Modelling the Absences through Survey: the Case Study of Syracuse

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Abstract Reading and disseminating information drawn out of (more or less readable) signs from complex places contribute to the "protection" of memory, meant as the contrasting process of any deleting action caused by the evolutionary processes of conformity of the urban system. According to this approach, the implementation is fundamentally important of the correct instruments. In particular, when the elements become extremely rarefied, "absent" so to say, the representation carried out with the most innovative technologies is suitable for several objectives, as it combines the need for accurate knowledge with the need for communication, enhancement and remote interaction. The aim of the present research is to master the remote interaction of the archaeological monuments of Syracuse which are actually "absent" either because their state of ruins doesn't allow their perception or because they are "hidden", not really visible. In this context, their interpretation has been carried out with a methodology which considers survey the co-developed instrument of analysis able to support the research. The modeling of the archaeological survey data offers the chance for dissemination and protection of cultural heritage.

Introduction: the representation of absences

Within the context of the experimentations carried out in the Laboratory of Representation of the University of Catania, directed by Giacinto Taibi and Rita Valenti, attention has been focused on the interpretation of the complexity of the archaeological site system. In particular, the research has considered the elements whose consistency is not necessarily tangible and are thus perceived as "absences".

It can be easily understood that the transformation of reality due to the succession of historical events determine a mutation of the urban landscape not always immediately recognizable.

"Places tell sedimentary stories which testify the original meanings and vicissitudes which transformed themselves in the course of time. Digging is like accessing to the unconscious part of the place [. . .] Revealing its forgotten past; its archaeological strata

emerge from a mythical depth, exposing the historical roots of its own existence. Use always persists in some aspects of things […] Ruins are like an *objet trouvé,* acquiring aesthetic cultural values beyond their original intention. The cultural characteristic which has patrimonial value is its antiquity which time, rarity and sedimentation make stronger" (Pinto 2008, 4).

The above words express, shortly, the meaning of stratified places which explicitly (through the integration into what is new) or introspectively (without any clear visual or tangible perception) provide the clues of memory. Places where the problems connected with the methodology of representation, due to the need of dealing with complex and intricate patterns, give the chance to reason about survey and quality of survey restitution with modern technologies.

The representation of the historical conformity process, through the reconstruction of the evolutionary dynamism of the signs left on the place and of the "absent" signs kept in the archives of memory, becomes the complete visualization of all the (visible and invisible) historical events (Fig. 1).

Fig. 1 Left: Syracuse historical photos of the Temple of Apollo e di Pancali Square. Top right: The archaeological site of Neapolis of Syracuse. Bottom right: Syracuse. Duomo Square, black lines of melted lead of the archaeological site buried underground.

Specifically, the perception of tangible reality without the support of memory gives back only some partial knowledge of reality. Memory and matter, actually, are closely intertwined in a relationship where past memories represent the basis of the collective memory of the evolving community.

According to this approach, visible information and absent stratifications are composed into a unity, developing a digital system properly structured in order to contain both.

In particular, the existing matter, a real "stone archive", appears a useful tangible historical document where it is possible to conduct researches regarding the past. Memory, on its turn, kept in an intangible way, acquires new materiality whose consistency is exclusively virtual.

In both cases, virtual modeling techniques give interesting results for the study, protection, conservation and dissemination of Cultural Heritage.

Safeguard and sustainable development are the two terms of the question and the study goes into this direction, embracing the motto "representing the city which represents us" in order to protect the perceptible identity not always visible.

The semantic interpretation of stratifications where architecture and archaeology are closely intertwined provides a kind of dialogue between matter and memory where present reality, with all its mutations due to the events occurred in the course of time, expresses what remains of the historical original reality which can be considered as a "virtual reality" to rediscover. Redesigning what is visible opens a window on what is invisible.

Sign decoding and interpretation, therefore, have been carried out with a methodology which considers survey the shared instrument of analysis able to support approaches and methods of research.

