TOWARDS A DIGITAL ARCHAEOLOGICAL ARCHIVE: THE CASE STUDY OF THE ARTEFACTS OF THE AREA OF FORI IMPERIALI

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ABSTRACT:
The following research aims to exploit the low-cost technologies, for the survey and mapping of historical archaeology in the Roman context. The main purposes of the research is to implement a large-scale survey campaign to understand the geometry and the materiality of the artefacts examined. Three-dimensional survey from photography, allows an immediate mapping of the materiality, of the degradation and of the architectural elements characteristic of the architecture in question. From the model it is possible to obtain an image that is faithful to the reality that can be the basis for developments in many disciplines such as, for example, in the restoration project, for the material analysis and the mapping of the degradation. The applications for this type of mapping are numerous, one of those proposed in this research concerns the virtual musealisation of historical artifacts. More and more in recent years, museums are exploiting the capabilities of three-dimensional modeling software of architectural elements to interactively convey architectural elements. A methodology of work that in recent archaeological excavations is not based solely on the didactic divulgation of the history of a place, but during the excavation phase on the mapping and cataloging of uncovered finds.

1. INTRODUCTION

In the last decade there has been an evolution in the development of technologies for surveying. The methods by which it is possible to detect the architectural artifact are based less and less on traditional analogical methods, referring to technologies and instruments that allow the three-dimensional restitution, decreasing and in some cases eliminating the error gap that was caused by the presence of the human constant in the survey intervention.
Simultaneously, software has been released that, starting from a set of two-dimensional images and using SfM (Structure from Motion) algorithms completed by stereo matching algorithms, allows to obtain photo-realistic 3D models that contain all the information (geometry and weaving) quickly with the use of low-cost hardware and software solutions or Open Source and without however renouncing the accuracy and quality of the result. The applications for this type of survey are many in the architectural field, not focusing only on the scale of the single building or artifact but extending to the urban context.
Firstly, it is necessary to activate a large-scale survey campaign to determine the geometries and the materiality of the objects within their context. Then compare the results underwent through laser scanning and photomodeling to first understand the error between the two techniques, and make up for the shortcomings of one with the second. The three-dimensional photography survey allows the mapping of the artifacts with detailed textures that immediately highlights the spatial geometry, the materiality and the state of degradation. The virtual three-dimensional model thus returns a faithful image of reality, which, in addition to the aspects described in this paper, can be the basis for restoration projects, the analysis of materials or the mapping of punctual degradation.The possibility of accessing a high-quality three-dimensional model of mesh detail and texture map, is in fact a not indifferent advantage for the analysis and the rear study of the product. In particular for the material and degradation analysis, new technologies have replaced the human eye, obsolete photographs or photogrammetry. Previously, the knowledge of the material plane was first of all through schemes and eidotypes taken from the truth, which already implemented the process of discretization of the detector. Even the photographs had their documentary function, and in some cases, the basis for the traces. The case study chosen for the development of this research is the Central Archaeological Area of the city of Rome, in particular a portion of the Fori Imperiali. The architectural artifacts present in the area are many, of various dimensions and geometric definitions, leading to the formation of a large sample of elements. The coexistence of small-sized artefacts, such as columns, capitals, sarcophagi, moldings ... as opposed to architectural emergencies with more complex geometry such as the Tabularium and the Arch of Constantine, allow us to better understand the application cases of the various technologies and important instruments. Photographing, through a three-dimensional digital survey, archaeological finds are becoming more and more important in recent years, where the deterioration of atmospheric agents and poor maintenance put at risk the stylistic and geometric integrity of the single find.
The applications for this type of mapping are numerous, one of those proposed in this research concerns the virtual musealisation of historical artifacts. More and more in recent years, museums are exploiting the capabilities of three-dimensional modeling software of architectural elements to interactively convey architectural elements. A methodology of work that in recent archaeological excavations is not based solely on the didactic divulgation of the history of a place, but during the excavation phase on the mapping and cataloguing of uncovered finds. The basis on which the research is developing is the preparation of an interactive map of the holes' area, designed in the Geographical Information System (GIS), where it is possible to map the position of each finding within the area, and through of the dedicated scripts, connect the two-dimensional GIS vector elements to three-dimensional elements and integrated by metadata of the single archaeological artefact. The development of this interactive map, Open Source, can be implemented through online publication and use of WebGIS.

