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VIRTUAL MUSEUM OF BOSNIAK INSTITUTE

Abstract. Presently virtual museums are implemented using variety of different concepts. Most of them contain some form of storytelling in virtual environments. This paper introduces the concept of audio stories guiding the user through the virtual exhibition. Our goal is to explore if the audio storytelling can compensate movement limitations in a virtual environment. We use the case study of the Virtual Museum of Bosniak Institute, containing the digital collection of furniture and decorated objects from BH cultural heritage. For evaluation of user feedback we use qualitative analysis methodology.

Keywords: virtual reality, virtual heritage, virtual museums, story guided virtual environments

CCS: I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism – Animation, Virtual Reality, I.3.8 [Computer Graphics]: Applications

1. Introduction

Media globalization offers the endless possibilities to visit and explore physically distant sites using virtual reality. Virtual museums (VM) are enabling the Internet users, as well as the real visitors on site, to access the exhibits, interact with them and learn about their background and context using computer graphics and multimedia. Recently storytelling is becoming an important part of virtual museums' implementation, as it enhances the immersion of the visitor and upgrades the pure visual expression of the exhibits.

The goal of this paper is to discuss the recent developments in virtual museums concepts with various kinds of storytelling and expand our work on the story guided VM concept. Being a partner of Virtual Museum Transnational Network [1], some of our virtual museum projects are included in the EU funded research about the most immersive concept for the virtual museum of the future. After introduction of story guided virtual environments in [9, 10] in this paper we explore the concept of virtual museums guided only by audio stories, with very limited motion possibilities.

We decided to introduce this concept after visiting the Anna Frank virtual museum [11]. While listening to the voice telling the story about the presented locations, we were so immersed in the storytelling that we did not feel the need to move through the virtual environment. This was our motivation to explore how the user would perceive the limitation of movement, while offered the audio story in the virtual museum.

The rest of the paper is organized as follows: Section 2 gives an overview of the related work in the field of virtual museums with storytelling; Section 3 presents the audio guided VM concept through the case study - virtual museum of Bosniak institute; Section 4 analyses the user

feedback using quantitative analysis methodology and Section 5 offers our conclusions and directions for future work.

2. Related work

The use of storytelling technology in virtual museums is not new. Nowadays many virtual museums that use digital stories in the presentation of their virtual exhibits are online [2] [3] [4]. They use different storytelling techniques, such as textual, audio, video or avatar-based storytelling. What is still quite absent however, is the use of full storytelling guidance through the virtual museum exhibitions - guidance that will provide visitors with an accurate and complete impression of not just a particular exhibit, but also events, times or places in history, and help them to understand and appreciate the artefacts in their historical context.

There are very few examples of such virtual museums online, each of them implemented differently. In some of them visitors start the stories by walking through virtual environments (automatically or by pressing buttons). In others, visitors listen to story intros about virtual exhibitions before entering virtual environments. Virtual environments in those museums also vary from still 3D renders to panoramic or 3D walk-through environments.

The National Palace Museum [5] has an exhibition hall guide for the antiquities in one of their permanent exhibitions halls called “The treasures of eight thousand years”. The exhibitions present antiquities from different historical periods (beginning from 6,200 B.C.) organized in several exhibition rooms. Each room has an audio guide and video story illustrated with old photographs and sometimes with 3D animations. The rooms are implemented as movable panoramic photographs of halls.

The Virtual Smithsonian [6] allows visitors to take a virtual, audio guided, room-by-room tour of the whole museum. The visitor can navigate from one non-movable 3D hall environment to another and explore hotspots containing 3D artifacts, high resolution images, video and audio clips, etc.

In „Anne Frank Secret Annex“ [7] virtual museum visitors can virtually walk and move around the panoramic 3D rendered images of rooms in the house, in which the Frank family and other Jews were living and hiding during the WWII. Beyond the ability to explore the house in great detail and click on various extras with additional information, such as text or films, visitors can hear the series of stories, accompanied with the ambient sound and music that describe what happened to people in hiding. These audio narrations bring Anne Frank’s life story to people's attention all over the world. They are based on the stories from now famous Anna Frank's diary and reports of witnesses from the Anne Frank House archives.

