

ENHANCING MUSEUM'S EXPERIENCE: THE DIGITAL VALORIZATION OF THE GEOLOGICAL MUSEUM G. CAPELLINI IN BOLOGNA

D.Abate¹

¹ ENEA Research Centre, UTICT, Bologna, Italy, dante.abate@enea.it

Today is well known that cultural heritage studies can benefit by the new digital web technologies for sharing, promoting and valorizing values of knowledge.

This study is part of an ongoing project led by the 3D GraphLab of the ENEA Research Centre [1] in collaboration with the Geological Museum Giovanni Capellini (MGCC) [2] in Bologna with the aim to develop an online digital content using WebGL and Java Script standards.

The MGGC is the largest and richest geological and paleontological museum of nineteenth-century in Europe with over a million pieces preserved [3]. It has the virtue of being still preserved almost as Capellini completed it in 1881, gathering collections, donations and acquisitions from all over the world, after already having conceived the museum in a universalist perspective. The MGGC basically aims to promote the communication and education on the history of earth science and life. What makes the museum unique and places it on a level of international importance is the fidelity of the content and museological settings to the original values of the founder Giovanni Capellini, as they were in the second half of the nineteenth century.

In order to respect the identity, and preserve the museum itself, the management has decided to offer and promote independent and non-invasive exhibitions, exploiting the potential offered by today's digital technologies.

Despite the great scientific value of the MGGC in the conservation and research panorama, his fame is often overshadowed by other institutions. This research project intends to power the museum visibility through new digital technologies, as well as to enrich the visitors experiences inside the museum itself.

The preliminary valorization project of the collections preserved at the MGGC is based on the use of different digital technologies:

- 3D models, digitized using a structured light scanner, accessible by users on the web exploiting WebGL technology [4], without the need to install new software or configure their own system;
- 3D models and multimedia data created with computer graphics techniques available directly during the museum visit using smartphones or tablets;
- digital documents and 3D interactive PDF files.

In accordance with the museum scientific committee, and with the final goal of the project, some objects were chosen and digitized.

The six objects selected are:

- Fossil fragment of Mososauro (dinosaur);

- Head of Tomistoma Calaritanus (crocodile);
- Murex (mollusk);

- Fragment of Cycadeoidea (fossil palm);
- Model of costal area of the nineteenth century.

For the digitization process it was used a structured light scanner 3D Breuckmann SmartScan HE 5 Mpx, (Fig. 1) acquired by ENEA 3D GraphLab within the research project Itacha (Italian Technology for Advanced Applications in Cultural Heritage). Although models constituted by a large amount of polygons are not suitable for web browser plug-in free visualization due to their size, the range based technique was adopted to obtain high-resolution models useful also for traditional scientific studies as well as for the realization of detailed physical replicas of the objects .

After the well-known 3D post processing pipeline (Fig. 2) the six models were optimized for on-line visualization. They have been decimated reducing the number of polygons from several million to approximately 100 thousand faces, and exported in PLY (Polygon File Format) with color information attached to each vertex. It was tested indeed that the WebGL application developed for the fruition via browser is not able to process more than this amount of polygons.

Each PLY file was subsequently converted to .Js format, interpretable by WebGL libraries, using a Python script based on Java.

The graphics library used in this project is Three.js, born primarily to work with the powerful WebGL API. For WebGL libraries, as well as for what concerns the rendering pipeline, the triangle constitutes the basic element for drawing 2D and 3D objects. In a WebGL environment Java Script, which generate the information, specifies where and how these triangles will be created and how they will appear. These data are then transferred to the GPU which creates the scene.

All these elements were then integrated in the HTML page, and encrypted. So thanks to the potential offered by the libraries WebGL, the end user, connecting to the dedicated website, can view and interact with 3D models without the need to download any files or install and configure any specific software, but using only traditional desktop browsers [5] (Fig. 3).

Given the special nature of the objects stored press the MGGC it was decided to develop another kind of application with the aim to provide added value to the visitor. The end user, when physically in front of the showcase, can access through QR code [6], metadata and in particular 3D models created with the so called spinning images directly on their smartphone or tablet (Fig. 4).

In order to provide digital material for further study, for each three-dimensional model 3D PDF files are also available for download (Fig. 5).

In this paper it has been described the potentials of WebGL, Java Script, HTML and PDF files for the valorization of geological and paleontological objects visualizing 3D models without the creation of any specific application, and with particular attention to the protection of copyright, freeing, at the same time the end user from any installation or configuration issue.