1.1 Aim of the research

The research is therefore aimed at overcoming the lack of information, or in some cases the excessive fragmentation of one of the most interesting points of historical architecture on the Roman scene. Digitally re-elaborating, cataloging and transmitting information allows instantaneous on-site fruition and knowledge with a scientific narration of the observed

architecture. New technologies are increasingly replacing old equipment and the campaign detection process has become a complete and scientifically structured process. (Parriniello, Picchi, 2009) The use of low-cost instruments, for the survey campaign and the comparison with more complex models, is aimed at the discretization of the survey methodology according to the object of the analysis. The digital three-dimensional model that derives from the photogrammetric one is, today, an essential tool for the project of recovery of historical architectures, even more, if they are in conditions of advanced degradation and mapping of the archaeological artifacts present in the territory.
A collaboration has already begun with the Capitoline Superintendency, during the large-scale survey of the complex site adjacent to the church of San Luca and Martina, a project already reported and published, and is continuing with the acquisition and the reasoned and localized cataloging of the finds exhibited in the Central Archaeological Area. The complex work would allow a more adequate and easy monitoring of archaeological remains and in case, through a synergistic collaboration with archaeologists, to hypotheses of digital anastylosis and virtual reconstruction, in addition to digital archiving and musealization.

2. RELATED WORKS

In the last few years, many museums have begun to acquire virtual three-dimensional models, which allow digital usability by users on the web, or in some cases by the museum visitors themselves. In the first case the three-dimensional models can be managed by the operator, only through zoom or orbit commands. Surely the 3D made available to the masses is a big step forward for the dissemination of art and culture.
However, despite the detail and the high resolution of the textures, the reduced navigability of the model is quite limiting. There are now also many online platforms where users can upload their own models, and often the quality is also very high. Polygon meshes obtained by photomodelling have been cleaned, eliminating holes and roughness, probably imported back into the modeling software, and texturized again. One of the most famous websites is Sketchfab, which incorporates within it a number of 3D models of the most disparate, from the faithful reconstructions of statues, the digital sculpture of visual artists, with fantastic characters that reflect the most advanced techniques of sculpture, texturing and mapping. The site, however interesting, is far from the idea of a virtual museum that the research wants to set itself.
In the same area it is inserted one job, followed with Margherita Caputo and Luisa Bogliolo, which is inherent to the archeology theme, it is a wonderful Etruscan urn depicting the myth of Oenomaus, dated between the late third and early second century BC. In the last months of 2013, the engineers of the Central Institute of Restoration were engaged in the restoration of 21 Etruscan urns and a lid sarcophagus and their kit, retrieved by the Police after a long detective investigation.
An urn that has a unique artistic importance. Moreover, all the elements described provided the opportunity to make a virtual model for the study and dissemination, as well as the production of orthophotos and 2D graphics for documentation of techniques of execution, of the conservation status and restoration interventions (Fig. 1).

Figure 1: Orthophoto in isometric view (parallel projection), made by PhotoScan. the 3D model is mapped directly from the photos with textures of 16,000 pixels per side. Two of the three sculpted sides are shown.

The Etruscan Museum of Perugia, where now is the urn found (along with all the others), plans to make an exhibition video which goes to explain the myth of Oenomaus and morphological characteristics of the urn.
Therefore, following the definition of the 3D model, one of the works carried out has been precisely to recreate a movie set of lighting and shooting video.
The digital urn was illuminated with effect's lights and sliding to highlight the chiaroscuro with sharp shadows, and dark background. In this way, the figures seem to emerge from urn so marked by darkness, as after the archaeological find.
An emphasis of forms allows to better represent the myth and make the story more dramaturgy appealing.
The possibility of being able to exploit the digital model, even for diversified purposes, from film postproduction, to the creation of informative videos for knowledge within museums, makes this experience more interesting than just the website. The contention to which the finished product is destined justifies a higher level of knowledge and an attention in obtaining a better result.
In Italy, a reality similar to the one described above can be found in the MURA Museum of Representation, an exhibition space of the Engineering and Architecture Department of the University of Catania, which houses the collection of projects, drawings and engravings. (Santagati, 2018)
But above all, it collects a vast 3D gallery of works found on the territory of Catania through innovative technologies developed and optimized for virtual reality, realized within the activities of the Digital Reconstruction Dept. Representation Laboratory (responsible for Cettina Santagati) and also support for the enhancement activities present in the territory of Catania, such as the Museo Civico Castello Ursino.
Finally, due to the close connection with the project of this paper, we would like to mention the research work that the Department of Architecture of Roma Tre carried out in the central archaeological area, on the slopes of the Tabularium, in the Piazza di San Luca and Martina. The work, supervised by Maria Grazia Cianci and Daniele Calisi, tries to mend the open

