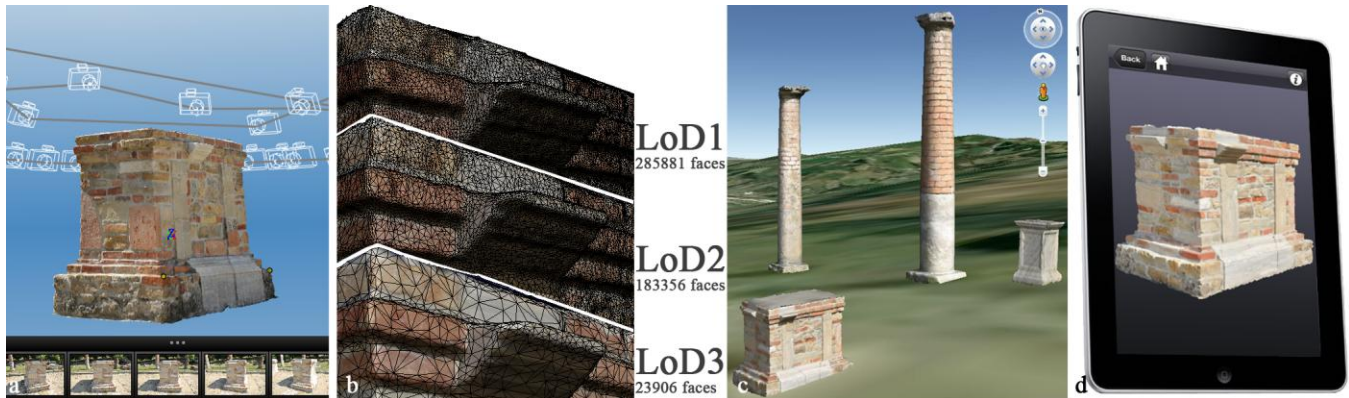


# A Methodology for the Promotion of Cultural Heritage Sites Through the Use of Low-Cost Technologies and Procedures

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**Figure 1.** The adopted workflow. 3d information are acquired from sequences of uncalibrated 2d images (a). Different levels of detail are defined (b). 3d models can be visualized in web browser windows (c) that can be accessed also through mobile devices (d).

## 1. Introduction

In the Cultural Heritage field a large variety of sites and artifacts could benefit from their free access and promotion through the web. But despite the possibilities offered by digital technologies [Manferdini and Remondino 2012], the high costs that are generally connected with their use, the lack of standard procedures and the need to train expert operators often limit the widespread digitization of Cultural Heritage sites and artifacts. As a consequence, during the last three decades, researches in the field of image-based technologies, such as, in particular, the Structure from Motion one [Ullman 1979], as well as the development of open-source algorithms and software aimed at helping the processing, management and visualization of 3d data through the web represent remarkable attempts to extend the use of digital technologies and procedures in this field.

The purpose of this contribution is to show a methodology aimed at easing the work of Institutions called to promote their heritage by documenting and virtually reconstructing sites and artifacts using low-cost procedures and existing technologies that can be adopted and easily used by operators who do not have specific computer skills, with consequent benefits in reduction in times and costs and in knowledge sharing.

## 2. The adopted Approach

The adopted workflow is organized starting from the survey process, that is supported by widely diffused open-source techniques, based on the Structure from Motion concept, which are able to recover 3d information from sequences of 2d images acquired using uncalibrated cameras (Figure 1a). Within this process, different levels of detail of the information are defined following various communication aims, ranging from fast visualizations on mobile devices and on desktops, to more detailed investigations on the geometry of digital models (Figure 1b).

The acquired information is then post-processed in order to overcome some frequent errors, such as the lack of information due, for example, to occlusions, to the presence of inaccessible areas, to insufficient overlap among adjacent images, or to topological errors occurred during the processing of polygonal meshes (i.e. non manifold, crossing or self-intersecting faces). The models are then scaled and oriented within a reference system. They can be therefore geo-located using Google MapsGL (Figure 1c) or exported in the X3DOM to be rendered through a web browser in order to enrich digital catalogues with 3d contents. The workflow finally allows to visualize 3d models on the move using mobile devices (Figure 1d).

This procedure was tested on the archaeological site of Veleia, Italy. The analysis of results and performances highlighted the remarkable reduction of costs and times (the entire workflow required from one to two man-days for each artifact) that was obtained following the above mentioned methodology.

As far as the quality of the re-built models is concerned, since in the Cultural Heritage field the multi-scalar approach is an indispensable practice in order to achieve different and changing communication aims, these technologies supply low-resolution reality-based 3d models and effective representations that can be easily accessed through the web, with evident benefits in cultural contents promotion. The use of this methodology can therefore be considered as the first step of a process that, starting from low-resolution acquisitions, can progressively improve the detail and definition of 3d digital representation of artifacts by gradually adopting different methodologies and technologies.

## References

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