In contrast to Anne Frank’s virtual museum where visitors listen to stories randomly by clicking on info nodes, Sarajevo Survival Tools [8] virtual museum uses linear storyline to share the story about the life of Sarajevo citizens who were forced to live under the siege for 3.5 years (1992-1996). To the best of our knowledge, it is the only known example of this VM concept. The digital story is divided into segments organized in a logical sequence. The story segments are profound to present an interrelation of exhibit objects within a specific theme, all linked through a storyline. In between story segments the user can visit the corresponding exhibition gallery. Exhibition galleries are implemented as non-movable virtual imaginary spaces with links to interactive 3D models of objects made by people in Sarajevo in order to survive the siege, movies about them and galleries of photos.

All these virtual museums use some kind of storytelling guidance through their collections. Our research question is if it is possible, in such kinds of virtual museums, to use the story as a visual distraction to make visitors of virtual environments do less moving and clicking

and more listening and viewing when the story is interesting and compelling enough to distract their visual attention.

3. Audio guided virtual museum

In this paper we introduce the concept of audio stories guiding the user through the virtual exhibition. Our goal is to explore whether the audio storytelling can compensate movement limitations in a virtual environment. Our case study is the virtual museum of Bosniak Institute in Sarajevo [14].

The Bosniak Institute is a cultural center located in Sarajevo, Bosnia and Herzegovina (Figure 1). Its work is focusing on promotion of the cultural heritage, historical truth and culture of the Bosniacs and other peoples with whom they have been living together for centuries. It was founded by Adil Zulfikarpašić, a politician, publicist and patron of the arts. The institute is housed in a renovated sixteenth century Turkish bath and includes a library, an art center, archive, collection of old manuscripts and old maps. There are also: a collection of Syrian furniture, a collection of furniture from Safvet Beg Bašagić family (Bosnian writer considered the father of Bosnian Renaissance and one of Bosnia's most cherished poets at the turn of the 20th century), and the collection of various antiquities from Bosnian history and culture.

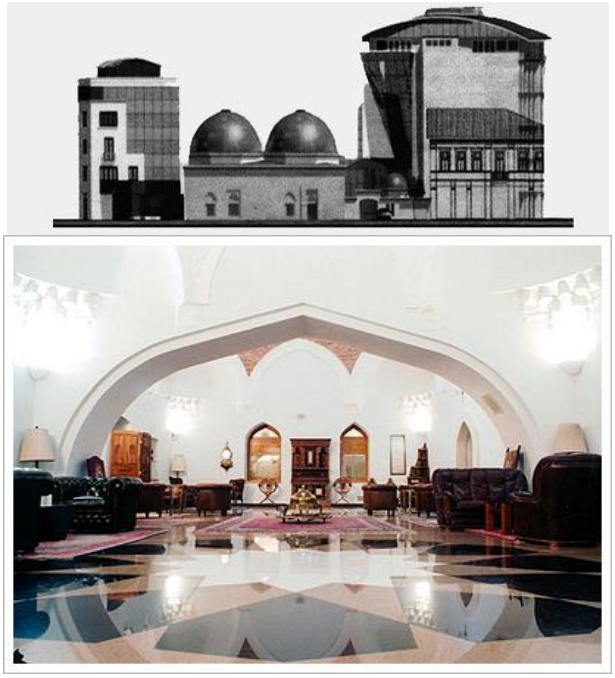

Figure 1. Bosniak Institute: exterior (above) and interior (below)

The virtual museum project was implemented through the lab coursework of the Computer Graphics course at the Faculty of Electrical Engineering in Sarajevo. Students were creating the individual exhibits' virtual representations that were connected in the virtual museum through the joint virtual environment.

Creation of virtual environment (Figure 2) is performed as follows. We have taken pictures of the real museum and all the exhibits. Virtual environment was supposed to resemble a part of the real museum, and to be as realistic as possible, so we have used 3ds max and Flash. Exhibits are grouped similarly as they are arranged in exhibition rooms of the real museum. For every virtual room a short audio story is recorded. The audio story is supposed to act like the curator in the real museum, to intrigue the visitor and to make him or her visit as much exhibits

as possible. Audio stories should help the visitor in navigation through the virtual museum and introduce him/her in the context of the exhibition. Figure 3 presents the structure of the virtual museum project.

