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Colloque / Symposium

15 - 16 Mars 2022 / March 15 - 16, 2022

Louvre / Bibliothèque nationale de France / PARIS

Un événement organisé dans le cadre
de la présidence française du Conseil de l'Union européenne*

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This event was funded by the European Union. Views and opinions expressed in the framework of this event and in the following proceedings do not necessarily reflect those of the European Union and the European Commission. The European Union nor the European Commission can be held responsible for them.

Publié par / Published by:

Fondation des sciences du patrimoine – Foundation for Heritage Science

Avec le soutien financier de / With financial support from:

Co-funded by the European Union

Septembre - September 2022

Fondation des sciences du patrimoine
33, boulevard du Port
95 011 Cergy-Pontoise Cedex

www.sciences-patrimoine.com

Citation suggérée / Suggested citation:

Fondation des sciences du patrimoine, *Un patrimoine pour l'avenir, une science pour le patrimoine*, Actes du colloque,15 et 16 mars 2022

Foundation for Heritage Science, *Heritage for the Future, Science for Heritage*, Symposium proceedings, 15 and 16 March 2022

Cultural Heritage 3D Data on the Web: Issues and Perspectives

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Résumé

Les modèles numériques 3D sont unanimement considérés comme un atout inestimable pour l'étude, la gestion et la promotion du patrimoine culturel. L'urgence de COVID-19 a accéléré la tendance commune à travailler à distance et, pour le patrimoine culturel, la présentation, le partage et l'accès aux données 3D en ligne sont désormais perçus comme une nécessité. Malheureusement, l'absence de méthodologies, d'outils et d'infrastructures standard rend difficile le passage du stockage local à la gestion en ligne de données 3D complexes. Dans cette contribution, nous souhaitons évaluer l'état de l'art de l'utilisation avancée de la 3D sur le web, en soulignant les besoins actuels, en présentant quelques études de cas et en explorant les perspectives futures.

Mots-clés: 3D, web, patrimoine culturel, infographie, état des lieux

Keywords: 3D, web, cultural heritage, computer graphics, state of the art

3D data are nowadays a key asset for the cultural heritage domain. This is particularly true if one thinks of 3D as a metric digital replica for supporting study, analysis, and restoration, but that is also true if one thinks of 3D as an important resource for learning, dissemination, and promotion. However, exploiting these resources only locally is no longer enough. Accessing, working, and sharing everything online is an important trend in the last few years, and COVID-19 has accelerated this trend. Also, the cultural heritage sector has been involved in this change, as the evolution in the online digital offer of cultural institutions all around the world can confirm[1].
Still, despite cultural heritage, the management of 3D data online is nowadays perceived as a necessity. Today, 3D is the less represented data in the cultural heritage web repositories, data science platforms, and infrastructures.

The results of a recent survey[2] investigating the online digital offer of the Galleries, Libraries, Archives, Museums (GLAM) sector in the United States of America and United-Kingdom (two of the most digitally advanced countries) show that 3D data are present in just one per cent of their offering, while images cover the seventy-six per cent, videos are at twenty-six per cent, and even 360° images count the two per cent. The results are quite impressive and confirm that despite all the advancements of the last twenty years, it is still difficult to jump from local storage to web management of complex 3D data.

Issues and Needs

The use of 3D models on the web platform is somehow limited by different factors. First of all, there are technical limiting factors. If we look at software tools provided to web3D content creators the panorama of solutions is split into two halves. On one side there are `high-level' solutions for the simple visualisation of a single 3D model, while, on the other side, there are `low-level' development libraries that can be used to create complex 3Dweb apps. The firsts do not scale with complexity and are mostly limited to just `visualising it', while, for the latter, writing from scratch a complex web app for the management of a specific 3D interaction often presents

steep learning curves and prohibitive development costs. Unfortunately, there is little or nothing in the middle. In addition to technical limiting factors, there are methodological limiting factors, which refer to how solutions aimed at handling 3D data on the web are designed and developed.

The web is currently full of interesting web3D applications and services. Unfortunately, these solutions are often not able to talk to each other because they are based on closed or different standards. Sometimes they have relevant maintenance costs because of the huge scale of infrastructures, and sometimes they have uncertain futures because they are dependent on temporary funds or the work of a small research group (or even the work of a single researcher). It is clear that solutions developed in such a way are not sustainable in the long term and risk having a short life.

