# APPLICATION OF NEW TECHNOLOGIES FOR 3D MODELING IN AN UNIVERSITY INFORMATION ENVIRONMENT

**S. Denchev, I. Trenchev, I. Peteva, I. Pavlova**

*University of Library Studies and Information Technologies (BULGARIA)*

## Abstract

The promotion of the cultural and historical heritage through information technology is an extremely efficient formula for the proper use of technology in the process of perception and study of human cultural heritage. The opportunities offered by modern technologies allow a more attractive and correct way to enrich the access options to the elements of cultural-historical heritage. Training in the field of cultural-historical heritage is a complex and multidimensional process which requires different interdisciplinary approaches in order to achieve a thorough understanding of existing knowledge, on the one hand, and to create an understanding for revealing, researching, preserving and promoting of new discoveries, on the other. Nowadays, the training for specialists in the scope of cultural and historical heritage offers a lot of opportunities so to include the mixed reality in the educational process. The creation of virtual reconstructions through 3D models enriches the educational environment and improves the way information is conveyed. Preservation of cultural-heritage is a systematic process of search, study, identification, documentation, registration, conservation, restoration and socialization. Hence, protection of cultural heritage presents a system of measures ensuring its preservation in the Interest of Society. Particularly important is the question of the socialization of cultural heritage. Traditionally, it is related to the adaptation of cultural values and to the development of a program for its preservation, restoration and social engagement. The goal is to become more available to both scientists and specialists, as well as to anyone interested in their value. New digital services change our lives at a rapid pace and education is undoubtedly one of the most affected areas in this process. With the introduction of mobile educational applications as well as new technologies such as virtual reality and "expanded reality", a new training policy is being developed at the University of Library and Information Technology. There is a symbiosis between traditional ways of teaching and integrating new technologies as a virtual reality in the educational process. In this paper we briefly debate the power of visual discernment in human education and encounter, and how we can control visual intelligence to advance understanding in science. Approaches will be presented how to create complex virtual models of cultural heritage from humanitarian students. Good policies and practices will be shown by the University of Library Studies and Information Technologies to integrate the mixed reality into our students' education. Another aspect of this work is to present the use of new 3D technologies in the training of students and PhD students as a virtual reality. It will be shown how to create virtual halls in which students will be able to distance themselves from lectures and "touch" the ancient cities. This virtual world enables people to take activities that include virtual meetings, training sessions, and virtual school or university training.

Keywords: new technologies, education, 3D visualization.

## 1 INTRODUCTION

3D (3-dimensional) graphics on the whole is a complex science that constantly develops. Instances of 3D graphics can be found all around us in computer games, advertisements, TV shows and so on. The 3D graphics is such that utilizes three-dimensional representation of geometrical data, mostly Cartesian data that can be processed using a computer programme. The processing of the data includes various calculations and two-dimensional image render [1, 3]. The process of three-dimensional computer graphics creation is executed in the following stages: 1. Modeling creating the objects shape. Modeling itself consists of a few object-building steps: - An object is defined in 3D graphics by its points (vertices) in three-dimensional space (x, y, z). - When the points are connected through lines a wireframe representing the object forms [1, 6]. - After the wireframe formation, a surface is applied to the object. The surface may have multiple qualities colour, texture, gloss, translucency etc. - Finally, every object radiates or absorbs light. Most objects are illuminated by a light source and their shadows must be represented accordingly. All 3D surfaces may be represented by a set of smooth polygons. More complex polygons are always divided into triangles. 2. Layout a process in which users apply textured cards to the complete object, a process similar to pasting a

wallpaper giving the object a more realistic and complete layout. 3. Animation directs the movement and location of the objects in the scene. 4. Light set a process of adjusting light sources, adding light and shade effects and atmosphere to the users scene. 5. Render objects image generation.

