

Basic principles and tips for 3D digitisation of cultural heritage

The Expert Group on Digital Cultural Heritage and Europeana has been tasked by the member states to contribute to the development of guidelines on 3D cultural heritage assets. The resulting list of basic principles and tips for 3D digitisation of tangible cultural heritage contains 10 basic principles and a number of tips for each of them geared toward cultural heritage professionals, institutions and regional authorities in charge of Europe's precious cultural heritage.



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The entrance hall of palais de justice in Brussels

In the 2019 Declaration of Cooperation on advancing the digitisation of cultural heritage, 27 European countries have called also on the European Commission's Expert Group on Digital Cultural Heritage and Europeana (DCHE Expert Group) to contribute to the development of common guidelines for comprehensive, holistic documentation of European 3D cultural heritage assets.

As part of their contribution, the DCHE Expert Group, using also input from other external experts as mentioned in the Acknowledgments section, has drawn up a list of basic principles and tips for 3D digitisation of tangible cultural heritage.

The list of basic principles and tips below is especially for cultural heritage professionals and institutions, and other custodians of tangible cultural heritage, including local and regional authorities, who are in charge of cultural heritage buildings, monuments, or sites, who do not have any experience with 3D digitisation yet, neither directly nor via an external service provider. At the same

time, it is also for all other such professionals, institutions and authorities, who may find here useful new principles or tips to help them in achieving the best results in 3D digitisation projects.

This list is a living document that will be updated whenever necessary, and any suggestions for changes or additions would be very much welcome at the DCHE's email address.

Principles and tips

This list contains 10 basic principles for 3D digitisation of tangible cultural heritage, and a number of tips for each of them. You can find more details and advice by following the 'Read more about...' link at the end of each section. You can also look at the full clickable report in pdf.

The basic principles at a glance

1. Consider the value of and need for 3D digitisation
2. Select what to digitise and for what use cases or user groups
3. Decide whether to digitise in-house or outsource
4. Clarify copyright aspects and plan for open and broad access
5. Determine the minimum quality needed, but aim for the highest affordable
6. Identify the different versions and formats needed for the different use cases targeted
7. Plan for long-term preservation of all data acquired
8. Use the right equipment, methods and workflows
9. Protect the assets both during and after digitisation
10. Invest in knowledge of 3D technologies, processes and content

Acknowledgements

Other references and resources

1. Consider the value of and need for 3D digitisation

- 3D digitisation is valuable for many purposes, including conservation and preservation, reproduction, research, education, exploration, and creative or tourism-related reuses.
- 3D digitisation is a necessity for tangible cultural heritage at risk, for preservation and restoration purposes.
- 3D digitisation can provide virtual access to cultural heritage that is difficult to access or inaccessible, e.g. underwater.
- 3D digitisation can broaden access to cultural heritage for persons with visual impairments, by contributing to the creation of accessible tactile experiences.
- 3D digitisation can contribute to better protection of physical cultural heritage sites and objects by enabling research or discovery using 3D models instead of direct handling.
- However, 3D digitisation itself does not prevent risks to cultural heritage, and it is by no means a replacement of physical preservation.
- Furthermore, 3D digitisation by itself does not imply digital preservation in the long term.

Read more about point 1. Consider the value of and need for 3D digitisation (Back to the top)

2. Select what to digitise and for what use cases or user groups

- Define the rationale or purpose(s) of your 3D digitisation project.
- Focus on cultural heritage that is at risk or has high re-use value in digitised form.
- Consider the target user group(s) for whom you would digitise and how they would use such content.
- Examine the features of what you would digitise.
- Different use cases require different equipment and digitisation strategies, and different minimum quality levels.
- Involve non-digitisation departments, such as communication, education, or conservation, in co-designing and following up the digitisation project.

