XV INTERNATIONAL FORUM

Carmine Gambardella

WORLD HERITAGE and DISASTER

WORLD HERITAGE and DISASTER
Knowledge, Culture and Representation

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Le Vie dei Mercanti _ XV International Forum

Carmine Gambardella
WORLD HERITAGE and DEGRADATION
Smart Design, Planning and Technologies
Le Vie dei Mercanti
XV Forum Internazionale di Studi

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Le Vie dei Mercanti
XV Forum Internazionale di Studi

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Peer review

Scholars has been invited to submit researches on theoretical and methodological aspects related to Smart Design, Planning and Te- chnologies, and show real applications and experiences carried out on this themes.
Based on blind peer review, abstracts has been accepted, condi- tionally accepted, or rejected.
Authors of accepted and conditionally accepted papers has been invited to submit full papers. These has been again peer-reviewed and selected for the oral session and publication, or only for the publication in the conference proceedings.

Conference report

300 abstracts and 550 authors from 30 countries: Albania, Australia, Benin, Belgium, Bosnia and Herzegovina,California, Chile, China, Cipro, Cuba, Egypt, France, Germany, Italy, Japan, Jordan, Kosovo, Malta, Massachusetts, Michigan, New Jersey, New York, New Zealand, Poland, Portugal, Russia, Slovakia, Spain, Tunisia, Turkey.

200 papers published after double blind review by the International Scientific Committee

Preface

A theme, that in addition to highlighting the word DISASTER, wants,as in all the editions of the Forum, place the emphasis on the wordCulture, the systemic product of knowledge and applications, whichhas a plastic strength as Nietzsche pointed out, capable of healingbroken parts, to recover lost parts, and as such belongs to humanity,the Man Artifex and Faber in its historical self-reproduction.

A faith in humanity's ability to achieve ever higher levels of knowledgeto offer as patrimonial value, beyond disastrous contingencies, whichcontains reparative stem cells and also fortifies evolutionary processesinvolving the Skills and Work of Man, the fate of Landscapes, Territories,Cities, Architecture and Archaeology as Traces of Geography ofthe past that emerges in the Geography of the Present.

For these reasons, in Naples on 15 and Capri, on 16 – 17 June, the15th "International Forum Le Vie dei Mercanti" will be held. An establishedevent that in three decades has seen the participation of ascientific community from around the world grow, discussing multidisciplinarytopics relating to the Landscape, Cultural Heritage, Governmentof the Territory, Design and Economics.

Therefore, I expect, along with the International Scientific Committee,contributions of studies and research relating to theories, concepts,applications, best practices to protect and preserve, in order to notonly transmit to future generations the tangible and intangible patrimonyof the World Heritage but also to orient the design processesand innovative planning for the modification that derive from thehumus of identities and roots of the places, the regenerating sap ofthe places and of a "new", which, citing Argan, possesses a contemporaryof what it does not have the same date.

The location is exceptional. Campania, with six sites included in theWorld Heritage List, two UNESCO Man and Biospheres, two assetson the List of Intangible Heritage, is one of the richest regions in theworld for cultural and landscape heritage. It is therefore no coincidencethat the Forum will be held in Aversa/Naples and Capri, with visitsto the sites and presentations of operational projects by thescientific community of Benecon*, a University consortium that hosts250 researchers and distinguished professors of five Italian Universities,UNESCO Chair on Landscape, Cultural Heritage and

Carmine Gambardella
President and Founder of the Forum

Le Vie dei Mercanti

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WORLD HERITAGE and DISASTER

Low cost survey techniques aimed to the Cultural Heritage conservation.