## 2 METHODOLOGY

The powerful tools are designed for specific user tasks, therefore do not contain the full set of graphic tools of the other graphic applications e.g. cameras, lights, shading and animation options. Nevertheless, through the use of more complex visual software packages such as Maya and 3Ds Max (Fig. 1), the users can benefit from the combined power for visualisation of various 3D models. Analytical representation of an object at specific parameter values in this presentation, along with the means for its construction and processing represent the geometric model of this object. Geometric patterns of basic and well-known objects we call geometric primitives (segment, broken line, rectangle, square, ellipse, circle, polygon, etc.). The basic model for creating 3D objects is based on polygon or NURBS modeling. [7-9] Using multiwall is probably one of the most common form of 3D software and is represented by such popular software as 3ds Max and Maya. Polygon modeling retrieves a 3D shape from primitive geometric shapes that scale, rotate, and transform. This method is quick and easy to learn [10]. The essence of NURBS modeling is that in the three-dimensional space, support curves are repeated, repeating the object's contours, and then "dress" the surface. NURBS is often used to model ergonomic objects, as well as objects with aerodynamic characteristics - cars, planes, all sorts of fancy objects. In the process of particle modeling, the surface of the object is composed of numerous small quadrangles - particles. The sides of these quadrangles are actually splinter with 2 vertices. We should not think that modeling is the basic and determining step in creating a three-dimensional graph. Even the well-done model may lose its qualities if it is dressed with a poor texture, poorly illuminated and shot at the wrong angle (Fig. 1).

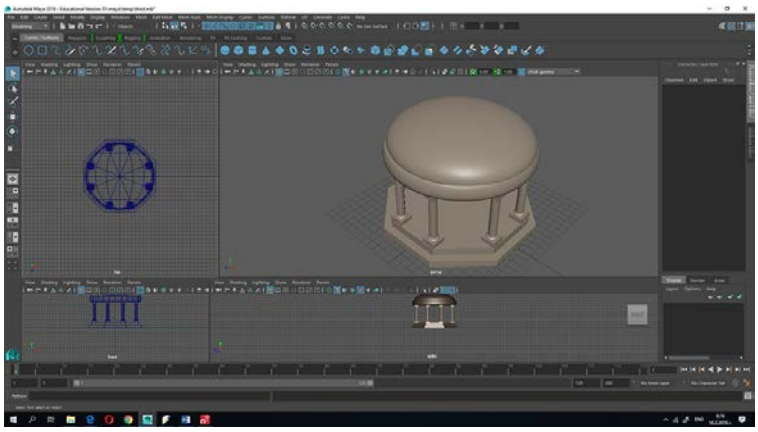

*Figure 1: Visualization of temple in Maya.*

## 3 RESULTS

Augmented reality is a field in information technology dealing with combining data from the real world with computer generated data. Currently, most of the research in the field is focused on the digital processing of video stream and adding computer generated imagery to it [2]. The definition given by Robert Azuma is one of the more aimed descriptions. It covers a subset of the original ideas of the augmented reality, but reaches the whole represented set of the augmented reality. According to Azuma, it is an environment, which includes virtual reality and elements of the real world. For instance, a user can wear transparent glasses, through which they can see the real world, as well as computer generated imagery superimposed on the real-world image. Azuma defines the system of augmented reality as a system, which combines real and virtual [8], it is interactive in real time and works in three dimensions. The augmented reality denotes computer-powered extension of the reality perception. Pictures, images and videos are extended with virtual objects. This technology has been implemented in the Imos Viewer application and enables the users to visualize furniture in real premises. The camera function of the mobile devices captures the real surrounding environment and Imos 360 superimposes the models including materials and demonstrates colours.

The opportunity for Second Life (SL) [7, 10] appeared in 2003, thanks to the American physicist Philip Rosedale, who created Linden Lab. As a matter of fact, the idea was conceived for the first time back in the dark romanticism of the Industrial era. The cyberpunk literature of the mid 1980s began drawing humanitys sci-fi concepts of the computerized future. It was back then when the book Snow Crash appeared, in which Neal Stephenson created a template for SL for the first time. The people in the novel run away from the world of capitalism in some sort of metauniverse, where they rediscover themselves by transforming into avatars meaning deities that took the forms of mortals [9], [12].

Naturally, in the process of materialization, the idea has changed. Today SL is a cosmopolitan marketing space where thousands of people earn real money for virtual products and services. Perhaps it was this factor that was most the influential for the existence of the community. The similar preceding projects were not as successful without their lack of business. If money governs people lives here and now, that applies to a certain degree to the second life as well. It was not a coincidence that Financial Times announced the SL economy the fastest developing in the world. Professions like brokerage, design, dating agencies and naturally, sex services, turn out to be the most profitable. The currency is called linden dollars, which on a request can be exchanged into re money and vice versa. The registration itself is completely free and ultimately one can spend their time without expenditures. Nevertheless, inevitably comes a moment when the user desires to upload a picture into their profile, whether on their avatar or not and that costs money. Furthermore, if the user wishes not to wander around all the time, but to possess their own house or a castle, they would have to purchase a unit of land (Fig. 2), for which they would have to pay a certain monthly fee[12 -14].