questions on the orographic system of the Roman holes area, subjected to a number of excavation works to bring back the archaeological remains, the other to the demolition of the the entire Alessandrino district the construction of the Via dell'Impero (Fig. 2).

Figure 2: Perspective sections obtained by modifying the clipping box of ReCap. The particular orographic condition is highlighted by the complexity of the sections.

The survey campaign through the laser scanner, and subsequent elaborations, has highlighted the complexity of the place, rich in countless finds, which without any discretization, are captured by the instrument.
Being able to separate the parts inside the cloud of points in such a complex system would be impossible. Finds, friezes, parts of columns, monuments still intact or reassembled for anastylosis, the green system, the terraces, the retaining walls ... are part of an indivisible unicum that precisely in this singularity hides its beauty and extraordinary nature.

This awareness has also determined the choice to work individually on the fragments of the open-air museum of the Roman Forums, in a sense separating them from time to time from that unicum that contains them.

3. DEVELOPED METHODOLOGY

The central archaeological area of Rome is undoubtedly among the richest in monuments and classical finds. Nowhere else in the world can you find yourself in a real open-air museum full of millennial history and be in contact with the intact classical architecture, relocated in anastylosis, or with countless fragments scattered everywhere in the public space.
However, in the face of this "great beauty" does not match an appropriate publicity and information system. You are immersed in an open-air museum (Fig. 3), but without having the services that a user finds in museums. In addition to the usual information panels, now obsolete, are missing the equipment that some of the most important museums have now adopted.

Figure 3: Aerial view of the Roman Forum which highlights the vastness of the central archaeological area. View of the Roman Forum on the side of the Tabularium.

For years, the Louvre Museum has been running customized itineraries based on the interests of each individual user, filtering the works to be seen. All this through a simple smartphone application, which anyone can download. Through it, moreover, it is possible to view the works with the information sheets. (Reilly, 1990)
Lately, on a visit to Turin, we enjoyed the restored Chapel of the Shroud. But the wonder was above all the use of the path in VR within the space that has been virtually rebuilt. The user is dragged upwards, like in a flight with the drone, to closely explore the details of Guarini's architecture.
A unique experience that allows you to fully explore the architectural space.
These are just two examples of how musealization is changing, adapting itself to modern technologies, allowing a more and more immersive experience of the artefact. The idea of a virtual museum of Roman forums was born from the desire to bring an area of such great interest to new technologies, to allow users to have a satisfying knowledge of the tracks that they are going to travel.

At the moment there are no routes that tourists can travel, but the area is navigable freely, letting yourself be carried away to one or the other monument. The few information available is not exhaustive and you have to rely on guided tours or paper guides that are not always of quality.
The first step, also following the proposed references, has been to create a photographic survey campaign aimed at creating the first virtual digital models of some of the artefacts within the archaeological area. (Pierrot-Deseilligny, 2009)
Clearly, it is unthinkable to immediately create the database of all the pieces in the area and a first selection was made on the most beautiful ones and with greater ease of photographic detection (Fig. 4).

Figure 4: Some of the pieces selected and digitized within the central archaeological area of Rome. From the three-dimensional models we have extrapolated the orto-photos, in order to have a greater awareness of the dimensional comparative aspects.

