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Representing Intangible Heritage: Questions Concerning Method

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Abstract

The research explores issues concerning the relation between text and images – an interesting field of enquiry little explored to date – involving archaeological heritage that has not survived and is therefore based on descriptions of artefacts and sites. Nowadays, this heritage can exist again thanks to digital technologies (relational databases) and methodologies (conceptual modelling) that allow the construction of 2D and 3D models. Studied here are the relations between the text and conceptual categories, between description and classification of objects in order to understand how all words and terms influence the results of interpretation and interaction between different profiles in the construction of models. In this context digital methodologies are discussed to assess the actual state of archaeological information systems and reflect upon possible future directions.

Keywords: intangible archaeological heritage, survey, 3D/2D/1D models, digital archive, Pyrgi

Introduction

The relations between literature and figurative arts have for centuries been objects of inquiry which resulted in theories and axioms applied in different contexts and different epochs. Even today the study of the dynamics between the text and the image is an interesting field that runs across different disciplines that investigate human endeavour. Many humanistic disciplines, such as philosophy, aesthetics, literature and history, have always used the text as the instrument for describing models. Ancient rhetoric applies the term ἔκφρασις (*ekphrasis*) to the verbal procedure that transforms the person that reads or listens into a spectator who creates a complex vision of an object, a person, a place or an event, having first decomposed it into articulated elements. Nowadays the term ekphrasis is most usually employed to *signify a text that represents or evokes a visual work of art* (Elsner 2002; Webb 1999; Zanker 2003), emphasizing the relation of subordination of the text to the image and evoking its relations with the visual nature of art. In spite of the ancient origin of this relationship, the debate on the interchangeability between literature and models – understood as a synthesis of data that allow one to visualize an object in space, is even more topical. Interaction between various disciplines puts in direct contact diverse aspects and dimensions of the cultural experience, allowing one to consider each work of art as a composite[1] (Mitchell 1986) and to study the relations between other works of art through the relationship between the text and the image.

The description of archaeological architecture emerged as a privileged sector that concretized the specialization of the term *ekphrasis*. The present study is an enquiry into these relations in the field of

1 The image/text problem is not just something constructed between the arts, the media or different form of representation, but an avoidable issue within all the individual arts and media. All arts are composite arts (both text and image); all media are mixed media, combining different codes, discursive conventions, channels, sensory and cognitive models.

archaeological heritage. In many cases, to comprehend such a number of elements, it is necessary, first of all, to study the existing documentation, in most cases almost exclusively textual. Nowadays quite a lot of archaeological heritage is based on descriptions of objects and places while communicating information is more and more linked to the construction of 3D/2D models enhanced by the development of information and communication technologies.

The construction of such models is especially complicated when their elements no longer exist and when their documentation is solely of the descriptive type - completely devoid of any images or drawings. Thus, it becomes interesting to enquire into the problem how the representation of an archaeological artefact ought to correspond to what is described as well as try to find out to what extent all words and terms used insert the interpretation and interaction between different profiles into 2D/3D model construction. The objects of analyses are the relations existing between the text and conceptual categories, description and classification of objects, addressing the problem of representation of artefacts that are only described. The textual data at the point of departure - while recognizing the essential role of the word - made it possible to translate the text into a model taking advantage of Information Technology tools and techniques for digital modelling and representation.

The text is mainly linked to interpretations of the subjective type when each interpreter refers to his or her own imagination through an adequate use of visual particulars, which is connected to the knowledge everyone has about the object in question. The models emerge as the visual extension of what is described through a character perceived immediately when passing from the verbal sphere into the figurative one. The main focus rests on the transition from the documentation constituted by models 2D/1D[2] towards cataloguing structured into semantic categories of 3D/2D/1D models. Such a classification makes it possible to archive all information and makes for their objectification determining as it does the identity of complex objects whose qualities can be subject to critical assessments (Ippolito and Attenni 2016).