*Figure 2: Presentation a lecture in second life.*

This begs the big question why would people spend their money on a virtual world? They don't actually wear Adidas sneakers (yes, they have a store there), neither actually drive a popular brand of an automobile, nor fly a dragon or attend some cool club, or perhaps that is the exact reason. The extension of our inner selves seeks a variety of metamorphoses like the soul cannot reconcile with the body and has been seeking multiple embodiments through the ages. Many people here opine that their avatar is a more realistic reflection of them then their real appearance. The primal human aspiration for perfection moves the virtual economy forward. The user can be more attractive, more interesting and can have more friends. The factor that everything in SL is cheaper is not to be underestimated. For instance, fashion products costing 500 USD, here can become the users possession for the simple 20 USD. In addition, the avatar has no physical needs, the users purchases are completely guided by their ego and mental needs. There are hundreds of departments that utilize educational purposes on various subjects such as chemistry. At least 300 universities around the world teach educational courses or do research in SL [13]. Harvard University, New York University, to name a few (Fig. 3). SL is used as a place for teaching and learning foreign languages. The English language, which includes the British Council, the Cervantes Institute and the Goethe Institute [10]. The list of educational projects can be found on the SimTeach website.

*Figure 3: View from virtual network - Second Life.*

Second Life has been prohibited twice by the California educational institution (specifically by the Woodbury University) in 2007 and 2010 [8]. The registration in Second Life (Fig. 3) is free and there is no tax for the avatar the user possesses. A so-called premium membership exists which is optional. It costs 9.95 monthly. Linden Lab through the premium membership pays an automatic scholarship amounting to L$ 300 weekly to the users account, also the user receives a small parcel of land, which they can use to their own ends or rent. Nevertheless, most of SL users are free members [10, 11].

The online education is a kind of education performed via computer and information technologies. It is defined as pedagogy consolidated by digital technologies. In some cases, face-to-face interaction between teacher and student is not established. Online tutorials are designed to guide the students through delivering information or assisting students with completing specific assignments. The information-based online content sends the information to the student. The examples include content distributing the history or facts associated with a service, company or a product. The information-based content does not teach a specific skill. In the contents based on performance, the students build processing skills, which are expected to improve their education. Despite some people's opinions that online tutorials decrease the educational level, practice shows that there is a benefit from such tutorial and that form of remote education is gaining popularity. There are several reasons behind that. First of all, online tutorial grants new opportunities to the learners, who would otherwise be unable to participate in the educational process. Such potential learners are for instance people, who experience difficulty in attending the educational facility for some reason, e.g. children, elderly or impaired people or ones living and working in remote areas. Second of all, online tutorial enables the educational facilities to teach a large number of learners by a small number of lecturers, which means less expenditure.

According to a number of researchers in Europe, the Republic of Bulgaria is one of the countries with a very rich cultural and historical heritage. According to experts, the number of real monuments is third, after Greece and Italy. Many modern studies prove that our peninsula and especially modern Bulgaria are the cradle of European civilization. Most monuments found in Bulgaria are archaeological. The remnants of the times of the Odrysian kingdom, the Roman Empire, the First and Second Bulgarian Empire, or the Byzantine Empire, remained only ruins. Once the excavations are made, the layout of the buildings, which have walls with a maximum height of 1-2 meters or only the foundations, can be established. Such remnants speak a lot to archaeologists and researchers, but they are hard to understand for the ordinary visitor. Our goal is students in their training course to make 3D small objects. Then they are merged into a large object. In this way, we will be able to revive our ancient history. Current 3D information technologies can also help visitors to explore the cities without having to rebuild them. The development of the current 3D model of the ancient town of Skaptopara, recently opened in Blagoevgrad, will help to make a full study of the lifestyle and lifestyle of the people living on the Struma River. Undisputable significance for the cultural identity of any society in the globalized world is its cultural monuments and cultural heritage in general. Stability and growth of society are strongly influenced by all objects, landscapes and buildings rich in spiritual or religious value. They are the winners of our national pride. The problem of preserving the Bulgarian cultural and historical heritage is complex and multi-layered, but also very important. A people's saying goes that "People who do not know their past have no future." Modern information technologies through multimedia, interactivity and accessibility can solve the problem of conservation and exposure easier, more efficiently and cheaper. Virtual buildings can be easily changed in later stages when new, unknown historical data on the architecture of the monument are obtained on the basis of new