Read more about point 2. Select what to digitise and for what use cases or user groups [\(Back to the top\)](#)

3. Decide whether to digitise in-house or outsource

- Evaluate your in-house 3D digitisation capabilities. What human resources, skills and equipment are available in-house? What additional resources or training would be necessary?
- Carry out a cost-benefit analysis to consider whether in-house digitisation or outsourcing offers the best value for your project.
- Consider also how easy or difficult it would be to upgrade an in-house 3D work environment, and the availability of support and learning materials for the different 3D digitisation methods.
- Persons who deal with 3D digitisation, including especially when outsourcing, must have the capacity to understand the limits of different 3D techniques as well as to analyse and judge the results.
- When outsourcing, seek technical advice from 3D experts with specific experience in the area of cultural heritage and use 3D digitisation service providers with specific experience in working with cultural heritage or in other similar or relevant areas.

Read more about point 3. Decide whether to digitise in-house or outsource [\(Back to the top\)](#)

4. Clarify copyright aspects and plan for open and broad access

- Identify the rights applying and the individuals and organisations holding them, and engage in discussions with them prior to starting the digitisation.
- Define the copyright that is compatible with the identified rights, and that would be most suitable for the purpose(s) for which the digitisation takes place.
- Follow and encourage adherence to the principle that what is in the public domain should remain in the public domain after digitisation.
- Integrate licensing and copyright provisions into your access and re-use agreement, and include such copyright information in the metadata.
- When outsourcing, ensure that the call and contract require that any copyright (or associated rights), including for metadata, be transferred to the beneficiary institution or released into the public domain, and not reserved by the service provider.
- Plan from the beginning how the 3D collection will be made available to your target users.
- Provide broad public access, storing and distributing 3D models via open public platforms as

well as self-hosting.

- Ensure the content is also available in open formats, in order to prevent vendor lock-in or restrictive re-use.
- Include the metadata captured as machine-readable interlinked data (Linked Open Data), in order to enhance findability.

Read more about point 4. Clarify copyright aspects and plan for open and broad access (Back to the top)

5. Determine the minimum quality needed, but aim for the highest affordable

- Quality in 3D digitisation of cultural heritage is not only about capture accuracy and resolution, but also about other key aspects such as historical accuracy, range of data and metadata generated and collected, and fitness for purpose.
- Investigate how high the capture accuracy and resolution could be, what the costs are (in time and money), and the equipment, software and skills needed.
- Determine what the minimum quality necessary is for the target users and the way they use the content, and whether the project budget and timescale permit capturing at a higher level of accuracy.
- Aim for the highest 3D capture quality for the largest number of assets that the budget and time available allow.
- What is high model quality today may become just standard in the near future, and high-accuracy and high-resolution raw data may be useful in the future to generate new, better 3D models.
- Collect, generate and include rich metadata and annotations throughout the workflow (during digitisation, processing, visualising).
- When outsourcing, specify from the beginning what the quality requirements are, which rights apply, and what data in which formats the external provider has to deliver.
- Keep in mind that, regardless of how high the quality of digitisation, a 3D model is not a 100% exact copy of the original subject.

Read more about point 5. Determine the minimum quality needed, but aim for the highest affordable (Back to the top)

6. Identify the different versions and formats suitable for the different use cases targeted

- Purposes such as preservation and reconstruction require high-quality geometrically correct 3D models, while for visualisation or VR and AR applications, optimised decimated 3D models are more suitable.
- Use the raw data to produce a master high-resolution 3D model, which would serve as the basis for decimation and conversion into different formats to serve different purposes.
- Make the content available in multiple formats, of which at least one should be an open format.
- Follow standards and best practices, and choose open and/or commonly used formats for 3D models, such as glTF, X3D, STL, OBJ, DAE, PLY, WRL, DICOM or IFC.
- Choose a viewer/platform for delivery that works on a range of devices and which can also be supported in Europeana.

Read more about point 6. Identify the different versions and formats needed for the different use

cases targeted

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7. Plan for long-term preservation of all data acquired

- Making 3D content accessible online or otherwise does not equal archiving or long-term preservation, not even when doing multiple backups.
- Take into consideration long-term preservation from the beginning, including all aspects such as formats, storage, future migrations and re-use, ongoing maintenance and the corresponding long-term costs.
- Keep as much data as possible from the 3D digitisation process, depending on the storage and data management capabilities available, including the raw data.
- Select an archive that is able to accept the incoming digital data files, has the necessary storage space, and can offer a preservation service.
- Use and support as much as possible open file formats, software and hardware, and consider archiving also the software and any other system needed to open the files.
- Log and store all metadata collected, including the paradata about the digitisation process, and all the different versions of the 3D model generated for various uses.
- Put in place a data management system that tags all data, in order to make it easy to store and research the data.

