Position paper: Current challenges in the context of 3D mass digitization

The following is a summary of the special sessions taking place at the 14th and 15th EUROGRAPHICS Workshop on Graphics and Cultural Heritage, 5-7 October 2016 in Genova, Italy and 27-29 September 2017 in Graz, Austria. During these sessions, practitioners and researchers discussed future trends, challenges and opportunities of 3D mass digitization in order to better implement and make use of large-scale digitization in the long term. Besides, further research related topics were defined to shape future work in this area.

Please note that the summary reflects the contributions of the participants only and is not the position of the moderators.

There are already a number of (research) projects at national and EU level, which show the benefit 3D digitization and online availability of content can provide in the cultural heritage field.

3D digitized artefacts can be used in photorealistic, interactive presentations for people not able to experience them first hand. Besides, digitizing in 3D helps documenting the preservation state for future generations to come. In case of loss or damage of the original, at least a digital replica is still available for scientists and interested people. For example, a digital snapshot of the conservation state would have supported documentation of those items destroyed and stolen during and after the Arabic spring, when robbery and sequestrating happened in the local museums.

However, digitization is not only about visualization. It is also about conveying the cultural and historical context of a heritage asset, capturing the experiences related to it and finding ways for visual expression.

For all the benefits 3D digitization brings, implementing in practice on a large scale still appears complex and raises the following questions:

- How can high costs be reduced to better implement mass digitization in practice?
- What content are we going to digitize and at which priority?
- How can scan data be enriched and interpreted?
- How can a community for 3D digitization be built and improved?
- What are the end users' needs?
- Which solutions are required, e.g. in terms of accuracy and (color) calibration?

The discussion during the session indicated that there is still a considerable need for action and research with regard to 3D digitization and automation technologies as well as the thematic areas associated with it. The following conclusions could be derived:

Increase awareness

Building user awareness and promoting the application of digital technologies remain an important point. The barriers in some disciplines to use digital tools are still high and there are striking differences between the technical understanding of some users working in the field of cultural heritage (art historians/ restorers versus computer scientists/ architects/ archaeologists).

Besides, there are only few institutions which have already established a digital infrastructure, such as some photographic departments of large museums as early adopters. In addition, the overarching question remains: How can users be best encouraged and enabled to adopt digitization technologies?

Communicate commercial aspects

Applications for mass digitization could range from wholesale companies using 3D for presenting and selling their broad range of products online, to craft industries in the cultural heritage sector making use of 3D digitization for processes that are still manual (e.g. forming molds), or to printing companies using scans of artefacts which property rights have expired for 3D print and other sales options.

However, awareness in the heritage field of how to use digitization technologies for marketing and selling is still at a comparatively early stage.

Sensitize cultural heritage institutions to 3D digitization

As part of their digital transformation, digitization technologies can deliver significant value to collecting institutions. To alleviate lingering concerns especially regarding potential damage to artefacts, their advantages need to be communicated more clearly.

A pilot project with a museum would be beneficial to sensitize collecting institutions further to 3D digitization. To raise their interest, a collection in storage of a museum undergoing renovation, could be used as online digitization example, incl. tracking the users or engaging them in form of crowdsourcing. Such approaches could provide information on the visitors' interest in the collection.

Address new training standards

The development towards 3D digitization places new demands on education and training. In the future, this will broaden the range of activities in the field of photography, restoration/ conservation, archeology and museum management and will lead to new job profiles. The need for experts in 3D digitization will be growing and experienced professionals, e.g. in photographic departments, will increasingly have to work with 3D digitization technologies and develop CGI expertise.

Currently, training is carried out comparatively hesitant and curricula are still too slow to address digital technologies. The education and training systems have to respond to the most recent developments and degree programs need to build up further, dealing with digital preservation of cultural heritage, digital collection and data management, digital curation and 3D – similar to the information management area.

This need to adapt to the digital transformation is similar to that in other industries.