Background

The great amount of information that archaeological heritage conveys imposes the necessity of a dialogue between various phases capable of being documented and of spreading information related to acquisition, virtualization, and data communication. Nowadays, the relation between archaeological research and informatization represents one of the most popular fields of research while the definition of potentiality and criticity of informatics system constitutes the most advanced point in the theoretical and methodological debates concerning these subjects. The practice of utilizing such systems has almost become a standard, as relates to the digitalization of documentation obtained from archivist research and excavations at archaeological sites, to the knowledge and documentation acquired thanks to the most advanced non-contact surveying techniques, as well as to the construction of models of archaeological elements on the grand, medium and small scales (Bianchini, Inglese, & Ippolito 2016).

The extraction (production) of the archaeological datum in whatever form it appears requires total transparency. Only then can it serve as the basis for studies and research and be subject to verification. The concept of data transparency is strictly linked to its properties, both quantitative (physical parameters, coordinates, position, geometry) and qualitative (contingent and permanent properties and formal aspects visible *in concreto* in a determined reality). Data measurability nowadays must derive from digital documentation related to non-contact surveying campaigns as well as to the successively carried out operations that serve the construction of 3D/2D models. It offers an important convergence point between architecture and archaeology - not only for strictly practical reasons but also for the theoretical and methodological point of view, thus directing the surveying theory towards the neo-processualistic) approach. Within this approach the quantitative aspect[3] plays the central role in data elaboration (Cowgill 1977, 1989) and becomes successively structured with the nascence of relational databases, all with

2 Definition of 1D models indicates all the textual, numerical and alphanumerical data, which describe the object and make it possible to define 3D/2D models in virtual space.

3 This approach is based on statistical methods proposed in the 1960s by Albert Spaulding at the very same time when database organized along hierarchical schemes were being developed, all the time remaining within the ambience of linear database.

the objective to construct a strongly particularized (Valenti 2012) picture of general knowledge. However, the development of informatics technologies certainly offers more flexible modes of managing and questioning complex data, when the user has to be able to define methods of accessing, manipulating, representing, and archiving the same data (Valenti 2015). Moreover, and this is the most important, he/she has to be able to validate (or to contradict!) the elementary quantity elaborated (Bentkowska-Kafel et al. 2010; Koutsoudis et al. 2015).

Within this framework of reference digital models of archaeological data - which approach closer and closer the work of the architect, no longer exist as simple hypotheses but as "articulated and dynamic constructions that must be capable of corresponding (responding) to the richness of the elements that constitute the integral part of the context" (Bietti Sestieri 2000). Elaborating such models becomes, then, one of the principal objectives to pursue the path leading to the knowledge of archaeological settings with their intrinsic historical stratifications and structural characteristics. It seems understandable now why the application of computer (informatics) methodologies have recently become fully ingrained in the ways archaeological data are acquired, archived, promulgated and interrelated (Valenti 2000).

We need, then, to understand how technology influences and is influenced by the methodology of archaeology as well as grasp the quality of the relation between technology and methodology when the matter concerns the knowledge (cognition) of complex contexts. In the study of realities that disappeared almost totally, there always re-emerges the question of its the relation with computer (informatics) technologies. In particular, one of the principal aspects to be considered when designing computer (informatics) systems for archaeology concerns precisely the conceptual modelling of the data. The activity in question brings together two important subjects: the abstract nature of the modelling process and the selective nature of the source archaeological data.

Within the structure of the formal model both subjects lead to the conceptualization into categories as a way to organize knowledge (Bommara 2004), which integrates the representation techniques with ontological analysis.

Figure 1. The etruscan sanctuary of Pyrgi.