Read more about point 7. Plan for long-term preservation of all data acquired (Back to the top)

8. Use the right equipment, methods and workflows

- The equipment and methods used have to match the category of cultural heritage involved and the quality needed for the purpose of the digitised assets.
- The size and characteristics of the target, the intended uses, the logistical aspects, the budget available, the timing and the environmental conditions all have an influence on the choice of equipment and methods.
- Carefully evaluate equipment outputs. What may be suitable for movable tangible assets (e.g. museum objects) may not be sufficient for immovable cultural heritage (e.g. buildings, monuments or sites).
- Photogrammetry is suitable for materials such as stone, wood, concrete, textile, plastic, or metal (matte surface), but not for shiny, transparent or highly glossy objects, nor for objects with loose/movable parts.
- For complex objects, both the work performed on site and the data processing last longer, and the work schedule should consider those.
- The use of drones, for 3D digitisation of buildings, monuments or sites, often requires a drone pilot license and specific authorisations.

Read more about point 8. Use the right equipment, methods and workflows (Back to the top)

9. Protect the assets both during and after digitisation

- Regard physical conservational aspects as part of risk management during digitisation.
- Carry out a preliminary study or analysis to determine the potential impact/damage of the technique used.
- Specify from the beginning of the digitisation project who would handle the cultural heritage assets, and who may come close to them.

- Make sure that any person handling the cultural heritage assets or operating any moving 3D digitisation equipment is competent to do that.
- Have professional conservators oversee the handling of objects, and involve them from the planning stage.
- Ensure that appropriate insurance coverage is in place.
- After digitisation in 3D, avoid as much as possible direct handling of the assets in question, using instead the digital twins created.

Read more about point 9. Protect the assets both during and after digitisation [\(Back to the top\)](#)

10. Invest in knowledge of 3D technologies, processes and content

- Using 3D technologies to document tangible cultural heritage is gradually becoming more commonplace, and knowledge of such technologies and processes is becoming increasingly more valuable.
- Knowledge of 3D technologies, processes and content is valuable regardless of whether you digitise in-house or outsource.
- Acquire at least basic understanding about 3D, including technical requirements.
- When engaging directly in 3D digitisation, begin with a limited scope and a limited number of assets to acquire knowledge.
- Outsourcing of 3D digitisation, too, requires an understanding of the technologies, processes and content involved.
- Training courses on 3D for cultural heritage or on 3D technologies more generally are also available online via the major e-learning and other platforms.
- If you produce learning material and/or documentation on different aspects of 3D digitisation, make that content available under fully open licences that permit re-use for commercial and non-commercial purposes.

Read more about point 10. Invest in knowledge of 3D technologies, processes and content [\(Back to the top\)](#)

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Other references and resources

Final report of the 3D Content in Europeana task force

Guidelines providing an introduction to the 3D workflow, from data capture and processing to publishing your models online, prepared by EU-funded project 'Share 3D'

Guidelines and case studies on all technical and logistic aspects to create 3D models of cultural heritage objects (3D data capture techniques, post processing of 3D content, 3D publishing methodology, metadata, and licensing and IPR considerations), by EU-funded project 3D-ICONS

Video training course on 3D for cultural heritage, by Visual Dimension bvba

Learning 3D tutorial by Sketchfab, in three parts: Simple geometry, Adding color, texture & light, and Create your own models

3D Scanning Software and 3D Modelling Software, by Sketchfab

How to set up a successful photogrammetry project, by Abby Crawford (Archaeological Graphics) on Sketchfab

GLAM 3D Open Access introduction and reference to the digital 3D content creation process

Examples of innovative digital experiences of cultural heritage, including cases that involve 3D content - Cultural Heritage @home

Guide on tactile accessibility and how 3D-printing is one technology that can support tactile accessibility

Europeana Public Domain Charter

London Charter for the Computer-based Visualization of Cultural Heritage

Smithsonian 3D Digitisation

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