, digital culture, digitalization, e-culture, PANDEKTIS, PC graphics, photograph,

¹ <http://aetos.it.teithe.gr/~siaka/noulas/e-culture.html>

3D Modeling of a Greek ancient monument

1. Introduction

Since ancient times humanity has wanted to present its treasures and maintain them for the future. This is one of the most important objectives of culture. Naturally, the cultural inheritance (the maintained elements of culture) not only plays an aesthetic and emotional role, but also, has a theoretical, practical and ideological value in fostering the citizens of tomorrow.

Digitalization constitutes technological and social growth. The degree of digitalization depends on the progress of Information and Communication Technologies (ICTs), and is incorporated and used in the society. Not only is the technical infrastructure being digitalized, but the whole society and the culture itself.

The totality of human structures and activities, as they are known today at individual and social levels, changes in the frame of the Information Society. Today, there is a plethora of services and activities, such as e-commerce, e-learning, e-government, e-health, e-inclusion, e-culture, etc related to every individual and social value.

The growth of ICTs and the Internet since the decade of the 60s has resulted in the development, not only of a new field for artistic creation, nor a powerful tool for the growth of artistic creation, but in a very powerful means for the projection of the artistic and cultural creation (Webpage 4).

Digitalization has exerted an extensive and complex influence on the handling of the cultural heritage. The most impressive forms of cultural heritage, such as two dimensional works of art in the museums, have an obvious digital potential. This is even more obvious regarding three dimensional presentations and the promotion of relevant information. Things, however, become more complex when speaking about tangible culture and more concretely regarding immovable heritage, such as monuments, archaeological remains and the cultural historical landscape.

2. E-Culture

Electronic culture (e-culture) emanates from the convergence of ICTs with the traditional forms of human cultural activity. In the beginning, the term was mainly a rhetorical term used primarily as a tool to change the prefixes, the attitudes and the policy background according to the cultural values. This requirement is recognized as result infiltration of ICT in all human activities and the growth of e-services. Later, however, and even today the term e-culture constitutes a vital fixed phrase in the context of culture, citizens and policy, on a national and European level.

E-culture and the policies around it have invested much interest, as well as a lot of time, to contribute to the transformation of cultural information into digital form. One of the most important examples of this activity is the transformation of the various museum collections into digital form, making them available on-line for the public.

The term e-culture includes all the axes and the expressions of culture that are nowadays created, presented, stored, recovered, transmitted, projected and granted access to, etc, through the use of services and facilities of ICTs. Substantially, we continue making the same things in the sector of cultural creation, but in a new way, namely with the use of ICTs. From the phrase, “*I do the same things but in a different way*” the necessity of reengineering occurs in various sectors requiring individual or social action. Culture is one such sector.

The reformation of processes naturally results in the use of new means including other possibilities, other restrictions and other degrees of freedom, in contrast to the traditional means. As examples of possibilities facilitated by e-culture we can mention the digitalization of cultural collections’, the creation of cultural digital content, the creation of infrastructures for easy access to the electronic cultural content and the creation of systems of distribution - projection of cultural collection, cultural portals, “digital” artistic creation, “digital” art, virtual tours in museums, virtual museums and rooms of art, etc.

In addition to the significance of reformation of processes (reengineering), a new significance that implies a simplification of processes is brought about. The simplification of processes means that certain processes (that until today were performed in a standard number of steps or in a standard way) now become shorter with fewer and simpler steps. Before, a museum had to buy an expensive object, to transport it, to maintain it, to secure and to display it. Today an electronic museum, which is specialized in certain areas, can simply buy the rights to use photographs or three dimensional depictions of objects.

Within this logic, the visitor of a traditional museum has to visit it in person, at its opening hours and spend time and money. A visitor to an electronic museum, can visit it from anywhere in the world, without spending additional time and with much less expense. In addition the citizen is given the potential to consider exhibits otherwise impossible to visit (Webpage 4).

However, can we claim that we simply do the same things in a different way? With the passing of years attention in the electronic culture was moved into a more fundamental object of cultural innovation. Digitalization shows new forms of content and new forms of expression. This means not only that the possibility of making the same things in new ways exists but, also the possibility to do new things, discover new forms of artistic and cultural creation and to develop the potential of technology to give new form and dimension to prospective ideas in the cultural field (Webpage 4).