Following the rules of photogrammetry, the selected findings were photographed in their entirety, making turns around them and taking photographs at each meter to allow the reconstruction structure from motion. The object always remains at the center of a hypothetical sphere, and the photographs are made by orientating the camera always towards the center. In this way virtual reconstruction will be easier, especially the texturing process (Fig. 5).
To make the modeling process easier, the images have been masked in Photoshop, creating clipping masks on a special channel, which you can recall later in Photoscan. (De Luca, 2011)
The high-resolution mesh was subsequently cleaned and the holes closed to obtain an excellent quality of the models and their respective textures. Obviously, in this process, the piece is totally decontextualized becoming an isolated and unique object. It can be associated with historical-archival information, and through pop-up cards you can view the data of the chosen find and the 3D model in VRML as in the previously mentioned SketchFab site. Certainly isolating the selected objects, however, leads to a series of problems.
First of all, decontextualization weakens the observer's interest in the object itself. Very often this can happen even when the architecture that contains the exhibition has a strong aesthetic connotation, and although with elevated canons of beauty, it can divert the interest towards the exposed pieces. (De Luca et al. 2011)

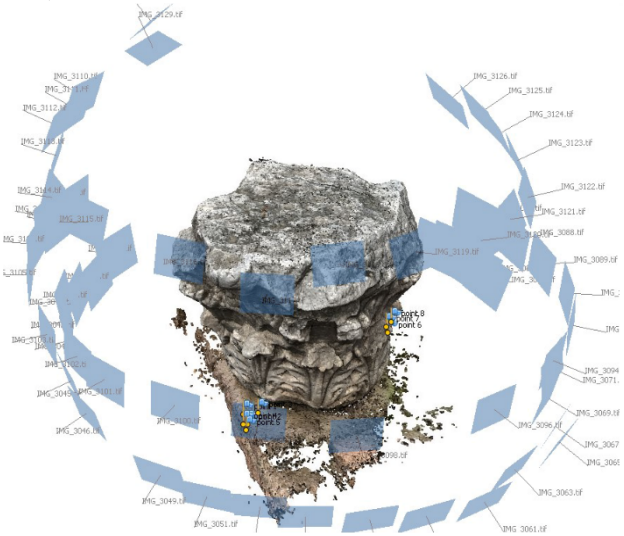

Figure 5: Structure From Motion photographic detection method applied to a single archaeological find in the archaeological area.

A de-contextualized object in itself loses some of its non-intrinsic characteristics and the danger is to return to an archive of digital models with a reduced temporal interest, which has very little connotation of the museum. Although, as mentioned for the Sketchfab site (Fig.6), the intent to create a digital archive is very appreciable, we should first follow a more complex and unitary scientific project.
The choice of models, their merging into coherent galleries, the information to be used by users, are just some of the information you need to choose and prepare for a digital archive of scientific interest. Otherwise it would only become an accumulator of 3d models made by even inexperienced users, and acting without a common action plan.

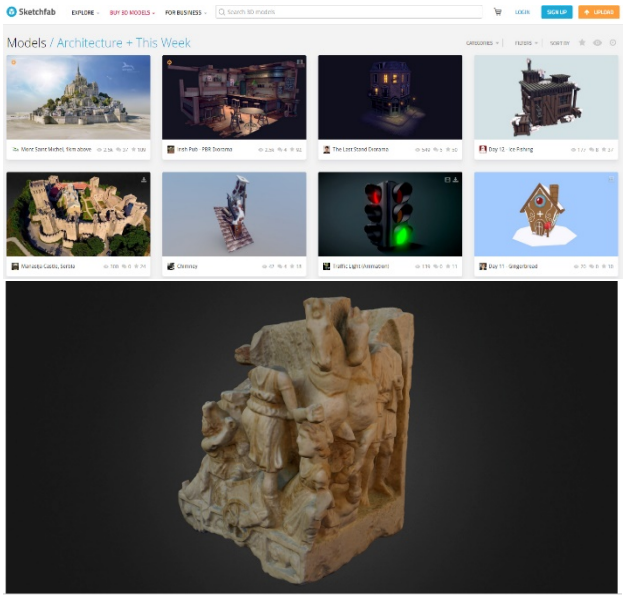

Figure 6: Sketchfab platform, in which the digital models are the most disparate, grouped without criteria, and in the absence of the information necessary for the understanding of the detected item.