Historical narrative takes place through a model of representation which expresses the mutations time has visibly and introspectively exerted on the system. The model becomes the visualization of a reconstruction of the evolving dynamism of signs imprinted in that place. The methodological analysis is then a living system which makes use of technology not only to virtually explore places but also to build the networks that history has woven with the purpose of culture dissemination and to reestablish the cultural order within the real space.

In particular, the analysis, conducted on the basis of precision surveying and with the support of literature and archive material, focused on the creation of a 3D document for the virtual reconstructive process of the archaeological heritage.

1   The representation of stratified places in Syracuse

The research has been conducted into the archaeological sites of Syracuse which tightly interweave with the dynamic and complex dialectic of landscape archaeology, urban archaeology and the archaeology of the stratified architectural structures. The rigorous analysis is the result of the succession and concatenation of historical experiences.

So, the types of relations established between material archaeological remains and time inspire reasoning about the urban space, as if in its evolving, it could "subtract" portions of the city incorporating them sometimes in a perceptibly visual way, some other times in an intangibly perceptible way. Gutting, with the subtraction of materials, confers new point of views to the space around with the new arrangements given by the contemporaries who rediscover its value.

In the specific case, it is necessary to distinguish at least two typologies of physical and architectural evidences; the first ones consolidated and settled in the perceptible history of the place, the second ones brought back to light in relatively recent times, therefore, "rediscovered" by the urban landscape.

As for the last ones—being forgotten or not refunctionalised in the course of time and being "rediscovered" from the half of the XIX century on thanks to archaeological excavations—the design of the landscape context deriving from survey operations conducted with the most innovative technologies, revives history mending the passages of the rediscovery of the city (Fig. 2).
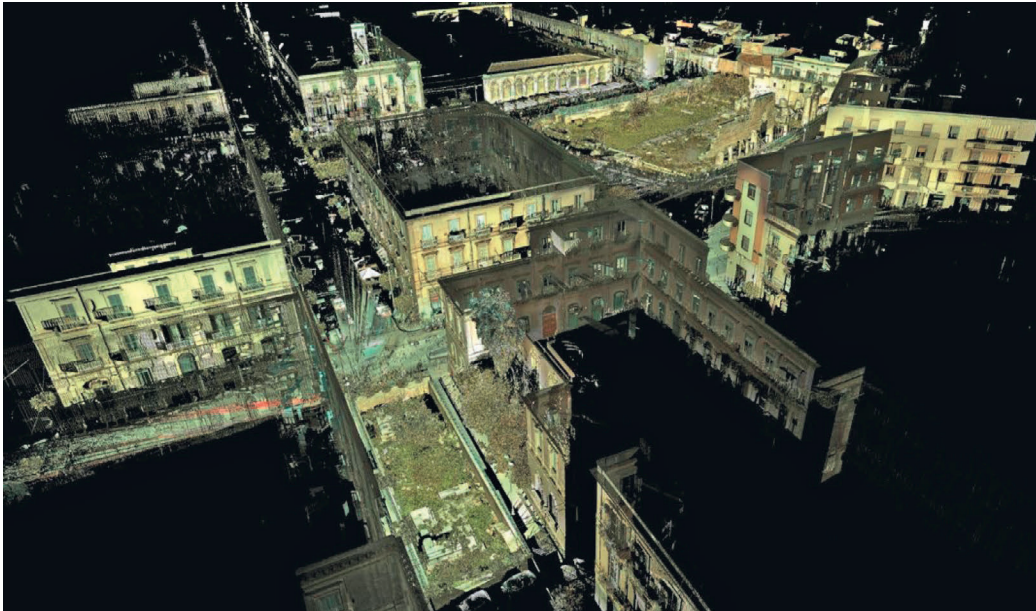
Fig. 2 Syracuse. Ortygia. Survey TLS. Images processed by Laboratory of Representation of SDS of Syracuse, University of Catania, by Emanuela Paternò.