The coupling of ICT with culture has functioned as a tool and a means for cultural creation itself and not only as a tool for the projection of the products and the services of culture that are produced with the traditional methods as determined through the processes developed in each art with the passing of years (Webpage 4).

Digital culture, consequently, creates its own insubstantial cultural heritage by producing mental capital and social practice which, in future generations, can be transmitted as *anamnesis* or as tradition. The potential for the digital culture bring new horizons to the promotion and the maintenance of our cultural heritage constitutes obligation of all countries.

3. The 3-Dimensional digital depiction

The creation of 3D models is vital for the current growth of Information Technology. “*Fashion*” requires that traditional operations in personal computers be created via a 3D wrapping. At the same time there is great enthusiasm in the wider public regarding the development of such undertakings. This is because optical in-

formation is naturally assimilated more easily by the average user than written text. “*A picture is worth 1000 words*” is probably true in the case of e-culture.

For a few centuries the growth of the art, or even the science, of the photograph has captivated humans. The power of the picture can communicate effectively with the population at all levels of education. At the same time, the growth of video and its enrichment with sound has placed it above other communication media, as most direct and effective.

Today, the video still holds the first place but the growth of ICTs has increasingly begun to affect people’s lives. The power that is given to an internet visitor is unlimited. Henceforth, the operations of finding a text or a video and much more a picture constitute basic knowledge to a medium user.

With the entry of e-culture in the ICTs and with the passing of time it has been realized that the existing means for the representation of information is insufficient. Thus, new means for the digital representation of cultural information were found such as PC graphics. One of them is the 3-Dimensional (3D) digital depiction of cultural objects, monuments or even still localities.

PC graphics are a transfer to digital levels of objects, phenomena, processes and relations that exist or develop in the real world. This transformation is achieved by the creation (modeling), the presentation (rendering) and the output (visualization) of information relevant to a given level of digital representation. More specifically, the creation aims to capture the 3-Dimensional or 2-Dimensional geometry, the presentation the rendered representation and the output the complex view of graphic information (Styliadis, 1999).

3D computer graphics (in contrast to 2D computer graphics) are graphics that use a three-dimensional representation of geometric data that is stored in the computer for the purposes of performing calculations and rendering 2D images. Such images may be used for later display or for real-time viewing. Despite these differences, 3D computer graphics rely on many of the same algorithms as 2D computer vector graphics in the wire frame model and 2D computer raster graphics in the final rendered display. In computer graphics software, the distinction between 2D and 3D is occasionally blurred; 2D applications may use 3D techniques to achieve effects such as lighting, and primarily 3D may use 2D rendering techniques. 3D computer graphics are often referred to as 3D models. Apart from the rendered graphic, the model is contained within the graphical data file. However, there are differences. A 3D model is the mathematical representation of any three-dimensional object (either inanimate or living). Due to 3D printing, 3D models are not confined to virtual space. A model can be displayed visually as a two-dimensional image through a process called 3D rendering, or used in non-graphical computer simulations and calculations (Webpage 5).

The 3D electronic graphic design is often referred to as modeling. Modeling is generally described as the creation of an ideal ‘process of simulation’ that tries to simulate another, usually more complex process (Hazelton, 1992). These ideal processes are named models.

A model, technically, is not a graphic until it is demonstrated optically. Because of the 3D printing, the 3D models are not limited to the virtual sphere. A model can be demonstrated optically by creating a 2D projection of the 3D model. Specialized programs are required for the manufacture and graphic representation of the models in a computer.

Initial assimilation of this technology by the public has been quite small. By the passing of time, however, more people perceive its power. From the simple representation of an object of the real world in a digital 3D model up to today’s most complex technology, virtual reality, spectacular development can be expected in the next decades.

The giants of today's information technology are trying to automate these processes. Already software has been developed that will construct simple 3D models from photographs of a desirable object. On the other side, the existing software today is in a very initial stage requiring the specialized work of an expert.