In our opinion, the creation of a database of carefully chosen and scientifically reproduced digital models, requires a virtual

context, which can be either a digital museum model, or even the same one in which the finds are inserted. (Calori et al., 2009)
It is extremely interesting to imagine a virtual museum in which the finds can be inserted, a space that can be easily reconstructed according to the countless existing projects in the cities of the world, and of exemplary examples there are many of them. But the most desirable solution, which would open up to new and unexplored roads, would be to design a virtual museum "ex novo".
Designers would be asked to create virtual architecture, working digitally on materials, lighting systems, digital architectural space and the placement of pieces. The projects will become the virtual containers of real pieces digitized and relocated coherently with respect to a path eventually made by appropriate museum curators who, like the architects, will work in the virtual space (Fig.7).
In this way the figures that take over any real process of creation, management and communication of a museum can also be used for the virtual one.
The substantial difference will be the use of the museum, which could take place through different technological means: applications from smartphones, tablets, laptops from the comfort of home.
The applications can certainly have different levels of interaction, from the most static (as for the Louvre museums) to the more dynamic ones (as in the case of the Museum of the Shroud Chapel in Turin).
But one could hopefully go even further, designing and executing an architectonic space that can be navigated freely in VR by the user through the oculus rift. Instead, through a controller it will be possible to manage interactivity in the virtual space: activate the information sheets of the exposed pieces, open the three-dimensional models to get to see easily even the details and the surface roughness obtained by the reconstruction, texture and maps depth.
The possibilities of managing virtual space can be countless, from the choice of personalized routes to the preference of the type of lighting, from the interaction with objects to the language of the virtual guide...

Figure 7: Proposal to musealize the reconstructed pieces in a newly designed museum project.

In the event that the choice of the container containing the selected items falls into the original space, the situation is more complex. The context needs to be finely reconstructed through laser scans. The project must be such as to cover every area, avoiding the shaded areas that would be seen by the user who can freely move in the digital space. The three-dimensional model must not neglect anything, being very complex to be realized both in the recovery phase, but also in terms of management. The dense cloud of points will have a considerable weight, as will the mesh whose optimization will require adequate time and resources. In particular, to imagine recreating the virtual space of the central archaeological area of Rome is quite utopian due to the complexity of the site and the impossibility of covering such a large park with just one model.
However fascinating and intriguing it may be to think of the accessibility of anyone and any part of the world to such a famous and important asset, we encounter technology and means which, at the moment, are an obstacle to the realization of such a project.

4. THE CASICS: THE VR AND AR MODELS

The modeling and management of the detected elements aimed at the drafting of a model for the didactic use of the archaeological areas varies according to the needs of use. The relief through instruments allows to reconstruct a cloud of dense points of both archaeological and territorial elements, allowing then to define a complex geometry formed by mesh.
The degree of definition of the three-dimensional geometry is directly proportional to the number of triangulations of the surface obtained by interpolating the points of the dense cloud. In the case of shooting with instruments, the number of detected points depends on the quality of the instrument used (eg. the laser scanner model, the camera lens). The use of photomodelling allows to capture the three-dimensional geometry of objects in a low cost way, with the characteristic limitations of this survey methodology. In order to use the artifacts found for virtual reality or applications within the archaeological itinerary, it is necessary to intervene on the geometry of the elements. The number of meshes greatly affects the use of the elements, in that it requires a need to process a wider range of data and limits the use on portable devices and increases management costs in the case of virtual models placed within museum settings. (Bennet, 2011)
There are pre-set procedural systems within the same modeling software aimed at systematically reducing the number of three-dimensional models meshes. This process, however, causes problems to the model, the geometry is simplified not specifically, going to also affect the UV mapping of the triangulated surfaces. For this reason it is necessary to switch to third-party software where it is possible to manage the meshes in a simplified way. (Fig. 8). The need to switch to third-party software arises from having to differentiate the definition of detail of the different parts of the architectural structure. The lightening of the three-dimensional geometry takes place on the lines of digitized video game molders and animated films where only some parts of the model are detailed to allow frames to scroll faster without requiring too high graphics performance.

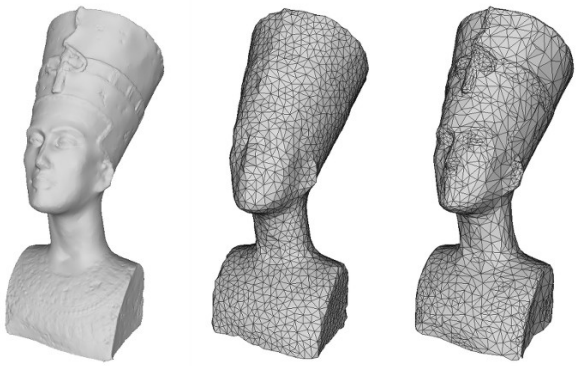

Figure 8: An exemple of a mesh decimating process applied to a 3Dmodel of a statue. Decimation of an input mesh to 1% of its original vertices, using different methods.