In the present case, 3D data restitutions acquired from specific survey campaigns conducted with 3D laser scanning technology provide the present urban images with high potential communication about the evolutionary processes of the city (Valenti 2015).

It is necessary, therefore, to put into action a holistic approach to the cognitive process which can take into consideration the complexity of all the components present in the study of a stratified landscape. This holistic approach will be able to create a network of information which makes clear the connections between the visible elements, and the "absent" reality, because no more existing or currently not visible.

The methodology in use is in assonance with the ongoing process of transformation of the representation which, thanks to the continuous evolution of technology for cognitive monitoring of formal complexity, becomes more and more digitalized (Attenni, Bartolomei, Hess & Ippolito 2017).

Extremely important, from this point of view, is the methodological process of product visualization through a virtual experience respecting the canons of objectivity and recognition of all the subsequent processing phases. In this way it is possible to start a network of easily accessible and communicable information.

All the problems connected with the dissemination of reconstructive practices and virtual visualization in large scale have drawn the international scientific community's attention on the strict and intellectually precise criteria developed by the London Charter in 2009. For the archaeological field in particular, the expression "virtual archaeology" is used with reference to the reconstruction of sites and urban landscape kept in the form of ruins or fragments.
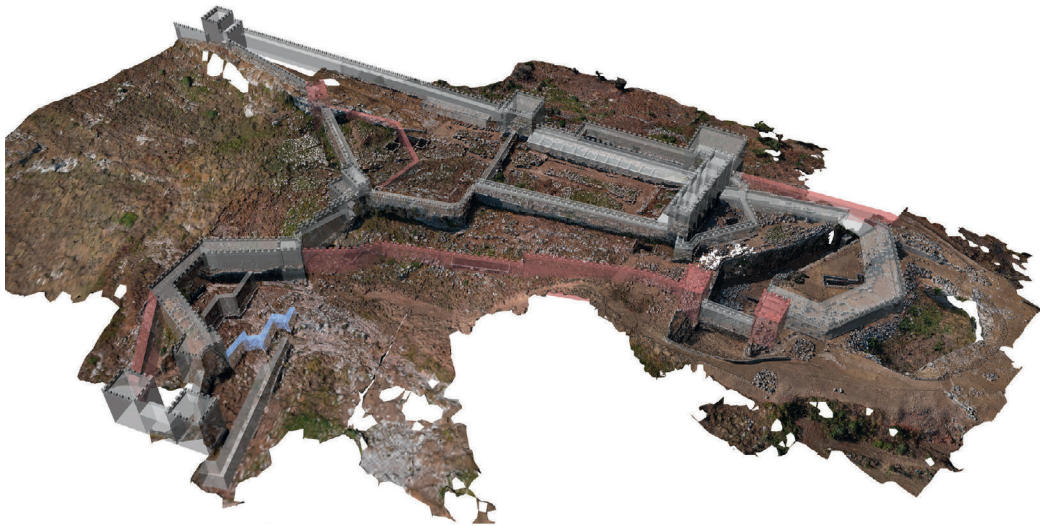
Fig. 3 Syracuse. Euryalus Castle. Thematic model created on the basis of instrumental and photogrammetric survey and bibliographic sources. 3D model constructed by the Laboratory of Representation of SDS of Syracuse, University of Catania, by Graziella Cusmano.

Particular attention must be especially given when the research is conducted into material undetectable archaeological remains (Fig. 3).

In this case, representation and communication through virtual simulation appears as the unique instrument for the visual dissemination of knowledge able to guarantee, at the same time, the protection of memory (Valenti 2022).

2   Virtual visualization of absent Archaeological Heritage: methodological approaches for 3D modelling

The archaeological heritage object of experimentation of 3D visualisation deals with some archaeological sites in Syracuse where the Laboratory of Representation of the University of Catania has been playing an active role for a decade.