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Abstract
Thanks to SfM (Image Based Modeling) survey techniques, is possible to realize 3D models of every object, in a very short time and with limited economical and training resources, today. These semi-automated SfM software allow users to simply upload photos and follow a mediated workflow, without any complex inner workings of SfM and this can be especially advantageous to users in non-technical fields or to those with limited resources. Every year there is an international Event, *#digitalinvasion,* that involves the Italian museums and that reckons on to allow to take pictures and video to the whole museum collections. This event is present in Palermo since 2014 and the Engineering first year classes were been twice involved in 2015 and 2016: it was possible to experiment the effect of a dissemination of these techniques in a sample of young and non-technical people. In these two occasions, the engineering alumni had carried out the 3D models of more than 120 pieces (with different dimensions and difficulties) of the Salinas Archeological Museum's collection. The same experience was been conducted in Catania with the third year engineering classes under the supervision of the Professor Cettina Santagati. In this paper will be reported the very impressive results of twice experiences and will be designed the idea project for a different vision and "use" of the museum visitors. The goal is to demonstrate that the museum visitors can be transformed in a fundamental resource aimed at creation of the 3D archives and conservation of the heritage museum collection.

Keywords: SfM, 3D modeling, museum collections, Cultural Heritage, conservation

1. Introduction

In these last years there has been a sensible increase in the Cultural Heritage (CH) survey aimed at the conservation and restoration. Especially refers to the tragic effects of earthquakes and terrorist attacks that endanger the conservation of artworks and CH generally [1]. For this reason there has been a proportional increase of the research aimed at driving down costs, time and training in survey field. Low-cost digital photogrammetry using structure-from-motion (SfM) has made it possible for nearly anyone with a digital camera to create 3D models of an object, an artwork, a building, a scene, a physical environment. SfM technique represents an easy and widespread photogrammetric method that uses the principle of parallax to derive 3D measurements based on shifts in 2D image features from different photographs taken at different vantage points. Nowadays there are several SfM software choices: some of them are available on web (3DCatch, Recap), some others are available in the low costs software market. These semi-automated SfM software allow users to simply upload photos and follow a mediated workflow, without any complex inner workings of SfM and this can be especially advantageous to users in non-technical fields or to those with limited resources. Since these techniques were been introduced, were refined and simplified so much that nowadays are common used by the practitioners and the scientific researcher staff [2-5]. The most important step in the Life Cycle Analysis of the CH is the monitoring one that aimed at the conservation of the Cultural-

Works (CW). To make a continuous and planned monitoring of the CW is needed its survey and the most diffused survey technique is the laser scanning ones. Nevertheless, it requires high technical performance and high instrumental costs.

Thanks to the SfM techniques use it become possible to have a frequent and easy 3D monitoring of the CH and this guarantees its own conservation .
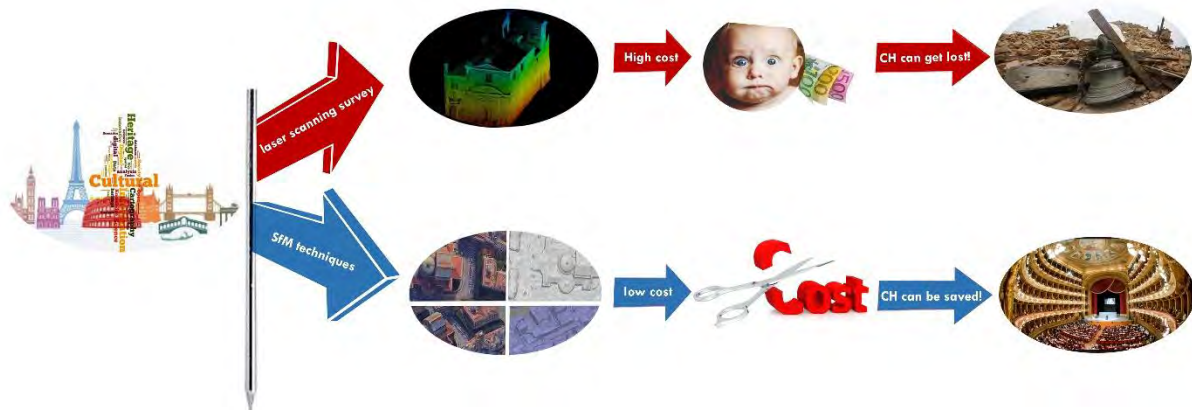

Fig. 1: Life Cycle Cultural Heritage conservation.