Pyrgi: Collection and Classification of Archaeological Data

The experiment has been conducted on the documentation and the conceptual digital modelling in of the Etruscan sanctuary of Pyrgi (Figure 1). It had been studied for years in its different aspects, from its urban and territorial characteristics and its connections with the port of Caere to the analyses of the remaining fragments of architectural terracotta (Figure 2). Excavations conducted in 1957 (Pallottino 1971, 1984) brought to light a sacred area upon which there stood two temple complexes, named Temple A and Temple B - endowed with rich architectonic ornamentation - and area C well known as the place where gold foils were found and a rectangular edifice divided into cells was placed against the enclosing wall of the sanctuary (Colonna 1970, 1985). Only a few vestiges of the temple context survived on the site but numerous fragments of deco-

Figure 2. The excavation of Etruscan sanctuary of Pyrgi, from 1957 to 2017.

rations have been found[4] (Baglione et al. 2013). Part of the archaeological material discovered is today exhibited in the Museo Nazionale Etrusco di Villa Giulia in Rome and at the Antiquarium of Santa Severa. Attention has been given to the study and analysis of archaeological elements that are parts thereof by applying methods and techniques which allow us to grasp the objects on the urban scale and in full detail (Colonna and Pelagatti 1990).

Therefore, presented here are the processes that followed as well as the results of some experiments

4 Three documents carved on gold tablets found around Tempio B on July 8th, 1964 during an excavation campaign go back to the 6th or the beginning of the 5th century B.C. The remains of considerable historical and linguistic interest for Etruscan archaeology are considered to be the first sources written in Italic languages. Today they are housed in the Museo Nazionale Etrusco in the Villa Giulia in Rome.

with the objective to bring out important aspects of the concerted efforts of architects and archaeologists working at the site. The present endeavour was taken up with the intention to implement a process never before attempted in relation to the data concerning the Sanctuary of Pyrgi. The aim of the study is to valorise cultural heritage by enquiring into the possibilities and the modalities for documenting and popularizing archaeological heritage (Van Dyke 2006).

The work was divided into the following stages: analysis of all the documentation available; semantic classification of the updated material (bibliographical documents, archive sources, images, archaeologists' drawings); integration of available information with data from surveying/surveys of existing objects[5]; 2D/3D philological reconstruction of the original state of elements which did not survive, taking departure from archaeological data; and preparation of a database for the digital documentation of the models and related heterogeneous information[6].

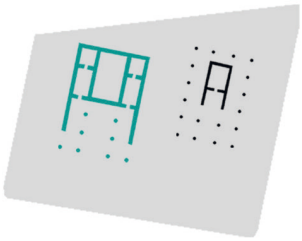
The initial, propaedeutic stage of these activities involved the acquisition and archiving of all the updated data relative to the two temples (see Figure 3). However, the main body of the existing documentation is made up of archive materials, bibliographical information and notes from excavation sites. So, the path taken has been directed towards systematizing and communicating heterogeneous information that includes documentation of the current state and a reconstruction of things lost (Callieri et al. 2015; Remondino and Campana 2014). The research made it possible to fine-tune a digitalized enquiry methodology aimed at extracting and systemizing unstructured or semi-structured data contained in archaeological documents but always related to the research carried out in situ (excavation diaries, archived documents, historical documentation, data gathered by archaeologists, drawings made during various excavation campaigns, and interpretative hypotheses).

The central point selected was that of the transition from problems involved in representing data that were essentially textual or that contained few graphic models to subsequently defining the ontologies of the domain of archaeology. The construction of archaeological models from textual data passes through the definition of categories and relations between them, allowing the construction of mental models also linked to a reality that no longer exists, such as the sacred area of Pyrgi. Two classes of problems are inherent in this particular operation: the first one is that the modelling of objects that no longer exist is always linked to subjective interpretation; the second - that the definition of the categories and relationships and the construction of models are always linked to the concept of scale[7]. To address such questions, one has to grasp the meaning of all the terms to be able to adequately express and represent -- through models -- the relations between them. Model constructing operations do not follow a hierarchical scheme. They have to embrace, instead, a complex network of relations within which the representations of objects of a structural and functional nature are associated. The analysis of textual documentation has proved to be fundamental for elaborating concepts, that is, for defining in proper terminology the elements to be described and represented and subsequently to be able to distill the relations --

5 Survey of existing elements was conducted by integrated methodologies for non-contact survey: topography and 3D laser scanning for substructures, Structure from motion (SfM) for architectural terracotta.