Improve metadata schemata to support information management

Besides 3D capturing and modelling, the creation of metadata is an essential element of the processing pipeline.

To optimize key information and context data for curation, preservation and further research, guidelines and standards for metadata management have to be further defined, as they are still incomplete. The EU project 3D ICON is an initial approach to set up annotation standards and to make 3D content accessible on platforms such as Europeana.

Ensuring correct metadata creation in particular when using crowdsourcing approaches is essential and more funding for research into intelligent data annotation is needed.

Develop infrastructures for digitization

So far, 3D digitization has been limited to single initiatives and high profile projects, which allow museums to experiment with 3D. However, they lack the opportunities to implement 3D on a large scale because of

- poor infrastructure,
- inadequate storage, and
- reduced financing capabilities.

Besides, research projects are designed to examine a particular selection of objects only. Digitizing in 3D on a large scale is never an objective of the research scope.

Therefore, long-term solutions at national and EU level are needed which consider

- sufficient funding enabling a sustainable approach for 3D digitization, and
- comprehensive infrastructure initiatives, which support museums to implement mass digitization on a broader basis and to better put into practice all the challenges related to it, such as storage or annotation solutions.

Support from the European Commission within the framework of the Digital Agenda would help facing the problem of digitization.

Use of structural funds

The European structural and investment funds (ESIF) are an instrument for financial support in five different areas:

1. Research and innovation,
2. Digital technologies,
3. Supporting the low-carbon economy,
4. Sustainable management of natural resources,
5. Small businesses.

The funds are available for any European country and it is the Member States' decision to decide where they invest the funds. There are already some countries, which use the ESIF for digitization purposes.

Discuss open access and democratize access

The fundamental issue is the access to digital data and the rights to it. The overarching questions are still who owns cultural heritage in the first place and what copyrights do exist.

In this context, it is necessary to clarify the role of museums as custodians of artefacts and what rights they have to control the engagement of the public in digitization processes. Especially when digital data has been generated within the scope of mass digitization, greater clarity must be achieved on the question what rights the public has to use this data and if cultural heritage as a public good can be monetized:

1. Shall creative commons be put on it in order to allow people to do what they want with it as long as they do not make money out of it?
2. Or shall an open culture license be adapted, accepting that there are commercial applications for the public use? When it comes to commercial applications content could be licensed and therefore more money be spent on digitization at the end.

Research on 3D digitization technologies

There are already some convincing examples such as the digitization pipelines from Picturae (2D) or from Fraunhofer IGD (3D, CultLab3D) that allow to scan large amounts of objects both time

and cost efficiently. However, more research on automation technologies is needed to allow more efficient and optimized processes.

Furthermore, the presentation of different material properties still needs to be refined. There has been a lot of improvement to record the objects' geometry and surface texture in every single detail. But research has not yet advanced far enough to answer the question of the precise representation of their optical material properties such as reflection and absorption characteristics to allow for photorealistic 3D illustration. Unlike the presentation of geometry being less important, the presentation of the material and appearance is really key, especially when it comes to mass digitization. There are nice shapes but the texture will only be like at the time of recording from a specific angle at a specific illumination.

Stronger political activities for digitization

As the protection of cultural heritage is genuinely linked to the protection of each country's national identity, national politicians must be urged to ensure the right framework conditions and sufficient funding for research and preservation as a means to safeguard cultural heritage.

Against this background, the cultural heritage community must continue to draw attention to all the risks artefacts and the built and natural environment are still exposed to. In this regard, showing that 3D digitization is an important tool for cultural heritage preservation and documentation is essential. Otherwise, the object in danger would disappear.

Besides, it needs a political decision on national and EU level to force digitization on a broad scale. This is because practical experiences have shown that, in current times of limited financial resources in the field of cultural heritage, digitization is often not given priority over real conservation, unless there is a political initiative.

Special Session: 3D Mass Digitization – Future Trends, Challenges and Opportunities

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http://gch2016.ge.imati.cnr.it/index.php/special-session

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