The opportunity offered by these techniques is strategic in some specific contest such as museum ones.

The Engineering first year classes have been involved in an international event, the #*digitalinvasion*, in 2015 and 2016 [6]. Thanks to these initiatives, the use of SfM techniques was tested by the young generation with a brief training made inside the museum site. The same experience was conducted in Catania under the supervision of Professor Cettina Santagati in the same event week both years.

The enthusiastic response of the alumni and the high 3Dmodels quality allowed us to create the 3D catalogue of the whole museum collection.

This experience, potentially create the assumption to consider under another light the visitor that become a co-creator of the 3D museum collection catalogue by guaranteeing a planning monitoring of the state of conservation of the collection itself.

Other projects with similar goals are still under development such as: 4D-CH-World [7], MicroPasts Knowledge Exchanges Project [8], Heritagetogether [9], Plaka project and Project Mosul [10]. Nevertheless, the methodology proposed in this paper is the first complete experiment that starts from crowdsourcing and ends to 3D models.

2.   Methodology

In this case, the methodology concerns the planning of the whole organization:
- step 1: knowledge of the whole collection to have the more efficient subdivision for small students team;
- step 2: first meeting to learn the SfM techniques;
- step 3: creates heterogeneous students groups;
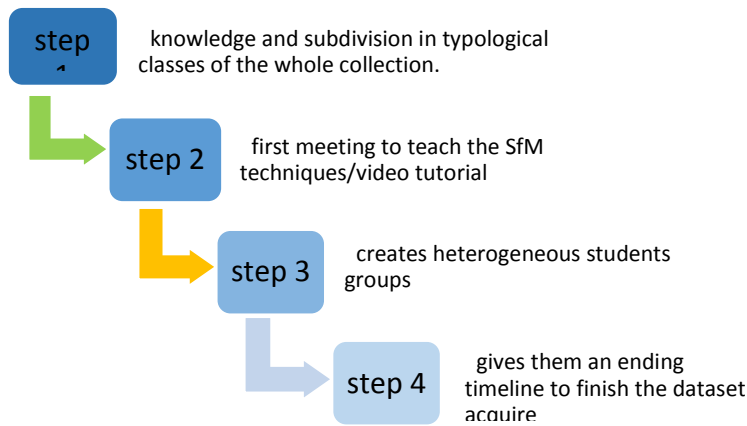- step 4: gives them an ending timeline to finish the dataset acquire.

Fig. 2: Main methodology steps.

2.1 Step 1: knowledge and subdivision in typological classes of the whole collection.

This step is among the most important. In fact, the planning of the whole organization depend on it: well know the museum collection to subdivide it in sub-typological classes. For example the sarcophagi, the head statues, the torso statues, the tarsia, the baptismal fonts, the metope, the small objects, the large objects, etc. The choice depend on the efficient effect on experience of young and technically untrained people. In fact, the large object or the geometrical articulated object are not suitable for a first time experience. For the 3D acquire of the Zeus statue (about 2 m width and more than 3 m eight) is necessary to have photogrammetry ability to create the photo dataset because the control of the hidden area and so big dimensions needs a solid experience. The same is for the geometrical complex statues that needs more than one revolution around the object at different levels. For Salinas Museum, it was necessary to create standard typological classes of objects to allow the students to acquire easiness and friendly in the data set creation phase. First of all, it was selected the museum room to start. The choice depend on the number of the people inside every groups: it is not recommended to have more than four students for group to avoid unpleasant incident that could damage the art collection. In Salinas museum there is an outdoor exposition in a colonnade space and you can easy walk and move yourself. We start from here.

The first typological class is the sarcophagus one. (Fig. 3)

Fig. 3: Some of the sarcophagi collection.

For this typological work-art is necessary to have more attention to make the data set because of the internal cavity in the structure. In fact, for this type of geometry the greatest difficulty is the one to reconstruct the external and internal surface without any mistakes. Instead, for those sarcophagi that have the cover, the difficulty is to reconstruct the articulated geometry of the same cover.