Figure 2. Home page of virtual museum

Our virtual exhibition consists of the Syrian furniture, furniture from Safvet Beg Bašagić's house and collection of various cultural heritage objects. The home page of the Virtual Museum is linked to the pages of: library, archive, manuscripts, maps, artwork, and benefactor and to the page of 3D exhibits as presented in the Figure 2. When the home page loads, an audio story starts with information about the Bosniak Institute. After the visitor clicks on the link to the 3D exhibits, another page opens with audio story about the objects from Bosniak Institute (Figure 4).

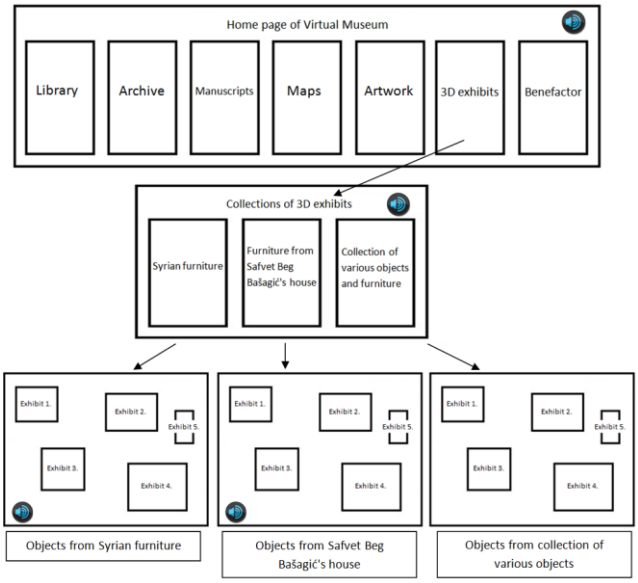

Figure 3. Structure of virtual environment

From this page, the visitor can choose to go to one of the three pages: Syrian furniture (Figure 5), furniture from Safvet Beg Bašagić's house (Figure 6) and the page with collection of various items and furniture (Figure 7). After choosing one of those pages, the user can select a single item and explore it through its web page. On each of those pages, an audio story is also loaded with information about the chosen collection. When the visitor clicks on a particular item from the chosen collection, a new page is open with digital content related to that item (pictures, 3D model, video and gallery of photos, Figure 8). The visitor can mute the audio story in order

not to be annoyed if he or she has already heard the story during the previous visits to the virtual museum.