The representation and dissemination of the archaeological heritage in Syracuse is especially devoted to the research of shapes and proportions through virtual reconstructive simulations not only of absent structures, but also and primarily, to the backward conformity process which during the different historical phases have generated the present urban and architectural setting. (Valenti 2016, 109).

In the course of the research, on the occasion of the present study, some emblematic cases have been selected whose 3D restitution pertains to three different methodological approaches.

The first two cases deal with visible and surveyable archaeological goods for which a survey campaign with TLS (Terrestrial Laser Scanning) instruments was implemented. The third case deals with archaeological sites whose structures, in the course of time, were transformed into real absent stratifications, therefore no more visible or tangibly perceptible. The different implemented modes to generate the digital models are the result of the specific contents which, through representation, should become evident according to the level of supporting information and communicative purposes.

3D modelling wants to be the natural instrument of expression able to connect the visible with the invisible, with just the same meaning Italo Calvino attributed to the term "word" in his "Lezioni americane": "the word connects the visible trace with the invisible thing, the absent thing, the thing that is desired or feared, like a frail emergency bridge flung over an abyss. The proper use of language, for me personally, is one that enables us to approach things (present or absent) with discretion, attention, and caution, with respect for what things (present or absent) communicate without words" (Calvino 1993, 85).

Hence the visualisation process through the modelling of the studied cases involves the clear and immediate explanation of the interpretation phases so that both the objective phase of restitution and the interpretative phase, together with the supporting references, would be always recognizable. The experimentation adopted a unique approach for the dif-

ferent emblematic cases and, however, provided the appropriate virtual restitution in relation to the peculiarities of the archaeological examined object, looking for a visual balance between analysis and synthesis.

The virtual geometrical models proposed in the present study allow an immediate interpretation of what is really existing (visible) from what has inexorably been lost (invisible) whose reconstruction is based on archive researches and on the drawings of conducted excavations.

In detail, the first two examples are about the Temple of Apollo in Ortygia and the so called "Roman pool" in Neapolis, Syracuse. In this context, a methodological approach basically similar to the starting phase was adopted with two modelling formats conceptually different in the final outcomes.

In both cases an objective survey campaign of the structures still in situ was conducted with TLS systems supplied by the Laboratory of Representation. The surveyed remains were digitally reproduced through reverse engineering process. Survey conducted with laser scanning technology, in combination with traditional survey methodologies, allows the study of the sites of interest and the disposition of scientifically exact data for reconstructive elaborations.

As for the Temple of Apollo a visual documentation summing up the two integrated parts has been processed. After a careful historical research, on the point cloud converted to a continuous surface through the generation of triangular meshes with *Geomagic Wrap* software, the reconstructed missing points were inserted. The starting level was made up of an objective stratigraphic environment which set up the subsequent modelling of the reconstructive hypothesis in the same way as a material restoration (Fig. 4).

The final model through "the implementation of render engines such as Cinema 4D has, also, made it possible to distinguish the objective parts from the interpretative ones recognizable with the application of a transparent texture" (Taibi et alii 2016, 2016, 111).

A narrative scenario was created which is able to transmit even to non-specialists useful information connecting the archaeological remains with the original work.

The second example is about the so called "Roman pool", a "small architectural jewel located in the Archaeological Park of Neapolis in Syracuse, made up of two adjacent areas, a overlaying church, probably of Norman origin, and a multiphase partially built underground chamber with different final usages, access road to the area of the theatre of Syracuse during Greek times, cistern for the storage of water in Roman times, place of worship in Medieval times and finally mass grave as far as the XIX century" (Taibi et alii 2016, 113).

In this case the complex survey campaign conducted with Leica C10 ScanStation provided precise information from the metric and formal point of view of all the multistratified archaeological system allowing a global perception of the present situation (Fig. 5).