The second typological class is the bust sculpture one. (Fig. 4)
In this case, the optimal condition is to have the possibility to walk around the object but sometimes these kind of sculptures are next to the wall.
The third typological class is the head bust sculpture one. (Fig. 5)
This kind of sculptures does not present particular difficulties, in fact are small sculptures and

generally is possible to walk around them.

Fig. 4: Some of the bust sculptures collection.

Fig. 5: Some of the head sculptures collection.

Fig. 6: Some of the large sculptures collection.

The fourth typological class has a lot of complexity because of the great dimensions in height. (Fig. 6). In fact, it is difficult to make a data set with the highest part of the sculpture. In our case, we conducted the whole process with the museum officer help and we had ladders and every things we needed. But, if we consider the support of the visitors it become more difficult to make the 3D model of this kind of sculptures unless it is planned before with the museum staff.

We created other typological sculpture classes such as the stones, the metope of the temple, small objects, etc. Nevertheless, in this paper, we cannot bring all the case studies for editorial space reasons.

2.2 Step 2: first meeting to teach the SfM techniques
The lesson to teach the SfM techniques was made to evaluate the efficiency of the methodology. The lesson has lasted around a hour and, within the lesson, it was presented the museum collection and the SfM method. The methodological strategy of teaching is that to make an application in front of the students: in this way they stay involved and they grieve to the technique. The easy and friendly use of this last one, indiscriminately drags all. They warn that they have the opportunity to know a methodology that, in a simple way, it puts them in condition to create a 3Dmodel of a real object. And, in this way, they live the wait to directly experiment their own abilities, stimulated by a guaranteed success.

2.3 Steps 3 and 4: creates heterogeneous students groups and gives them an ending timeline to finish the dataset acquiring

The establishment of heterogeneous students groups is very important because it allows us to have a heterogeneous photo data set collection: in this way we ensure the creation of an efficient data set. In fact, if the result of a photo collection is not enough to create a 3D model, with the implementation of the others one it will works well. Every data set depends on the sensibility, of the knowledge, of the degree of learning of whom does it. To foresee an overlap of the data set is important to ensure the metric and visual accuracy of the object. You don't have the immediately successes of the data set: you deduce if it works just only after the software elaboration and it should be too late to come back to the object site to do another data set!

Onces you made the groups you have to give them an ending timeline to finish the dataset acquiring to avoid that they made a data set too big and it become difficult to manage.

Well done! that's it. Now let's start to analyse the results.

3.   Results

In this paragraph the results will be brought gotten on the works above you list and also on other works- art.

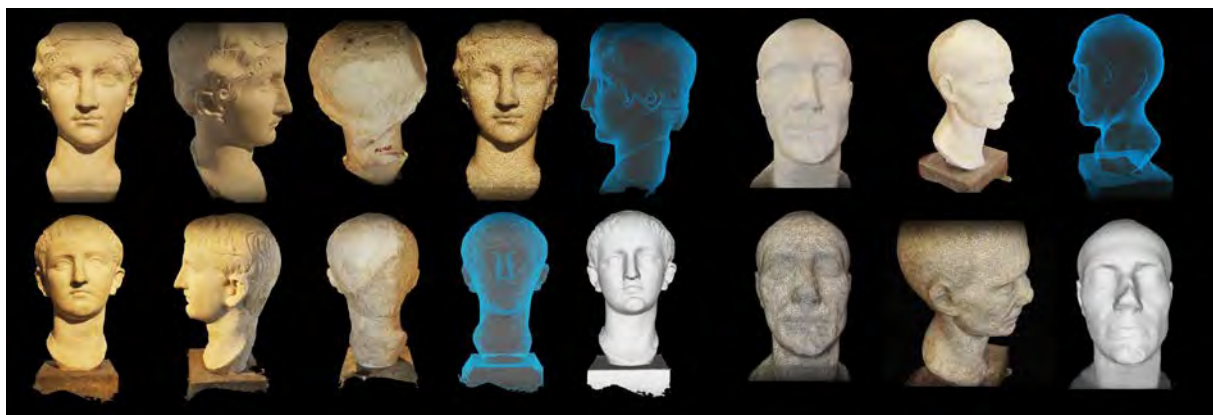**Fig. 7:** 3D visualization of the Alabastro sarcophagus.

