HBIM: a method on the test bench

Analysis of the usability of HBIM for cultural heritage buildings in three cases

Introduction

As the amount of research and documentation data in the field of cultural heritage increases the tools for managing, analysing, storing and representing the data can't keep up. The methods of digital and three-dimensional data acquisition are becoming more accessible and provide an additional increase of data. Methods like Heritage Building Information Modeling (HBIM) can help with the task but must be adapted to the individual requirements of each building and the tasks and issues involved.

Methodology

The work focuses on the usability of HBIM for larger heritage buildings in the field of building research and heritage management. The focus of the modelling process was on structuring the data rather than on the representation of precise geometry. The actual geometry is already represented by the point cloud and the original building. Revit was chosen for this task because it was developed exclusively for BIM, can handle large point cloud data well and was available as a license through educational institutions. Though the case studies differ very much, the applied method of HBIM should be as comparable as possible. Therefore, all the data is processed in an equal way and the buildings are modelled in the same software environment on basis of the point cloud.

Data

The basis for the HBIM-models are point clouds mainly obtained by terrestrial laser scanning, partly supplemented by point clouds obtained from photogrammetry. The method of HBIM is being tested with three different case studies. Those vary in construction, size, state of preservation and use of the building and are briefly presented below.

Villa of Sette Bassi

The south suburbia of the antique city of Rome in Italy was the location of the so-called Villa of Sette Bassi. The three main buildings with baths and a big architectural garden of the Villa were built in the 2nd century AD, based on the various brick stamps (Seiler and Weferling, 2018, p. 86). Only a few rooms of the villa remain today and it is in a ruinous state.

St. Valentines Hospital

In the town Felsberg in Hesse in the middle of Germany an old hospital named St. Valentines Hospital is constructed of timber frame. The hospital was built in 1522 as a two-storey building with a basement (Stöhr,1996, p. 130). It is in a slightly damaged condition and out of use.

Former carpet factory

The former carpet factory was originally built in 1912 in the small city Wurzen in Saxony located in the east of Germany near Leipzig (Töpel and Klinkhardt, 2014, pp. 154-156). At the time of data acquisition, the five-storey building was a reinforced concrete construction with external walls of bricks in a well-preserved state soon to be renovated and reused for living.

Results and Conclusion

The first results show that as one could expect it is easier to handle a modern reinforced concrete building with HBIM rather than a ruined antique villa. But there are some issues that have to be addressed in all cases and also the opportunities the method provides can be seen with any heritage building. The software offers a good and systematic structure with which important information and findings about the building can be linked using so-called attributes. These are supplemented with automatically generated attributes from the system, such as the dimensions of a wall. The attributes and the classification of the components are in turn very static and are difficult to adapt to historical buildings. A good example is the absence of the component category “vault”, so that these have to be categorized as “ceiling”, which does not fully correspond to the function.

Discussion

In this research three larger building structures are being modelled and organized with HBIM. The results of this process and the knowledge gained by it are used to understand the possibilities and limits of HBIM. The work with HBIM in the cultural heritage field can only show its full potential if the data can be accessed and used by different stakeholders. One of the biggest issues with HBIM is the lack of reliable options to share, publishing and archive the data. The standard exchange format for BIM-models is the Industry Foundation Classes (IFC) format, which is constantly being further developed (Berlo et al., 2021). It is also the standard exchange format for HBIM data. Though IFC can be created and read with any standard BIM software, some important data might be lost in the process. In various tests, models were exported in IFC formats from Autodesk Revit and then opened with various open source viewers. The results were partly acceptable but mostly inadequate due to missing information and/or poor representation of the geometry. Importing the IFC files back into Revit produced catastrophic results with broken geometry and the absence of most attributes. Therefore, a solution is needed that will represent the HBIM data in a reliable format without restrictions due to licences, logins or paywalls.

On the other hand, HBIM shows great potential for reconstructions of historic buildings. The ability to create different reconstruction proposals in one environment and compare them with each other or with the existing building is a great advantage. However, this advantage can only be put to good use in scientific contexts if the problem of data shareability is solved.

References

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