In particular, the digital reconstruction makes clear the researches and the hypotheses deriving from an extensive interpretation of the survey.
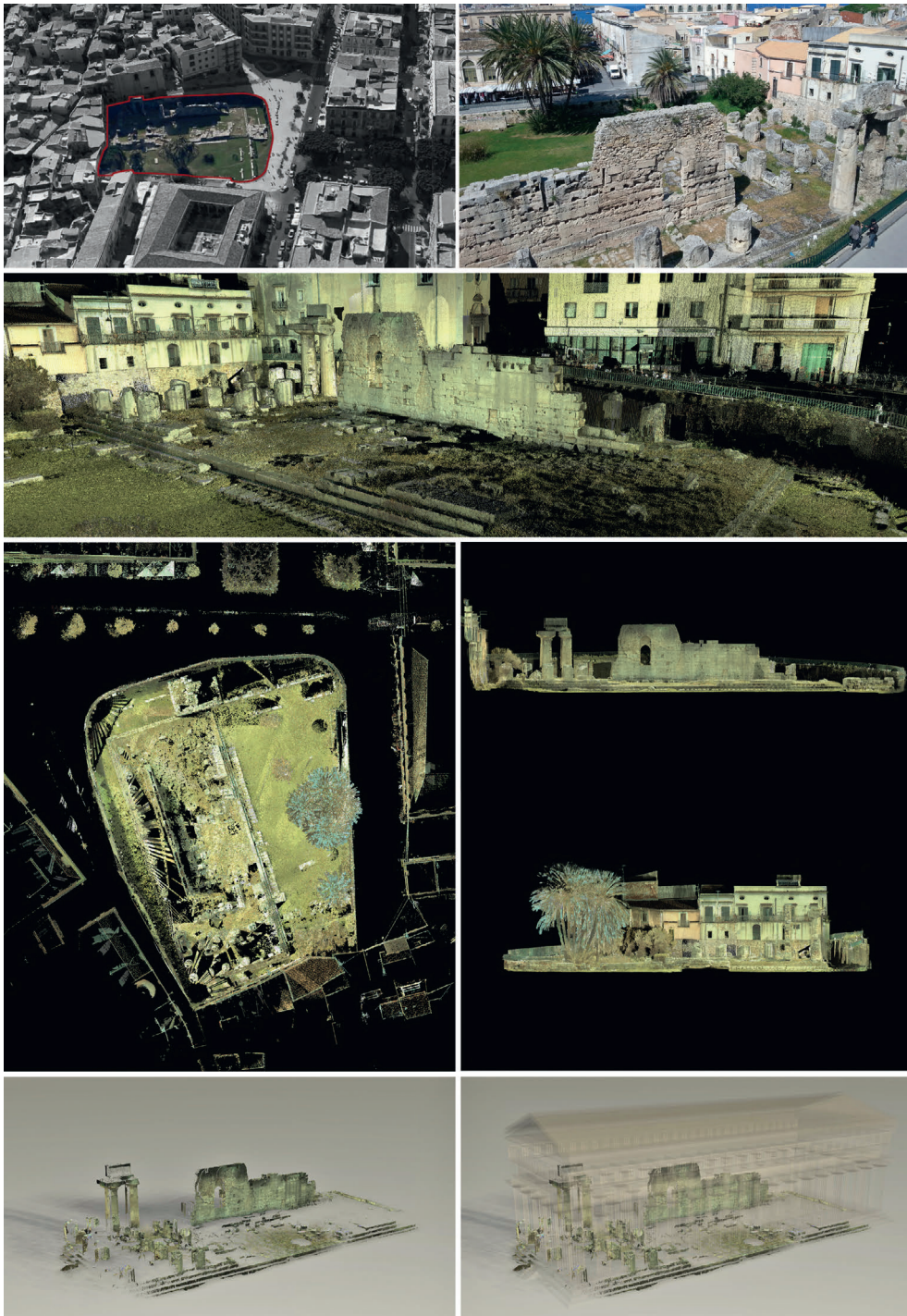
Fig. 4 Syracuse. Temple of Apollo: stratigraphic objective reality and reconstructive hypothesis. Images processed by Laboratory of Representation of SDS of Syracuse, University of Catania, by Emanuela Paternò

Fig. 5 Syracuse. The Archaeological Park of Neapolis. Roman Pool. Survey TLS, virtual reconstruction and life cycle restitution. Images processed by Laboratory of Representation of SDS of Syracuse, University of Catania.