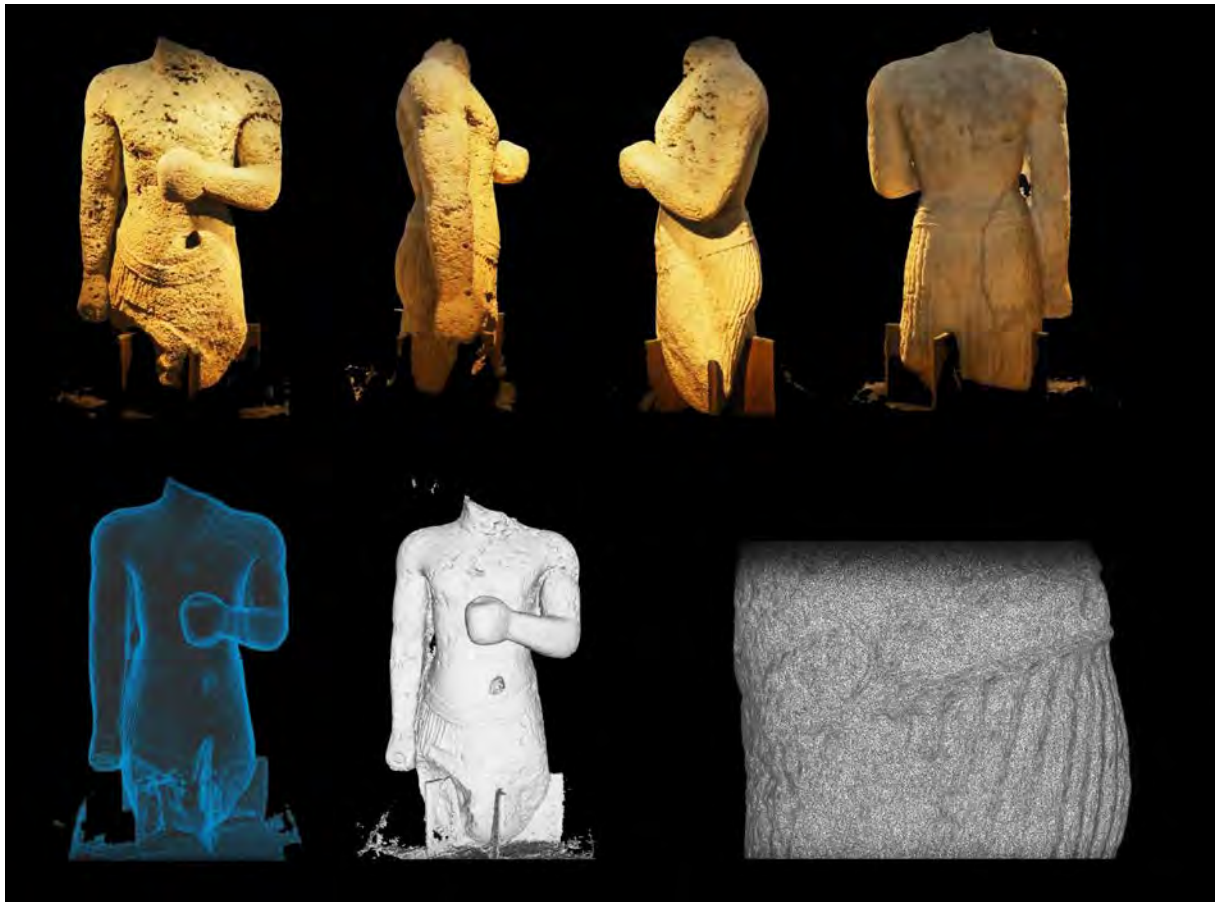**Fig. 8:** Three head sculptures in SfM.