Figure 4. Selection of exhibit group

Figure 5. Syrian furniture

Figure 6. Furniture that belonged to Safvet-bey Basagic

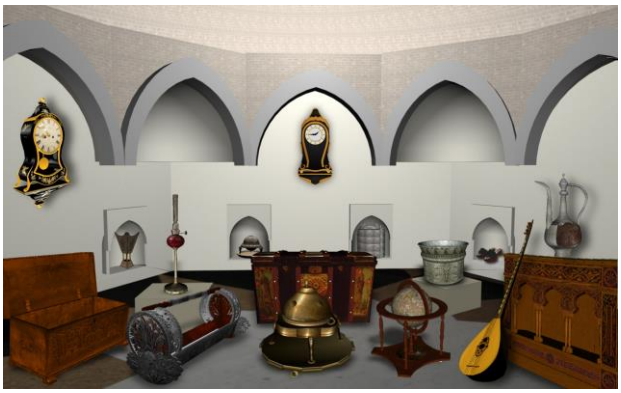

Figure 7. Collection of various items and furniture

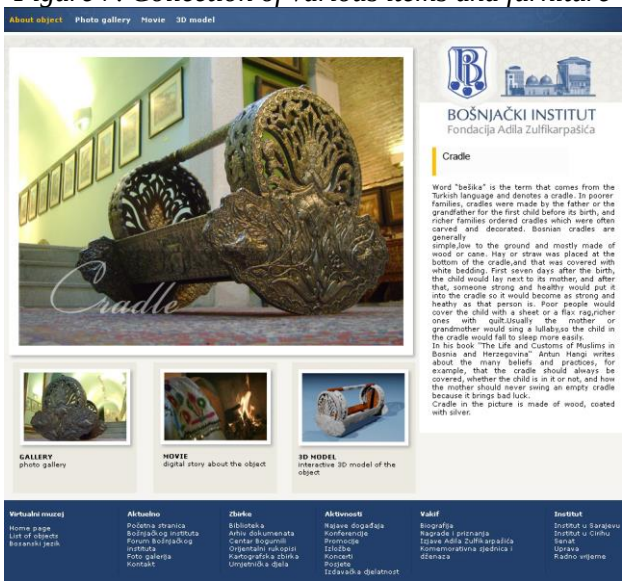

Figure 8. Cradle exhibit homepage

4. Evaluation

Evaluation of the audio guided virtual museum concept has been conducted using the two means: questionnaires and in depth interviews. The main goal of both user studies was to determine if the audio storytelling was enough for guiding the users through the VM collection, considering that they had no possibility to move in 3D virtual environment. The analysis of results was performed using qualitative analysis methodology [12] and therefore no statistical calculations were used for results analysis. Since the practice has shown that 7 users will find approximately 80% of problems of a graphics user interface [12] we have performed the user studies on 14 users in total.

4.1. Experiment design. *4.1.1. User study based on questionnaires*. Ten users participated in the study, 4 male and 6 female. They aged from 25 to 50, with the average age of 35. All of them reported normal hearing. Also all of them, except two users, reported normal vision. There were no particular criteria for selecting the users. All of them were from Bosnia and Herzegovina.

We created a semi-structured questionnaire, with both open-ended and specific questions (some of them displayed in Table 1), and sent it to the participants by email, along with the instructions document. They were asked to read the instructions, explore the virtual museum environment, fill in the questionnaire and send back their responses.

4.1.2. In-depth interviews. We had 4 users, 2 male and 2 female. They aged from 23 to 30, with an average age of 26. All of them reported normal hearing. Also all of them reported normal vision. There were no specific criteria for selecting the users and all of them were from Bosnia and Herzegovina. Users were interviewed based on the questionnaire from the previous section, but they had more freedom to express their opinions and time to discuss the topic.

4.2. Analysis of the results. Qualitative data analysis is based on data coding [12]. It is a process of extracting qualitative data into quantitative form. In such a process the possible values of the qualitative data are created according to the given answers. Since participants often use different terms for the same phenomenon or same words for different phenomena, it is important to perform coding as accurate as possible, without losing too much information.

The data analysis was performed in two steps: defining the hypotheses and grounding the evidence. The hypotheses were generated using the constant comparison method [13]. After coding the questions (Table 2), each of them representing a particular section, we went through the data looking for patterns.

From the data we built the following hypotheses:
(H1) - audio story improves the quality of virtual museum presentation;
(H2) - having the story to guide them through the museum, users do not feel limited even if their movement in 3D environment is disabled.

Question	Code	Possible value
What do you think about the story that guides through the virtual museum?	S1	Good Average Bad
Were you immersed in the story?	S2	Yes No
Did the story distract you from exploring the virtual museum?	S3	Yes No
Did the story contribute to your immersion in the environment?	S4	Yes No
What do you think about navigation in the virtual museum?	N1	Good Bad
Were you able to move in the 3D environment?	N2	Yes No
Did you feel the need for moving?	N3	Yes No

Table 1. The questions, codes and possible values used in the study.

The aim of this study is not to prove our hypotheses, but to build up the weight of evidence supporting these propositions, that could be used as ground theories in future studies.