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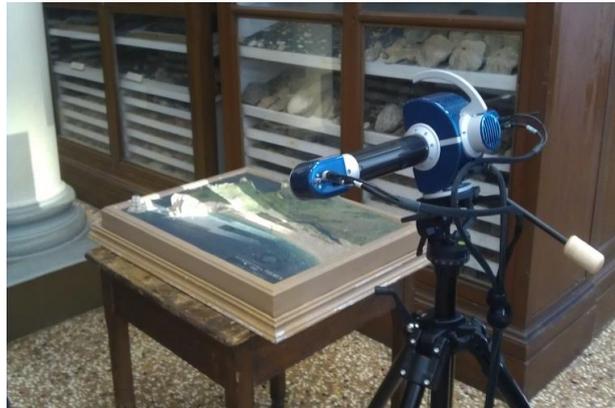


Fig. 1. Structured light scanning survey of a XIX° century costal area plastic model

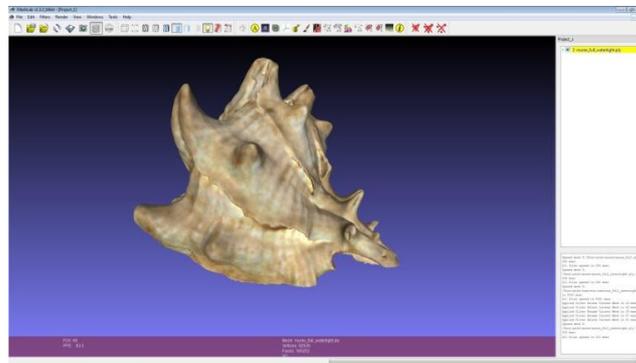


Fig. 2. 3D Murex model visualized in Meshlab Software

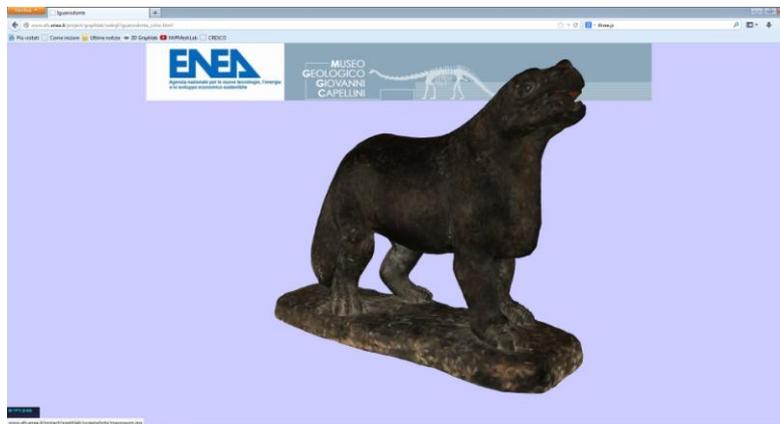


Fig. 3. Web browser visualization of 3D Iguanodon model

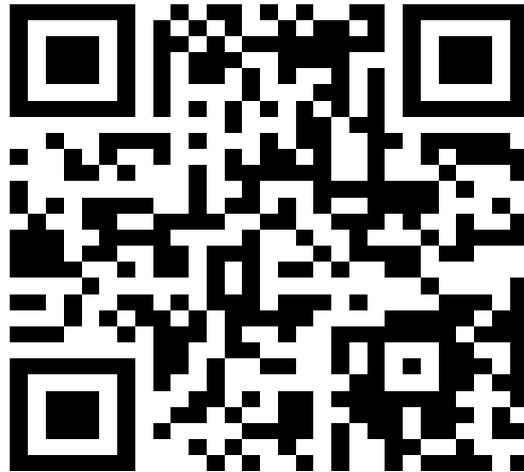


Fig. 4. QR Code

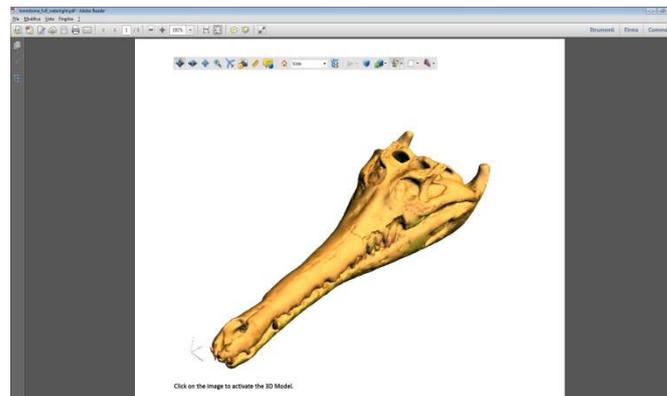


Fig. 4. 3D PDF of Tomistoma Calaritanus

References

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