Case Studies

To better understand these limiting factors, some case studies can be analysed. Starting from the technical limiting factor, several examples that represent well the split panorama of web3D tools. For instance, libraries like Three.js or Babilon.js can be considered perfect representants for the `low-level' solutions, while the well-known Sketchfab could ideally be placed as a `high-level' solution. Intermediate solutions are missing for creating Web3D applications with complex features but easy to use and with the capacity to make the development, deployment, and maintenance of these applications sustainable.

In the last years, this middle ground has been explored by developing a solution called 3D Heritage Online Presenter[3] (3DHOP). 3DHOP is an open-source framework for the creation of interactive web presentations of high-resolution 3D models, oriented to the cultural heritage field. It has been designed to be easy to use, still providing advanced features for developing quite complex web3D applications (**Figure 1**).

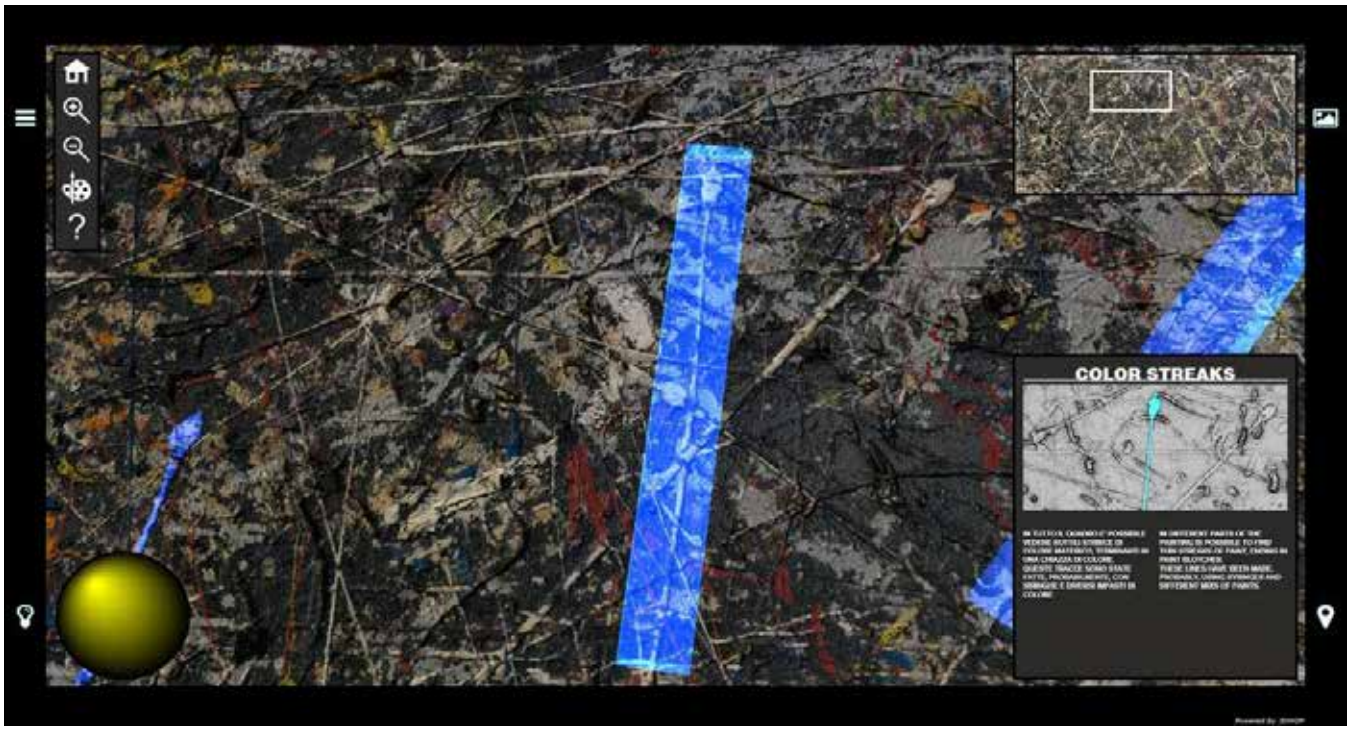

Figure 1. 3DHOP web3D application developed for the exhibition `ALCHEMY BY JACKSON POLLOCK. Discovering the Artist at Work'. Peggy Guggenheim Collection, Venice, Italy, 2015[4]

The experience gained with this framework and officially released in 2014, has shown that it is not easy to stay in the middle ground because the design choice made to be simple often prevents from offering complex features, and *vice versa*. However, the feedback gathered over the years[5] indicates that the middle ground perspective is right, and, since there is still room for improvements, that is worth continuing to work on it.