4. Greece and e-Culture

Greece is a rich country in history and cultural heritage. There are a large number of museums, objects of historical value, monuments and archaeological sites. Thus, it is very difficult, if not impossible, for a visitor to visit or observe all this cultural wealth. Taking this into consideration ICTs can play a decisive role via the digital depiction of all objects or monuments and the possibility of access to them by citizens and potential visitors.

The use of photographs is of decisive importance for the manufacture of 3D digital models with the use of a computer. The fact that the constructor of such models can observe the object of modeling from a fixed position constitutes an important aid since the constructor has the possibility to compare the real object with the digital one before the publication.

In Greece, the digital culture is governed primarily by the Ministry of Culture which uses resources from the European Union through the Operational Program (OP) of Information Society (IS). It is important to stress the contradistinction of digital culture itself, which in practice means the growth of digital content, from the significance of digital culture, meaning a way of thinking that incorporates functional possibilities of digital applications. Consequently the digitalization, the projection and the distribution of the digital capital via the internet, gives the possibility at providing information via different interconnected sources and new ways of exploiting the information. This is one of the main aims of OP IS, which, through the programme entitled "Documentation, Appointment and Exploitation of Greek Culture", provides an investment of 70 million Euros aiming at the growth and promotion of digital content. At the same time through work that is mainly being materialized by the organization of projection of the Greek culture, has been created a platform on which the Greek culture will base a solid background of management and tradition of services to each interested.

In addition, according to the Ministry of Culture, the products of the "Digital Culture" create enormous dynamics of employment, specifically in the sectors of Multimedia and the Software Applications. There are more than 80 institutions that are related to culture, above 1.680.000 pages of books, more than 1.100.000 handwritten pages (manuscripts), roughly 5.000 hours of recorded tapes and 46 hours of film.

These are only some of the elements that concern the transfer of cultural material to digital form in Greece. At this moment an enormous effort the Greek cultural heritage and the production of digital models accessible by all citizens, via the Internet, is made.

According to the existing data in digital form today we can also find 12.390 2D objects, 229.507 photographs, 2.642 paintings, 10.549 work of art, 993 hours video, 5.013 hours sound documentaries, and 7.225 3D objects (Webpage 8).

Another still essential effort of digitalization of the Greek cultural heritage is also being made by the National Institution of Research which is fully accessible to the public.

The collections that are digitalized consist of pieces of cultural heritage of Institutes of Modern Greek Research, Byzantine Research and Greek and Roman Antiquity and are available digital by the National Centre

of Documentation and produced within the frame “PANDEKTIS - Digital Treasure of Primary Evidences of Greek History and Culture”. In these collections substantial information is freely provided about the historical and cultural heritage of Greece in the Internet thus giving everybody interested direct access. In this way free access to knowledge and learning is provided.

PANDEKTIS, includes the collections of 47 years of operation of the Institute of Modern Greek Research that encompass work of Greek architects and editors of maps (from the 15th century until 1820) up to the Greek Painters after the invasion in Konstantinople (Istanbul) (1450-1830). The Institute of Byzantine Research by contrast “inherited” all monasterial files and documents of Mount Athos and Patmos. However, one of the most important objectives of the Institute is also the publication of unknown primary historic material. For students and researchers, digitalization has a particular value due to the plethora of information and evidence with regarding the ancient Greek and Roman traditions (Webpage 9).

5. The church of Aghios Nikolaos Tranos

One ancient monument is the church of Aghios Nikolaos Tranos, once placed in the centre of the city of Thessaloniki. At the time it was built it constituted a landmark in the city and its contribution was vital for the growth of Christianity of the wider region. Unfortunately, however, because of a big fire that burned down most of the city in the summer 1917, the church was destroyed completely.

Except for some parts of the foundations that were brought to light by archaeologists, the only existing record of this church is a single, unique photograph. Also, because of the long period that has passed since its destruction, it is not possible to collect information from witnesses who have seen the church.

This constituted a very good inspiration for a final year project on the subject “Three-dimensional digital render depiction of the Church of Aghios Nikolaos Tranos (Thessaloniki, 1917)”. The final year project was carried by a student of the department of informatics at ATEI of Thessaloniki, Nikolaos Noulas, under the supervision of Athanasios Styliadis, in year 2007.