The working methodology for the processing of objects therefore foresees an *a priori* selection of what is considered most relevant, dividing the element into different subsets. A mesh decimation system is applied to each subset, taking care not to translate the reference point as it would damage the way in which the HD texture developed by the photomodeling software is enveloped on the artefact. In fact, the texture generated by software such as

Photoscan is similar to a coating that surrounds the detected element, through specific mapping systems that refer to homologous points present on the meshed surfaces.
An example for the application of this working methodology can be the management of the mesh of a capital, where not all the elements must necessarily have the same definition. The volutes, as they are the most complex geometry, with the presence of articulated geometric curvatures, require a greater surface triangulation in order to assimilate the fluidity of a curve. Finding a criteria in the modeling and decimation of the meshes, is fundamental because if in the modeling phase apparently the geometry is not different in the rendering phase it is possible to verify those that in the technical language are defined as artifacts. The surface undergoes deformations, accentuated by light and the wrong mapping of the texture, forming imperfections in the rendered three-dimensional model.
In recent years, in parallel with virtual reality, augmented reality (AR) is being developed even more widely. The fundamental difference between these two types of fruition of digital reality is that the former is immersive, the user participates in first person and is completely estranged from the real context; in the second case, the user uses a specific medium (eg Smartphone or Tablet) to display objects in three dimensions, always remaining aware of the real context. Applications and related technologies for AR increasingly attract attention from both the scientific community and companies originally involved in different research areas. In particular, the progress made in the fields of computer vision and mobile computing are mainly shifting attention towards the development of mobile AR systems. AR is therefore creating new opportunities to explore the mechanisms of interaction between humans and virtual and physical environments. However, even if it is booming, the current state of the art of AR technologies and applications is still below expectations, especially considering the quality of the interaction offered. The AR allows low-cost technologies, when compared to the counterparts of the virtual reality, to identify and display three-dimensional objects in the context. Recently, the development of this technology is becoming standard on all new smartphones or tablets, making it a development tool within the platforms dedicated to application developers. (Di Capua et al., 2011) Many applications are being developed and already commercially available, using this technology to measure objects in reality or how furniture manufacturers are doing to visualize the furniture in the room in real dimensions to make the final idea.
In the same way this development methodology can be applied to archaeological areas to identify historical artefacts. (Fig.9)

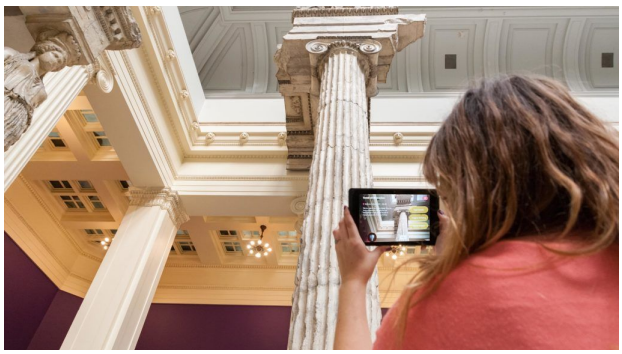

Figure 9: Application of augmented reality within the Carniegie Museum of Art. Visitors can query through the dedicated application the archaeological finds present.

This application is being developed in archaeological sites on the island of Cyprus, by the University of British Columbia (UBC) scholars. The research started on the island is aimed at mapping and digital reconstruction of the ancient historical architectures of the island dating back to the Bronze Age. This allows tourists a tour inside the ruins that through the smartphones not only makes it possible to view them at present but also in a previous era.
The application, called KAD-AR, is among the first of its kind and stands out because it offers users an interactive experience using both visual data and location and GPS data.
The Central Archaeological area of Roma Capitale, in particular the area of the Roman Forum is banning competitions of ideas to renew the museum paths. It is therefore likely to hypothesize an interactive path with the use of augmented reality, a reality that can be used in two different ways. The first time to the reconstruction of historical archeology for an immersive tour and visualization of the area of the holes in Roman times, the second to identify and manage the historical artifacts in the three dimensions. The hypothesis is to eliminate the use of information signs and to replace it with specific identification elements such as QR codes. Many finds are fenced and impossible to reach and study closely, not allowing complete use. Through the development of a cross-platform application for smartphones and tablets it is possible to connect to each QRcode a three-dimensional model and the related information connected to a central server. In this way it is possible to visualize the element in the three dimensions, orbit it, zoom in and understand its historical geometry in the specific. The augmented reality within the archaeological routes must not take on greater importance than the archaeological find. The function that must go to have must always be to support the usability of the work. For this reason, the research envisages the use of augmented reality as a tool for the collection of three-dimensional geometries and thematic cards dedicated to each artifact or area. The fundamental difference between augmented and virtual reality lies in this concept, while virtual reality replaces the historical finding and its context through digitization and allows a fruition in different places, the augmented reality is specific to that place for how it is its use in the research has been hypothesized. In fact, the function of interrogating the architectural element is only possible within the path. As with virtual reality, models developed for augmented reality must respect specific characteristics. The models even more than in augmented reality must be used on devices with variable characteristics and therefore must have a very low geometric weight while maintaining a high degree of detail where necessary. (Ho, 2012)