Moving to the methodologic limiting factors, and as previously said, the web ecosystem is populated by many brilliant examples of web services hosting cultural heritage 3D data: Europeana, Archaeology Data Service, Digitizing Early Farming Cultures (DEFC) Database, and Edition Topoi Repository, just to mention a few of them. These platforms have many pros, but also some cons. They all propose different ways to access 3D data, represent them, archive metadata and paradata, and export information - when possible. The result of this scattered

panorama is that none of these resources can be universally recognised as a reference platform or a standard to follow.

Also, in this case, we explored the research space, thanks to the development of the Visual Media Service[6], in the context of the ARIADNE European project[7]. The Visual Media Service is a platform for creating a web presentation starting from different complex media such as 3D, RTI and highresolution images. It has not been designed to be a repository, but to give the cultural heritage audience the possibility to experiment with web publishing by playing with some lower-level libraries exposed in a shared environment with simple web interfaces (**Figure 2**).

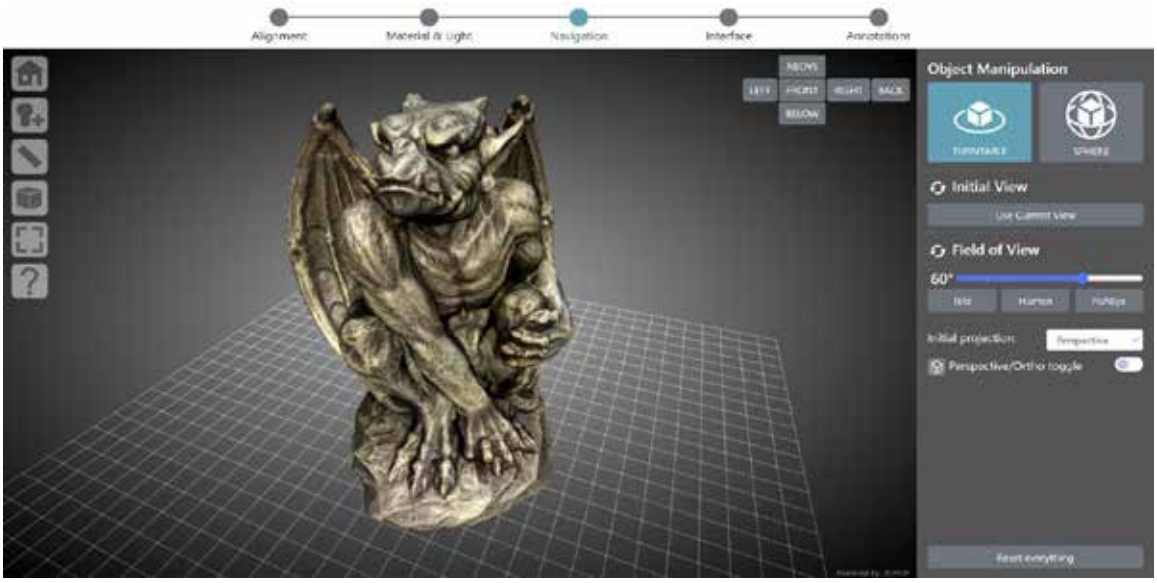

Figure 2. Step-by-step configuration wizard assisting the setup of the web presentations of 3D content in the Visual Media Service

The lesson learned working on the Visual Media Service is that these kinds of solutions cannot be lonely islands. Providing non-integrated services is sustainable only for atomic and simple tasks: data uploading, interface customisation, and so on. But things change with more complex actions, for instance, data enrichment. In this case, the way to structure, reference, and export annotations, metadata, and paradata is fundamental and has to be coordinated with other services. Otherwise, the risk is to have non-sharable - and so quite useless - data information.

Future Perspectives

The polarisation of the technical landscape, and the lack of standard methodologies, are critical issues for the advanced use of cultural heritage 3D data on the web. Nevertheless, nowadays Web3D is a quite mature domain able to offer a lot of possibilities. Future perspectives for cultural heritage in this field are, therefore, still promising, provided that the efforts of those who design solutions for this community will be oriented in the right direction.

From the technical point of view, this means exploiting in a better way the great amount of valid basic solutions (such as libraries, application programming interface (API), viewers) produced by the last decades of research and combining these basic `bricks' to cover the empty spots and neglected needs, providing more specialised solutions.

At the same time, to ensure that these specialised solutions do not turn to be lonely islands and last over time, it will be necessary to take care of the methodological aspect. One shall keep in mind that technical accessibility, interoperability, use of open standards, long-term support, and sustainability of maintenance will be the keys so that these solutions could be cornerstones for the next generation of digital humanists.

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