research or archaeological discoveries. They can dynamically show the different stages of its existence. For this purpose, it is first necessary to create quality content as a 3D model and then to find a suitable way to visualize it to the visitor so that he gets a really good experience and learn something new about the history of the visualized monument. Virtual Reality Technology (VR) has already reached a level of maturity that allows it to be introduced into the humanities of science as education and cultural heritage. Recently, Augmented Reality (AR) has been developing significant research efforts. It expands VR systems by mixing real and virtual elements into a continuous composite scene. By combining virtual reality with real-time video processing and computer visualization technology, AR systems offer a natural view of real scenes and objects enriched with virtual objects and scenes. So today we have the potential to make Bulgaria's cultural and historical monuments more accessible, more interactive and more interesting to every visitor.

At present, however, these technologies are limited (Fig. 4). The goal is to build a community in which students can participate and collaborate in a learning process based on teamwork and solving specific practical tasks. Applying learning by doing to American scientist John Dewey enables students to design and build new places, perform various tasks - assigned to them by the lecturer, and acquire knowledge in new and exciting ways. This ensures an experience that is unlikely to forget and acquire the necessary skills and qualifications to work in a real work environment (Fig. 4 and Fig. 5).

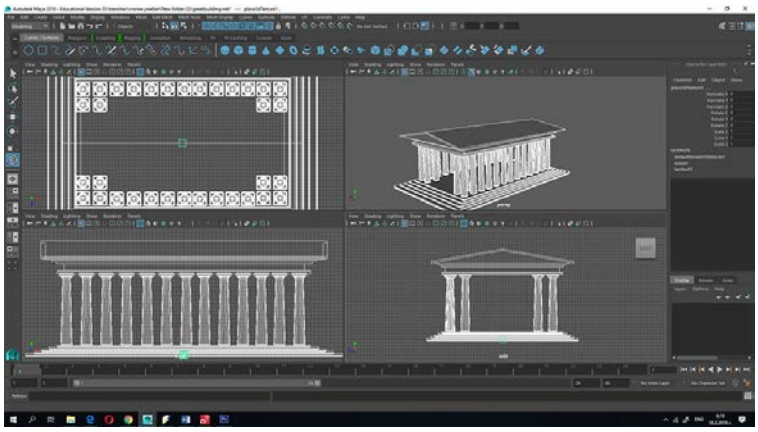

*Figure 4: Greek Building from turbosquid.com.*

*Figure 5: Greek Building from turbosquid.com.*

One of the possible applications of the results is the placement of 3D objects such in virtual network Second Life [8], [11]. We did this experiment in the University of Library Studies and Information Technologies (ULSIT). The students showed great desire to visit the virtual network (Fig. 5). Students saw her alone.

Computer graphics helped us a lot. It happened following

- Students were no longer in the classroom;
- Showed initiatives for this new way of explanation;

Courses in which the use of mixed reality, have become very popular. The3D technologies provide a realistic way for more complete representation of architectural sites, museums and galleries in the digital space. For this reason 3D model presentation should include the necessary information so that the users get the same knowledge as if they would have actually visited the site. During the educational process students will be able to get acquainted with the virtual objects of the historical-cultural heritage via virtual reality glasses. They will be able to learn about these 3D models and how to create such models [9].

The authors of this article are part of the project “Application of the mixed reality in the training and promotion of the cultural heritage for the purposes of the in the university information environment”. The aim of the project is to show the possibilities of the virtual and added reality through the so defined mixed reality in training and promotion of historical-cultural heritage for the benefits of the users. Another goal of the project is to develop new learning opportunities for the students by creating virtual sites of historical-cultural heritage. A real 3D model of the ancient town of Skaptopara will be created within the project.

This results come from random experiment.  Just one of the authors put protein in 3Ds Max and Maya [5], [8], [12] then and presented to students. The surprise came when students liked this way of teaching and demanded more. From two competitors courses students chose this with the augmented reality. One complaint is that they can‘t enter in second life with tablet. One of our future developments in education in our university is to purchase helmets for virtual reality and use them in training (Fig. 6).


*Figure 6: Project Viewer for Second life.*

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