"The virtual 3D reconstruction of the site allowed a broadening of the historical knowledge already known, enabling a comparative study of the sources, the restitution of the life stages and a better focus on the reconstructive hypotheses provided by different and renowned authors" (L. Aliano in Taibi et alii 2016, 113).

The third case study deals with the stratified urban context of the Duomo Square in Ortygia which hosts the remains of its own past in an introverted way considering that recent history has returned them back to earth, making them invisible.

At the end of the excavations conducted in the course of the last decade of the 20th century, the urban landscape appeared as an inaccessible memory archive.

Today, the elegant carpet with large white stone slabs, protects the history buried underground whose presence is "marked" by black lines of melted lead which becomes the graphic sign of the origin and devotion of the place to holiness. Signs point at the foundation of the *oikos* in the 8th century B.C., embedded in another holy structure of the 7th century B.C., to which the section of the Greek road running parallel to the Archbishop Palace can be added. These findings go back to the excavation campaign of 1990s conducted by the superintendent of cultural heritage of Syracuse Giuseppe Voza on the occasion of a new paving of the square.

The survey and the photos of the excavations conducted between 1996 and 1998 (Voza 1999) represent the only source of the status quo of the ruins today buried underground.

For this "absent" stratification the study[1] has implemented a faithful modelling of the buried archaeological site and a 3D restitution of what remains (graphically and photographically) surveyed during the excavation campaign.

The study intentionally proposes no reconstructive hypothesis of the context with the specific purpose to provide a complete interpretation of the history of this little urban area.

In particular, it was not possible to put into action a reverse engineering process. The study proceeded through the management and processing of digital images using the orthographic survey of the excavation area in front of the Cathedral.

The obtained model was then inserted in the present context of the wings which delimit the square importing the point clouds of the overlooking buildings acquired from previous TLS surveying (Fig. 6).