Code	Answer
S1	Good (9) Average (2) Bad (2)
S2	Yes (11) No (2)
S3	Yes (1) No (12)
S4	Yes (9) No (4)
N1	Good (9) Bad (5)
N2	Yes (10) No (4)
N3	Yes (12) No (1)

Table 2. The codes and the number of answers provided

Nine out of 14 users (10 from questionnaires + 4 in-depth interviews) were satisfied with the story. Two out of 14 users said that the story was good but it could be more dynamic and 2 out of 14 users said that the story was too long, boring and distracting. Overall, the users liked the story; it made them feel as they are in the real museum, they were immersed in the story. Also it was not distracting and it acted like a guide through the virtual museum. They argumented their opinion on the story with the following explanations: "We get two things in one - It can save us time and that is what we all want" or "Story gives the intimate touch to virtual environment; visitor has a feeling like he or she is not alone, he/she feels like somebody is guiding him/her."

Results related to the codes S1-S4 give enough evidence to support our first hypothesis (Figure 9).

Nine out of 14 users liked the navigation - "It is very intuitive, and I've just followed one link to another". Five out of 14 users did not like the navigation; they found it as too static and had problems with returning to the previous pages ("You have to click too much to go back on Home page of the Virtual Museum"). One user did not answer some of the questions.

The most important result of the study is that 11 out of 14 users did not notice that the movement in 3D environment was disabled (Figure 10). On the specific question "Were you able to move in the 3D environment?" they answered positively. Most probably some of them considered as movement changing of virtual environments using links, but however, they did not report problems with lack of movement abilities. This result gives enough evidence to support our second hypothesis.

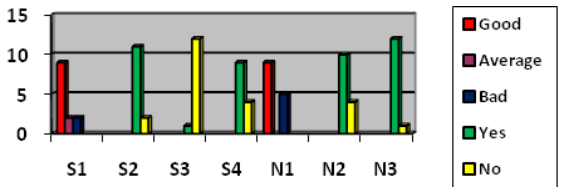

Figure 9. Graphic representation of answers

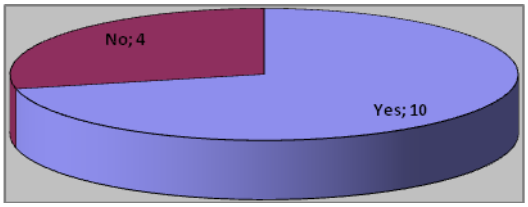

Figure 10. Graphic representation of answers to question N2

Semi-structured questionnaires also allow collecting not only the foreseen information but some additional, unexpected data as well. Besides the mentioned, positive critics on the projects, some gaps of the proposed concept were identified. There were a few complaints and suggestions about the content: „There could be some background music also“, „I know it is a student project, but could the sound be recorded by a professional narrator“, „Can pages be more interactive, as in a game?“. There were some suggestions related to the content of the story and design of the web site.

It was also interesting that users who were not from technical disciplines liked the project more than computer science professionals. Also, users who do not have much experience with virtual museums think that the environment is realistic, and do not have problems with navigation. Experienced computer users were more demanding in technical sense. They had more suggestions considering navigation and technical realisation. Almost all users said that they they had learned a lot from the project and would have liked to visit the real museum after visiting the virtual museum.

5. Conclusions and future work

In this paper we presented the concept of audio guided virtual museum. This research is a part of our exploration of storytelling in virtual museum projects, performed inside the Virtual Museum Transnational Network [1]. Results achieved by now show that the visitors appreciate story guided virtual museums, as they provide them with the context of the exhibition and historical background, not always visible from the virtual presentation of the very artifacts. The story also enhances their immersion in the different space and time.

Audio guided virtual museum of Bosniak institute introduced audio storytelling in virtual environments presented as still images with links (hot spots). We were interested to explore how the users react to the movement disability and if the audio story can make up that limitation without decreasing the overall quality of the virtual museum.

Qualitative analysis of the user study results shows that most of the users do not even notice that they are not able to move in the virtual environment. They also find that audio storytelling improves the overall quality of the virtual exhibition.

In the future work we will perform more different user studies in order to find the best relationship between the storytelling and freedom of movement in virtual museum environments. We will also explore how to make the storytelling more interactive, incorporating it in serious games for cultural heritage.

Acknowledgements. Virtual museums developed by Sarajevo Graphics Group are included in FP7 NoE Virtual Museum Transnational Network V-MusT.net [1].

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