Fig. 8: The etrusc bust sculpture in the different visualization of the 3D model..
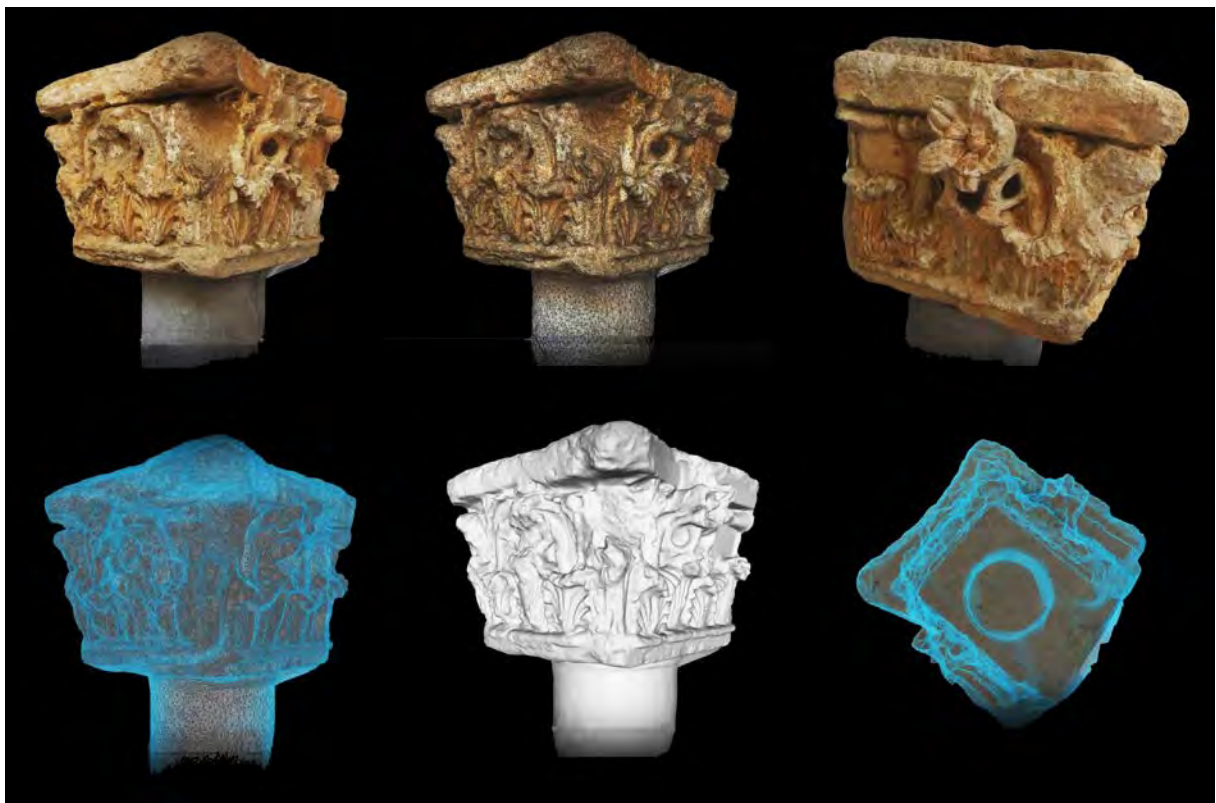

Fig. 9: A ionic capitol.

Fig. 10: Zeus like. The iconic museum sculpture.

4.   Discussion/ conclusions

In this study it was possible to reproduce some of all the results only (Figg. 7-10), due to the limited editorial space. Nevertheless, the example listed previously are typological different and each of them shows a deep level of visual and metric accuracy. Furthermore, the twice experiment allows us to carry out the 3D models of the whole collection and, this is a great achievement for us, as researchers, such as for the museum, as beneficiaries.

