

The Virtual Rotunde

Bringing Industrial heritage back to life

Virtual reconstructions find a widely range of application in cultural heritage and are used for documentation purposes, virtual tours, material and surface analyses and many other cases. Rapid technological advances make it possible creating complex building reconstructions on a highly detailed level while simultaneously processing the data in real time environments. Nevertheless, most of these digital building models are used only for visualization and presentation purposes. This reconstruction project aims to go one step further, digitally preserving a significant building and returning it to its original use as an exhibition environment, but on a virtual basis. The focus is on the question of how the virtual building can be reached as barrier-free as possible and without specific hardware by the widest possible audience, while at the same time exploiting the new possibilities of the game engine technology to achieve a maximum of realism.

Vienna's historic center with its numerous old buildings is not without good reason a World Heritage Site, but most of the large industrial buildings from the historicism era, such as the former five terminal stations, are no longer existing, or, in the case of the gasometer buildings in Wien Simmering, have been converted to such an extent, that their original quality is no longer recognizable. A perfect example of lost industrial heritage is the Rotunde, the central building of the Vienna world's fair in 1873. At the time of its completion, the Rotunde, with a span of 108 meters and a height of 84 meters, was considered the largest domed building in the world and joined the list of spectacular exhibition architecture, such as the Crystal Palace in London or the Eiffel Tower in Paris.. The history of this building, which was initially viewed critically, came to an end with the major fire on September 17th, 1937, but over the years had become an important landmark in Vienna.

With the publication of sketches and photos from the time of the world fair in the online library of the Wien Museum (Wien Museum Online), sufficient information was available for a detailed 3D reconstruction. After the modeling phase, all geometries, materials and textures were transferred to Epic Games Unreal Engine (Unrealengine.com, 2019). An initial exhibition use case was implemented rebuilding old mechanical objects and machines with building blocks digitally derived from the "Matador" construction kit, a famous technical building system toy. Levers, gears and transmissions of the models are able to interact with each other. Object information can be interactively displayed for each machine model. In addition to detailed surfaces and materials of the interior, a simulated day and night cycle provides changing lighting moods and is intended to give visitors a realistic impression of the Rotunde. Thanks to the underlying streaming technology, visitors can call up the exhibition in their web browser without any additional software; the complex rendering process runs in the background based on cloud services and sends the necessary 3D data packages to the user.

The following requirements were met during an initial four-month public test phase with 550 visitors until the end of April 2024.

- Easy navigation:

Simple keyboard navigation, but also use of the touch interface for mobile devices could be created with the Unreal Engine with only slight adjustments from the basic range of functions. With a navigation overview and predefined positions within the Rotunde, the inexperienced visitor can jump back to predefined starting points at any time.

- realistic 3D visualization

The highly detailed geometry is implemented using Unreal's virtualized geometry system called "Nanite" and the dynamic global illumination and reflection system "Lumen" (Epic Developer Community, n.d.). The geometry system proved to be stable, no geometric simplifications were made in favor of a smooth gaming experience.

- Easy accessibility

Equipped with an appropriate internet connection, the remote streaming technology (Unreal Engine, 2020) distributes the 3D data as an interactive video stream to any device such as notebooks, tablets or smartphones. No special hardware is required. Furthermore, no additional software installation is required. The 3D application can be accessed directly via the web browser.

- Hands on experience with exhibits

Some of the Matador toy models on display are equipped with an interactive simulation of their mechanical function. Visitors can interact with these models via provided navigation elements.

Further test cases focus on a smooth transition between 3D information from the game engine and the 2D web interface and a better process that integrates existing scanned or modeled 3D data faster with better changeability.

Many of the game engine realizations currently available are either based on a technical view that includes 3d environments with more arbitrary or simplified geometrical content, or are built on fantasy-like worlds with different styles ranging from medieval to steampunk, supported by a growing mix of AI-generated background content. With this small test case, it was possible to prove that 3D cultural heritage data is another important source that represents historically correct geometry either from scanning technologies or, as in this case, from pure 3D modeling. By using Unreal's virtualized geometry system, simplifications and adjustments to 3D data for a smooth gaming experience were almost unnecessary, although resource-saving working methods are always useful during the development process.

Even if the concept of the metaverse has been treated almost inflationarily in recent times, virtual worlds will take their place in our everyday environments in the future. This approach aims to propagate "pearls" of industrial culture, that are no longer existing, as essential part for virtual environments. This not only provides a digital model preservation, but the interaction in virtual spaces leads to a new usage and continues the history of the industrial monument in a new and exciting way. The current status of the development can be followed on the website of the Virtual Rotunde (Schnedl, 2023).

References

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