Underlying elements regarding dimensions and stonework of the foundation have been recorded by the archeological service. Also, the unique photograph played a major role in the process of the creation of the three-dimensional model.

According to the procedure that was followed, the dimensions of the temple were calculated, initially the main building and afterwards all individual distinguishable structural elements. With the completion of this stage the three-dimensional model was constructed, according to the photograph. Finally, when the modeling stage was completed, certain extreme points on the photograph of the church were identified by an equivalent three-dimensional model. The differences between the picture and the model were considered as “errors” and the model was corrected until the corresponding points coincided with each other.

Thus, a photograph gave enough clues to recreate this church in digital form even if we do not have the possibility of seeing it directly. With this methodology there is a possibility of three-dimensional digital representation of monuments with the use of even one single photograph.

This process, provided that it is applied systematically by the responsible departments of culture, can provide substantial results in the area of digital culture.

6. e-Culture objectives in Greece

Some of the objectives that have been determined by the Greek society for the e-culture growth in Greece, are mentioned below.

The growth of electronic services provides benefit of information sharing, but also interaction, through:

- the possibility of access by anyone interested in scientifically selected digital cultural content,
- the possibility of cross-cultural dialogue,
- the support of special groups in society, such as disabled and immigrants, to equivalent access in content and services,
- the protection of the Cultural Heritage of the country with the use of modern technologies.

Benefit of e-Culture is the increased business exploitation of cultural products, giving rise to:

- the creation of new work places,
- the intensification of the region and the achievement of conditions of sustainable growth,
- the activation of the private sector in the area in the form of free-lance investments, and projects in the form of Public and Private Sector cooperation,
- the guarantee of long-term viability of all actions that concerns the application of modern technologies in the area of culture.

The continuous interaction of culture with the country's strategic sectors, through programmes, such as "EDUCATION - CULTURE" and "CULTURE - TOURISM" boost economic development. The digitalization and documentation of cultural content within the educational process constitute a priority in the new Programmatic Period. At the same time, the connection and common dissemination of culture with the tourism provision of the country constitutes a strategic choice for attracting visitors to Greece during the whole year and not only during the summer. This brings profits to individuals and improves the National Economy on a whole.

Particular emphasis in this effort is given to the digitalization and transmission of the cultural artifacts related to historical personalities, such as e.g. Alexander the Great. Also historical regions of the country, such as Marathon, Thermopylae, Salamina and Ithaca, constitute symbols of world scope with high identifiability and through digitalization aim to bring added cultural and economical value (Webpage 10).

Other areas are also amplified by e-culture. The mechanisms that guarantee the implementation of the National Strategy for the Culture with use of modern technological mean that particular emphasis is put on:

- the growing protection of Intellectual Property,
- the electronic supply of services regarding access to the existing digitalized cultural reserve,
- the guarantee of interoperability between all systems that provide cultural content and services,
- the permanent planning and realization of innovative applications in the area of Culture, and
- the production, exchange and export of relevant know-how.

Conclusion

The initiative of digital culture aims to allow all Europeans to have access to the collective memory of Europe and to use it for educational purposes, for work, for free time activities and for creativity. The efforts in this area will contribute in the competitiveness of Europe and will support the action of European Union in the cultural arena: contact with material from different cultures and in different languages will let its the citizens appreciate their cultural heritage as well as the heritage of other European countries. The recommended actions will contribute to the presentation of rich and different heritage of Europe in the internet and protect cultural virtues whose loss would be irreparable. Beyond its fundamental cultural value, cultural material is an important resource for adding value to new services in such sectors as tourism and education. High quality digital content is a basic driver of large-scale industrial activities (consequently the interest of important search engines). Analogue-digital transformation and digital maintenance are knowledge-intensive activities that it are likely to increase somewhat in future years. This should lead to a coordinated approach from the member states to basic questions about appropriate digital transformation, the possibility of direct access and digital maintenance, and it should help to create a multilingual common point of access for the distributed digital cultural heritage of Europe (Webpage 7).

“As long as our culture becomes more and more technological, the technology will become more and more cultural”

Marshall McLuhan (1911-1980)

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