Re-Building a Historical Cityscape with Virtual Reality

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Keywords: Virtual Reality, 3D Modeling

Abstract:

The city centre of Würzburg was almost completely destroyed during an allied air raid on March 16th, 1945. The extent of the destruction is thematised and presented in various ways, for example in the books *Würzburger Chronik des denkwuerdigen Jahres 1945* by Hans Oppelt or *In stummer Klage* (no author). However, there are only a few examples that display how life and the cityscape looked like before the bombing or before the National Socialists came to power. For this reason, we developed a Virtual Reality (VR) application to provide a realistic image of Würzburg before the 1945 destruction. We focused on a street in the city-centre (*Domstraße*), a central street in Würzburg with many adjacent landmarks, such as the *Würzburger Dom* (cathedral), the *alte Mainbrücke* (bridge) or the *Grafeneckart* (town hall).

The VR application developed in this project is based on different types of sources. Examples include two panoramas from the book *Würzburger Chronik des denkwuerdigen Jahres 1945* by Hans Oppelt, as well as more than 100 pictures from the archives of the *Verschönerungsverein Würzburg* (see Figure 1). With the help of these data and the modelling software 3ds Max, the individual visualization objects, especially the building facades, were virtually modelled in the process of the project.

Figure 1. Panorama of the north side of the Würzburger *Domstraße* and three illustrations from the archives of the Verschönerungsverein in Würzburg.

The next step was to export the finished 3D models into the game engine Unity, where the actual VR application was created. However, the mere addition of the 3D models does not yet create an immersive application. The scene still appears static and lifeless without atmospheric elements.

In order to create an exciting and lively atmosphere, we modelled and animated a tram, which repeatedly moves through the scene. Since illumination also plays an important role for creating a realistic atmosphere, we placed several streetlamps in the scene and illuminated them to guarantee optimal lighting of the *Domstraße* both during the day and at night (see Figure 2). Unity's High-Definition Render Pipeline has a considerable influence on the graphic quality of the application and facilitates creating high-fidelity graphics on high-end hardware.

Other atmospheric elements are:

- Smoke from the chimneys and ambient noise such as the ringing of the cathedral or tram bells

- Lighting and time of day change

- Interactions with buttons

The buttons in particular offer the users the possibility of interaction and thus allow them to decide for themselves in which atmosphere the *Domstraße* should be viewed. Hence, there are four interactive buttons in the scene with which users can switch between day and night, view the *Domstraße* from the perspective of the tram, make it snow or switch the sound on and off.

Figure 2. The *Domstraße* by day and night

With the right technical prerequisites, the appropriate image data and a lot of time (approximately 400 hours), we created an immersive VR application and also a desktop version of the application. In the desktop version, users can view the scene without VR glasses and can move around using only the mouse and keyboard. The application enables interested people to discover the historic *Domstraße* before its destruction in 1945 and to learn more about the old cityscape in a playful way. The use of VR in particular will appeal to a younger target group and bring them closer to the history of the former city center.

Looking to the future, we can imagine developing a mobile version in addition to the existing applications. This would again significantly expand the target group, since the application would be accessible from every smartphone (see Figure 3).

Figure 3: Mockup of a smartphone application