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1   The research was conducted within the PON project named "NEPTIS" ICT solutions for the accessibility and "augmented" exploration of Cultural Heritage. The modelling methodology was experimented by architect Emanuela Paternò who was awarded a PON Project research grant; Prof. Rita Valenti was scientific supervisor. The research results were published in Valenti & Paternò 2016.
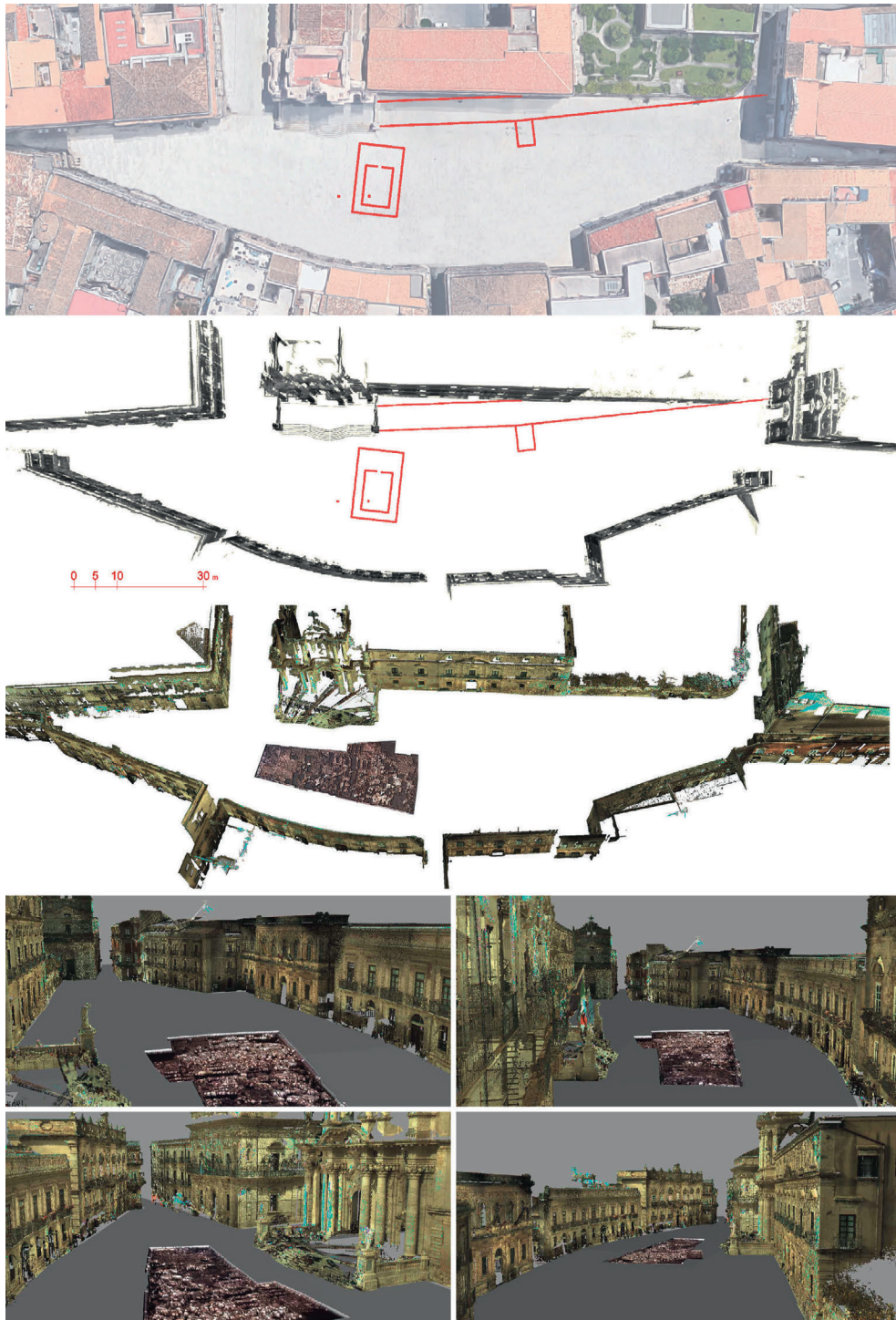
Fig. 6 Syracuse. Duomo Square. Insertion the 3D model of the excavations. Images processed by Laboratory of Representation of SDS of Syracuse, University of Catania, by Emanuela Paternò.

The proposed digital modelling has the only purpose of bringing back to light and making visible the ruins placed at a few decimetres under the paving of the main basin of Ortygia in order to restore all the strata of the stratified site of Duomo Square in Syracuse: from the paving level to the archaeological excavations to the (accessible) hypogea connecting the square to the Marina and to the great harbour.

Conclusions

The main purpose of the research has been to identify a complete approach for the representation of the archaeological visible and "absent" remains, through 3D modelling visualization.

Modelling, in the first part of the study, is meant not as a replica of what exists but as an explicative means of absent parts with the same assumptions of a material restoration and as an instrument of analysis and a study of stratigraphies imposed by history. In the last example, on the contrary, modelling becomes a replica of the invisible with the aim of giving shape and consistency, virtual though, to an "absent" reality full of important evidences.

In such a way they become accessible even if only virtually and the virtual model becomes a primary document of knowledge.

Generally, modelling archaeological monuments offers an opportunity for dissemination towards a non specialist audience and, above all, for the preservation of cultural identity over time. Virtual visualization becomes then an additional document allowing accessibility and dissemination of the history of places.

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