Game engines as a method for inventorying and mediating a historical landscape

Introduction

The rapid rise of 3D- technologies has been significant in the practice of recording archaeological sites and cultural heritage management. At the same time, conventional data acquisition and data management may not be sufficient by itself to gather all the information of a site. Despite the efforts to manage metadata and paradata (London Charter, 2009) in a proper way, questions about accessibility and costs often remain unanswered. However, a democratisation has taken place with open sources and free licensed software.

In this paper, we propose that these two aspects together with traditional archaeological and data acquisition techniques can be combined. We argue that by using a 3D game engine, it is possible to create a visual database in form of a digital reconstruction based on an inventory of a cultural landscape.

We will demonstrate how we utilised the 3D-game engine Unreal Engine and the open-source 3D-modelling program Blender, to visualise and mediate the data collected from the "West-link project" in Gothenburg: the construction of a railway tunnel through the city centre that has led to extensive excavations, unearthing Gothenburg's history back to its founding in 1621. The 3D aspect of the project we are presenting is part of the documentation, spatial analysis, and public outreach work we are conducting at the West-link project.

The result, in form of a digital reconstruction of the historic landscape, offers a myriad of possibilities in the management of cultural heritage. It brings the possibility of mediating knowledge to wide audiences, from academia to educational diffusion such as schools or museums.

Material / Data

The data utilised to construct our digital landscape comes from

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primary sources such as excavation results, geographical data in Intrasis (a GIS based software specialised in archaeological data), laser scanners, LiDAR-data and photogrammetry, as well as secondary sources such as historical records, maps and documents.

Furthermore, an already existing low-resolution 3D-model of Gothenburg in the year 1700, created in 2017 in Unreal Engine 4, was used as a foundation.

Methodology

The project started with the theoretical assumption that any 3D model or virtual environment is largely based on the hypothetical representation of a physical object and its reconstructive process. The fundaments of this reconstruction are the primary sources from excavations followed by the secondary sources as an important part of the reconstruction. Following the work of Demetrescu and Ferdani (2021), we divided the data into archaeological stratification (primary sources) and virtual stratigraphic unit, that is, the hypothetical reconstruction of the former. This is important to distinguish as “Authenticity”, mentioned in Principles of Sevilla (2017:6) When this data is gathered and analysed the virtual process begins with the use of the programs Blender and Unreal Engine.

To reconstruct the historical landscape, an 8 km² LiDAR data map of the Göta River Valley was imported into the GIS program Q-GIS, along with several of the earliest historical maps of the area. A digital elevation model (DEM) of the 17th-century shoreline was created using the add-on Serval 3.10.5, which was used to manipulate the LiDAR data and remove later landfills caused by industrial activity. The DEM model was imported into Unreal Engine 5.3, a game engine compatible with digital elevation data, where the landscape was recreated to the correct scale.

The modelling of Gullberg Fortress and the Gothenburg fortifications began with the import of all relevant archaeological data from Intrasis as shapefiles. Using the Blender-GIS add-on, the georeferenced measurements were converted into polygons, which were then imported into Unreal Engine. The two photogrammetric models were imported and scaled to the previously modified digital terrain model and the measurements from Intrasis.

Finally, maps and profiles were imported using the "Image to Plane" add-on in Blender to convert the images into textured

models a placed in scale to the geography. Unreal Engine's built-in sculpting tools were then used to add and remove landscape features.

Results & Conclusions

The result so far is a digital visualisation of the inventory of Gullberg fortress and its surrounding historical landscape as it may have looked around the year 1612, based on our interpretations. During 2024 and 2025, the project will extend to encompass the city of Gothenburg. The goal is to reconstruct several time layers within the city's development, based on the features excavated during the West-link project.

The model is primarily presented through the program 3D-Vista, which enabled a web-based 360-degree experience.

Beyond its use for communication, the model functioned as a three-dimensional testbed for interpretations and hypotheses about how the various archaeological structures related to each other.

Discussion

We believe that 3D-models present new possibilities for interpretation and digital preservation of cultural heritage, as well as the mediation of archaeological results. Due to the flexibility of the game engine, a 3D-model can be adapted to different needs and wants; from professional use, aiding the analysis of spatial relationships, to use in exhibitions or development of educational videogames. It also does not limit itself to traditional desktop setup with monitor, mouse and keyboard but opens the possibility of utilising immersive hardware such as VR-technology.

However, we think there is much to define and to work with, the gap between the development of recording tools, data acquisition and the more detailed analyses and interpretation of the archaeological material is still wide (see Forte, pp.,128). It is by continuous practice in this issue that researchers can collaboratively establish general norms which facilitate the analysis and consequently the quality of the results.

References:

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