4.1 An application for the AR

Many applications within existing mussal complexes, use geometric recognition to create informative pop-ups on smartphone screens, the hypothesis of a museum itinerary inside Roman holes, due to the extreme geometrical complexity of each artifact excludes this hypothesis , instead going, as mentioned previously, to prefer the use of QRcode assigned to each find. Taking as reference projects already started in museums, a functional scheme of an application for smartphones and tablets has been suggested. The application, which compensates for the functions of a guide within the museum itinerary, is designed and divided into three main categories: Map, Scan and Routes. The first is a map based on an Open Source Maps system as a reference, on which all the digitized archaeological finds are geolocalized, and through specific pop-ups it is possible to receive information on each element. The graphing of the element detected on the map continues along the lines of the WebGIS, where each artifact, regardless of the geometric extension, is graphicized as a questionable point. The second menu that can be used is Scan and is aimed at recognizing the QRcode, so as to be able to show the object that can be consulted in the three dimensions and the related information sheet. We have chosen to use this system for the great diffusion it is having in the last years. The same pavilion Russo, in the 2014 Venice Architecture Biennial had designed an interior pavilion based on simple panels with printed this identification code. The entire exhibition could be used only through a tablet, with which you

could access photos, videos and documents on display not in the hall but in the cloud. The third menu, that of the routes is perhaps the most interesting. Through the digitization and collection of information on each artifact, thematic paths have been preset, within the application, allowing to visit the stratifications of each era individually. The development work of this application is in an initial version, as the mapping work is extremely difficult due to the presence of numerous artifacts deriving from stratifications over the centuries. Digitization is only a part of the process to make the realization of this tool possible, as the data of each element, specifically historical documents, assume even more importance in this method of use. (Fig,10) These are essential for the drafting of a didactic information system. When one thinks of outdoor museum contexts one must also reflect on the way in which the tools for augmented reality are used. Being an outdoor area, without strong shaded areas, it is always in the presence of direct light, this requires some precautions in thinking about the graphic design for an application. The design of the application is in fact strongly contrasted, to allow the commands to be made recognizable, and to facilitate their reading and use within the context of the archaeological park. (Verlinden, Horvath 2009)

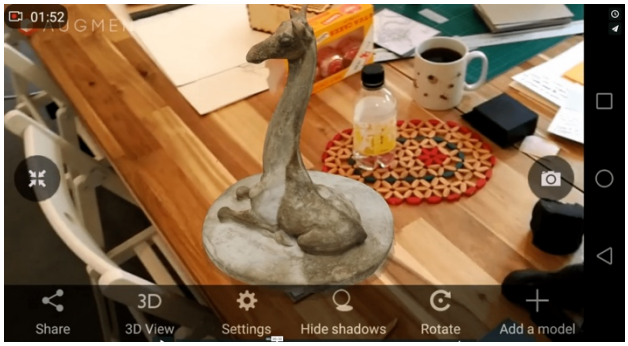

Figure 10: Image of the representation of a 3d model in the space in scale 1:1. Through an app it is possible to locate the object anywhere in the view range of the phone camera

