

Web-based platforms and metadata for 3D cultural heritage models

A critical review

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Keywords: *Web repositories — 3D digital cultural heritage models — 3D visualisation on the web — 3D metadata*

CHNT Reference: Rigauts, T. and Ioannides, M 2020. Web-based platforms and metadata for 3D cultural heritage models: a critical review. Proceedings of the 25th International Conference on Cultural Heritage and New Technologies.

Introduction

3D digitisation of cultural heritage (CH) has become increasingly widespread in the past decade. New and more affordable technologies have made it much easier to capture, model and publish tangible CH assets. These developments have led to a substantial growth of online platforms which provide access to 3D CH content, raising the question as to how all this data can be documented, stored, archived, preserved, and published by giving access to a variety of both professional and non-expert users worldwide.

Despite commendable efforts by the international community such as the 3D Content in Europeana Task Force (2018, 2020) and a number of EU-funded projects (3D-COFORM, 3D-ICONS, CARARE, PARTHENOS, Share3D, et al.), there is currently still no single internationally recognised standard for the storage of 3D tangible CH assets. Each stakeholder (e.g. museums, cultural institutions, etc.) has its own approach to recording, documenting, and archiving their 3D CH content, as well as different ways to make their collections accessible online. Although a variety of web-based platforms are currently available, they differ greatly in how they present these digital models and provide associated metadata.

For the first time, this paper analyses, compares and critically reviews online platforms that are used for storing and visualising 3D digital replicas of CH assets. A particular focus goes to the manner in which these assets are uploaded, stored, archived and presented, which metadata is included to describe the 3D CH objects, how users can interact with 3D content and which domains in the CH sector may benefit from (re-)using these online assets. Based on the gaps identified in the comparative analysis between these platforms, the authors argue for the *development of a digital 3D repository where the knowledge held by the CH object is presented in a holistic way*. This platform should be a single point of access, where users can access unique knowledge about the 3D CH models, which are enriched by other digital data and metadata so that they can easily be stored, archived, presented, preserved, studied and shared with the rest of the world.

Digital knowledge containers and metadata for online 3D cultural heritage content

As a result of steadily increasing technological advances in 3D surveying and modeling, a sound strategy for the long-term archiving of 3D CH models becomes increasingly important to ensure the digital conservation of our heritage. At the same time, dissemination of CH is essential to reach the wider audience possible. This paper will analyse online 3D CH repositories according to a set of parameters that play a significant role in ensuring the long-term preservation, dissemination and (re-)use of digital 3D CH assets. Currently widely used web-based platforms (such as Sketchfab, Smithsonian 3D, Potree, 3DHOP et al.) are reviewed according to their metadata, visual presentation and interaction, and use and re-use capacities.

Uploading and storing 3D content online

The challenge of long-term sustainable e-preservation of CH assets starts already with the internationally accepted standardisation (or lack thereof) of 3D data formats. These data formats are strictly bound to the devices and software used to record and process 3D information. The large amount of (proprietary) file formats available often make it difficult to exchange 3D content and its corresponding recorded metadata is closely related to acquisition tools and their modeling software. Supporting the most common and relevant 3D file formats is essential for an online repository to allow users to easily store and archive their digital CH content online. This paper reviews how straightforward and sustainable the process is to upload 3D CH content on the current range of web-based 3D platforms.

Metadata for online 3D cultural heritage assets

Digitising cultural heritage in 3D is a very complex process that involves using specific equipment and has several stages, including data acquisition, (pre-)processing, modeling and sharing 3D models for various purposes and different users. To capture the whole spectrum of this process, this paper argues for enriching the 3D CH content with meaningful metadata at every stage. Therefore, to holistically describe a 3D replica of a CH asset, its metadata should ideally include information on 1) the physical, real-world CH asset (including rights), 2) the digitisation process (or paradata) and 3) the final digital resources and data corresponding to the CH object. This paper presents metadata as an essential factor for the online preservation, visualisation and interpretation of 3D CH assets, which is vital to ensuring the quality, sustainability and repeatability of 3D documentation for future generations.

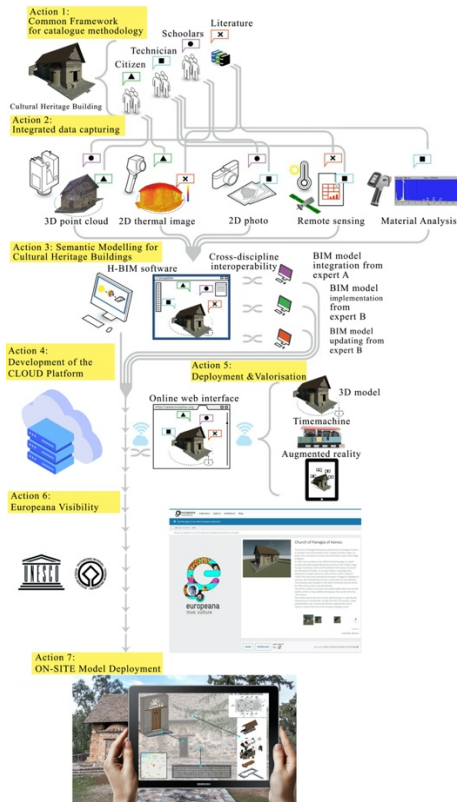


Fig. 1. A holistic approach for the 3D documentation: From Data Acquisition to the 3D Model and Europeana (© DHRLab, CUT)

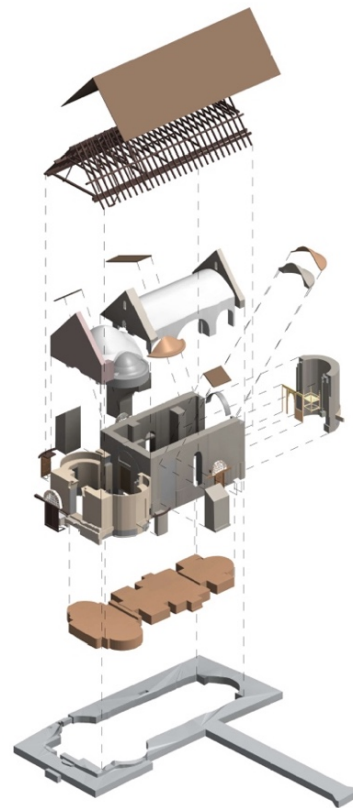


Fig. 2. The different 3D geometrical elements of the World Heritage site of Asinou church in Cyprus (© DHRLab, CUT)

Preserving and presenting tangible cultural heritage in 3D

Visualisation and interaction are key to the use and re-use of CH objects for different types of audiences. While annotations and animations may be useful for educational purposes or the general public, researchers and professionals may benefit more from using measuring and semantic selection tools. The online platforms under review in this study, are providing standard transformation operations for all of their 3D content (such as rotating, panning and zooming). Some offer more advanced and interesting ways to present and manipulate 3D content. This critical review of online 3D CH platforms maps the different ways CH content is currently presented and interacted with and offers a preliminary methodology for a layered approach to 3D CH presentation.

Conclusion

This paper presents for the first time a critical review of the currently available web-based repositories which offer the capability to visualise and describe 3D CH models. The full paper will clearly demonstrate that there are still many key challenges and issues when trying to aim for a holistic documentation of CH and an internationally standardised way of preserving and accessing 3D CH replicas. These challenges will be presented with a particular focus on 3D knowledge availability, interoperability and retrieval of 3D CH content.

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