If we think to make automated the methodology (for example thanks to a tutorial video at the museum entrance, thanks to an SfM automated system, thanks to the installation of a work- room equipped with workstation points) this methodology could become a project idea for the 3D implementation of

the museum collections aimed at them conservation [11].

Bibliographical References

[1] GUIDI, Gabriele- BARSANTI GONIZZI, Sara- RUSSO Laura Loredana- RUSSO, Michele. Massive digitization of museum contents. In Toniolo, L, Boriani, M, Guidi, G (eds) Built Heritage; Monitoring Conservation Management. Springer International Pubblishing, Cham 2015. p. 335-346.

[2] INZERILLO, Laura- SANTAGATI, Cettina.*Using dense stereo matching techniques in survey. Disegnare Idee Immagini.*47, 2013. p. 82-91.

[3] LERMA,José Luis- CABRELLES, Miriam- VILLAVERDE, Valentin. *Terrestrial laser scanning and close range photogrammetry for 3D archaeological documentation: the Upper Palaeolithic cave of Parpalló as a case study*. J. Archaeol. Sci. 37, 2010. p. 499-507.

[4] LO TURCO, Massimiliano- SANNA, Marco. *Reconstructive digital modelling: The Church of Mercy in Turin.* Disegnare Idee Immagini, 41, 2010. p. 42-51.

[5] REMONDINO, Fabio. *Advanced 3d recording techniques for the digital documentation and conservation of heritage sites and objects.* Change Over Time 1 (2), 2011. p. 198-214.

[6] BONACINI, Elisa- INZERILLO, Laura- MARCUCCI, Marianna- SANTAGATI, Cettina. TODISCO, Filippo. 3D#Digital invasions: a crowdsourcing project for mobile user generated content. Furnace J.2. 2015

[7] IOANNIDES, M., HADJIPROCOPIS, A., DOULAMIS, N., DOULAMIS, A., PROTOPAPADAKIS, E., MAKANTASIS, K., SANTOS, P., FELLNER, D., STORK, A., BALET, O., JULIEN, M., WEINLINGER, G., JOHNSON, P. S., KLEIN, M., and FRITSCH, D. *Online 4D Reconstruction Using Multi-Images Available Under Open Access. ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences*, (1), 2013. p.169–174. CIPA2013 Best Paper Award.

[8] BONACCHI, C., BEVAN, A., PETT, D., KEINAN-SCHOONBAERT, A., SPARKS, R., WEXLER, J. and WILKIN, N. *Crowd-sourced Archaeological Research. The MicroPasts Project.* Archaeology International 2014. p. 61-68.

[9] GRIFFITHS, Seren- EDWARDS, Ben- KARL, Raimund- LABROSSE, Fred- MILES, Helen- MOELLER, Katharina- ROBERTS, Jonathan- TIDDEMAN, Bernie- WILSON, Andrew. *Crowd-sourcing archaeological research: HeritageTogether digital public archaeology in practice*. Internet Archaeol. 40, 2015. http://intarch.ac.uk/journal/issue40/7/3/toc.html

[10] STATHOPOULOU, E.K., GEORGOPOULOS, A., PANAGIOTOPOULOS, G., KALIAMPAKOS, D. *Crowdsourcing lost cultural heritage.* ISPES Annals of Photogrammetry Remote Esens. Spat. Sci II-5/W3,. 2015. p. 295-300

[11] INZERILLO, Laura- SANTAGATI, Cettina. *Crowdsourcing cultural heritage: From 3D modeling to the engagement of young generations.* In: (a cura di): Ioannides M, Fink E, Moropoulou A, Hagedorn-Saupe M, Fresa A, Liestol G, Rajcic V, Grussenmeyer P, Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection: 6th International Conference, EuroMed 2016, Nicosia, Cyprus, October 31 -- November 5, 2016, Proceedings, Part I. Lecture Notes In Computer Science, vol. 10058, p. 869-879, Cham:Springer International Publishing AG, ISBN: 978-3-319-48496-9, ISSN: 0302-9743, doi: 10.1007/978-3-319-48496-9_70