5. CONCLUSIONS

In conclusion, the research is a means to preserve the historical memory of archaeological excavations through digitalization systems. The didascalic aspect of the working methodology allows to set up an information system aimed at transmitting, even at a distance from the place of the survey, the historical memory of the past epochs. The application fields as explained in the research are numerous. If you think of a totally immersive virtual reality, where the reconstruction of the environment is complete, and not only applicable to specific places like museums, but also transportable for educational purposes in schools. This process is applied today in the field of architecture through computers and instrumentation such as oculus rift and immersive maneuvering knobs to convey to customers the three-dimensional and usable reconstruction of homes. Applying the same concept it is possible to do the same to allow the use of this traveling digital museum. (Wagner et al., 2005)
In a wider perspective, where the economic resources are not such as to allow the development of an immersive VR reality, the research is extended, allowing the creation of applications with specific applications, through Augumentated Reality (AR) to see and observe the objects in the three dimensions and define them in space.
The importance of this research is not only to create virtual reality systems and thematic routes within the archaeological areas but also to start a process of digitization of all archaeological finds, in order to create a digital database. The need to create this database is increasingly compelling, given the scarcity of funds for the maintenance of historical archeology, natural disasters and atmospheric agents that each year cause more and more damage to the finds. Recently in the central archaeological area of Rome, there has been the collapse of the coverage of the Church of San Giuseppe dei Falegnami, in the absence of a digital and traditional survey, the only evidence of the coverage are the archival project drawings, without however preserve the memory of historical changes. (Fig.11) In this way, there are no tools other than photographic documentation and project drawings for philological reconstruction.

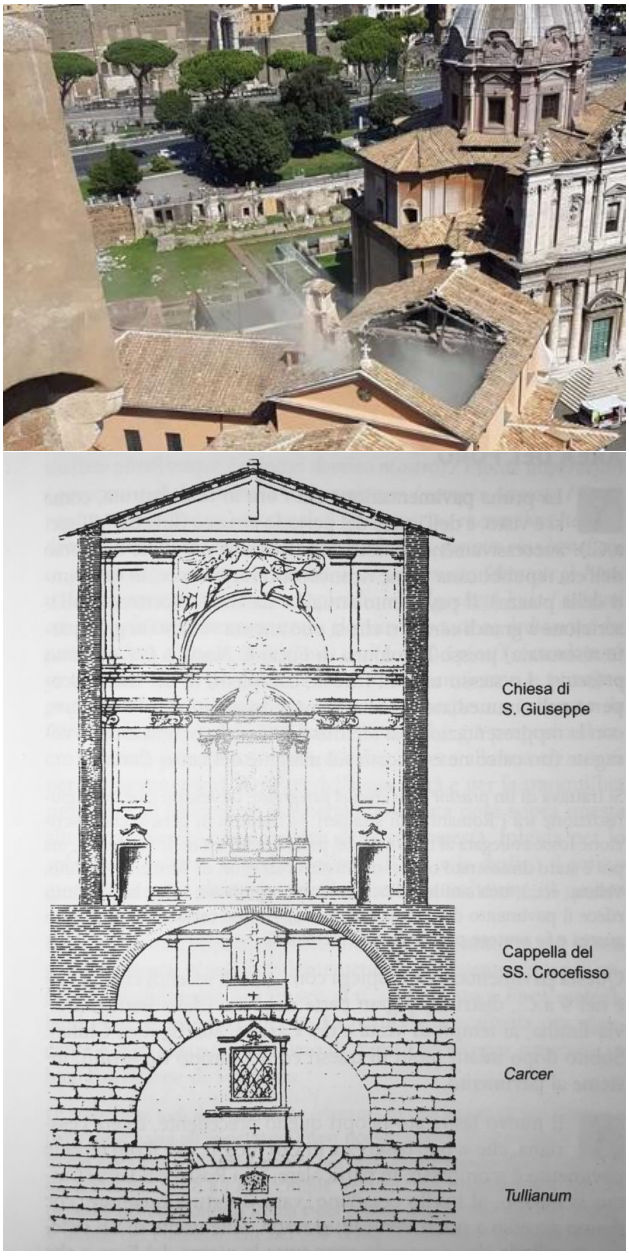

Figure: 11 From top to bottom Image of the church of San Giuseppe ai Falegnami after the collapsing of the roof. Original design drawing of the church.

The changes introduced by the dematerialization of the data that become ubiquitous and by more and more performing techniques of complexity management, suggest provocatively towards the hypothesis of a museum of the future created starting from virtualized and recreated goods, thus investing the digital of a contingent importance to the lack, for any reason, of the original pieces.

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