Visualization of Landscape Changes in a 3D Environment using the Storytelling Approach

The Example of the City of Pristina

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This thesis proposes a detailed concept of how landscape changes can be transferred and communicated in a 3D environment using the storytelling approach. According to Mocnik and Fairbairn [1], maps are good to represent a geographic space but text have a better benefit than maps for telling a story.
In this thesis, a framework is presented on how a landscape change can be retrieved out of textual descriptions. A prototype of a 3D model with a projection on top of it was developed. The case study tells the story of the landscape change in the City of Pristina. The key element of the visualization is a timeline. Several media like cadastral maps, orthophotos, texts, graphics, and background sound are used and combined in an animated lightshow and the visualization was evaluated within a user study.

OBJECTIVE

The main objective was to investigate how textual descriptions about landscape changes can be transferred and attractively communicated in a 3D model using the storytelling method. The main objective was split into two sub-objectives:

I. Visualization of textual descriptions using storytelling method.

II. Evaluation of the effectiveness of the visualization (3D model and projection).

VISUALIZING THE LANDSCAPE CHANGE

A prototype consisting of a 3D wooden model and 10 buildings with transparent PLA material has been developed (figure 1 and figure 2). A projected lightshow overlaying the 3D model and the buildings for the City of Pristina was implemented. The key element of the integrated user interface is a timeline. The types of elements used within the projection are cadastral maps, orthophotos, text, various graphics, and background sound.

The main landscape change has occurred from 1893 until 2018 is Marshall Tito Street where it has been transformed into the main squares of the City of Pristina. At the location of Marshall Tito Street, now the Zahir Pajaziti Square and the Mother Teresa Boulevard are located.

The combination of a 3D wooden model and a timeline provides a compelling level for landscape changes.

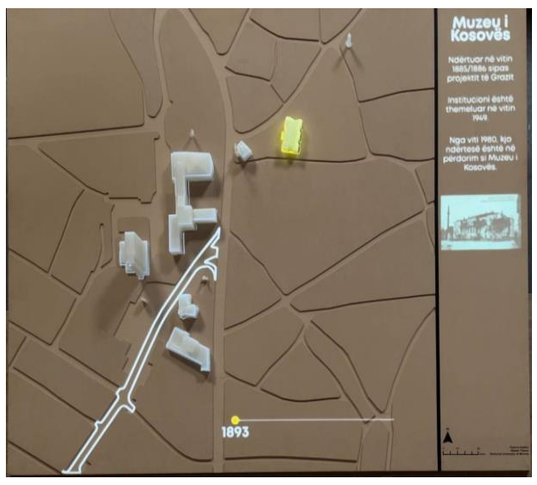

Figure 1. Information on the objects.

The timeline help users to understand the underlying landscape changes over time.

Although, orthophotos can detect landscape changes by taking the same scene at different times. The orthophoto's from 2001, 2004, 2009, 2012 and 2018 were used in the timeline.

Audio was used for narrating the main information for all the 10 buildings. In addition to the audio, text was also displayed in a shorter version in a reserved section on the 3D wooden model. Objects and roads are colored with different colors (yellow, white) in order to draw the user's attention to important information in a text. Yellow is displayed when objects and roads are shown one by one with important information while white color appears at the beginning of the projection.

RESULTS

In order to test the effectiveness of the visualizations, this research used questionnaire and interviews which allowed both quantitative and qualitative analyses to derive insights. The questionnaire method was chosen to evaluate the effectiveness of visualizing landscape changes in the context of storytelling. Interviews have been used to interact with participants and to get insights into participants opinions, feelings, behaviors and experiences. Besides, the strategy of interviews does require great listening, locks in, and asking abilities of the interviewer [2].

Figure 2. Qarshia Mosque printed with PLA material in 3D.

Prior to the start of experiment, a brief information was given to the participants about the experiment. Afterward, users were asked to fill in the questionnaire with some general questions about previous knowledge concerning the changes that have occurred in Mother Teresa and Zahir Pajaziti Boulevard.

Afterwards, users were asked to explore the exhibition themselves one by one. Upon completion, an interview with an accompanying questionnaire was conducted. The evaluation was completed by 20 users with different professional backgrounds and prior knowledge.

The majority of users found the combination of the multimedia elements an attractive solution for describing the landscape change. The time series elements helped users best to see the visualization of changes.

CONCLUSION

The multimedia methods and techniques used to visualize the change for the City of Pristina are a recommendation for similar cities that have overcome a similar landscape change, but not for cities or areas that have undergone a different type of landscape change. In the case of Pristina, the data collection was difficult as the textual data was very rare. With more information, the projection would incorporate more details or select different locations in another part of the city.

Another scale and consequently more 3D building models are suggested for a future continuation of the thesis case study. The implementation of this idea in another city would be the determination of the smallest scale so that the space is larger and the presentation of the multimedia elements would happen more often. Frequent animation presentations would make storytelling more realistic and more emotional.

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