6 Systematization of data within a platform and their diffusion is part of the Digital Heritage defined in the Charter on the Preservation of the Digital Heritage published by UNESCO in 2003, as: "cultural, educational, scientific and administrative resources, as well as technical, medical and other kinds of information created digitally, or converted into digital form from existing analogue resources including different kinds of products such as texts, databases, images, audio, graphics, software and web pages."

7 Models of all types, whether ideal or real, provide a determined quantity of information related to the detail level at which it has been realized. The concept of scale (or the ratio of reduction) is directly linked with that of intrinsic uncertainty (also referred to as the error of graphicism) and is characteristic of all graphic models. Knowing this value – conventionally linked to the capability of the human eye to distinguish clearly two adjacent lines (0.2/0.3 mm) – immediately allows one to characterize any graphic elaboration in terms of metric uncertainty, a parameter that from this standpoint depends solely on the adopted ratio of reduction. In this way it becomes possible to evaluate a priori the uncertainty level to be dealt with in the stage of realization, starting with any scale drawing (towards the Project); and vice versa, it must be taken into account as soon as a surveying campaign is organized because the data have to comply from the moment of acquisition with the requirement of equal or lower drawing uncertainty (towards the Survey). For example, a drawing in 1:50 scale allows the intrinsic uncertainty level ranging from 1/1.5 cm (0.2/0.3 mm x 50 = 10/15 mm = 1/1.5 cm): so, in the stage of acquisition it will be necessary to select instruments and methods which meet this prerequisite.



■ Temple A documentation

criteri per la catalogazione / elementi archeologici	PERIODO		CLASSIFICAZIONE			MATERIALE ARCHIVIO			EL.FISICO		LOCALIZZAZIONE			ACQUISIZIONE	
	580-480	480-230	livello costruttivo	livello funzionale	livello decorativo	modelli grafici	testo	immagini	si	no	Antiquarium Pyrgi	Museo Nazionale Etrusco Villa Giulia	Santuario Pyrgi	rilevamento non a contatto	virtualizzazione dato archeologico
	A	B													
stereobate muri perimetrali	●	○	●	○	○	●	●	○	○	●	○	○	○	○	●
stereobate muri trasversali 	●	○	●	○	○	●	●	○	●	○	○	○	●	●	●
stereobate muri interni 	●	○	●	○	○	●	●	○	●	○	○	○	●	●	●
stereobate pavimento in tufo	●	○	●	○	○	●	●	○	○	●	○	○	○	○	●
terrazza	●	○	●	○	○	●	●	○	○	●	○	○	○	○	●
podio	●	○	●	○	○	●	●	○	○	●	○	○	○	○	●
copertura	●	○	●	○	○	●	●	○	○	●	○	○	○	○	●
ordine tuscanico fusto 	●	○	○	●	○	●	●	●	●	○	●	○	○	●	●
ordine tuscanico base 	●	○	○	●	○	●	●	●	●	○	●	○	○	●	●
ordine tuscanico capitello 	●	○	○	●	○	●	●	●	●	○	●	○	○	●	●
architrave lastre rivestimento 	○	●	○	○	●	●	●	●	●	○	●	○	○	●	●
architrave lastre rivestimento 	○	●	○	○	●	●	●	●	●	○	●	○	○	●	●
architrave lastre rivestimento 	○	●	○	○	●	●	●	●	●	○	●	○	○	●	●
architrave lastre rivestimento 	●	○	○	○	●	●	●	●	●	○	●	○	○	●	●
spiovente sinistro lastre rivestimento 	●	○	○	○	●	●	●	●	●	○	●	○	○	●	●
spiovente sinistro lastre rivestimento 	●	○	○	○	●	●	●	●	●	○	●	○	○	●	●

Figure 3. Classification of existing archaeological documentation.

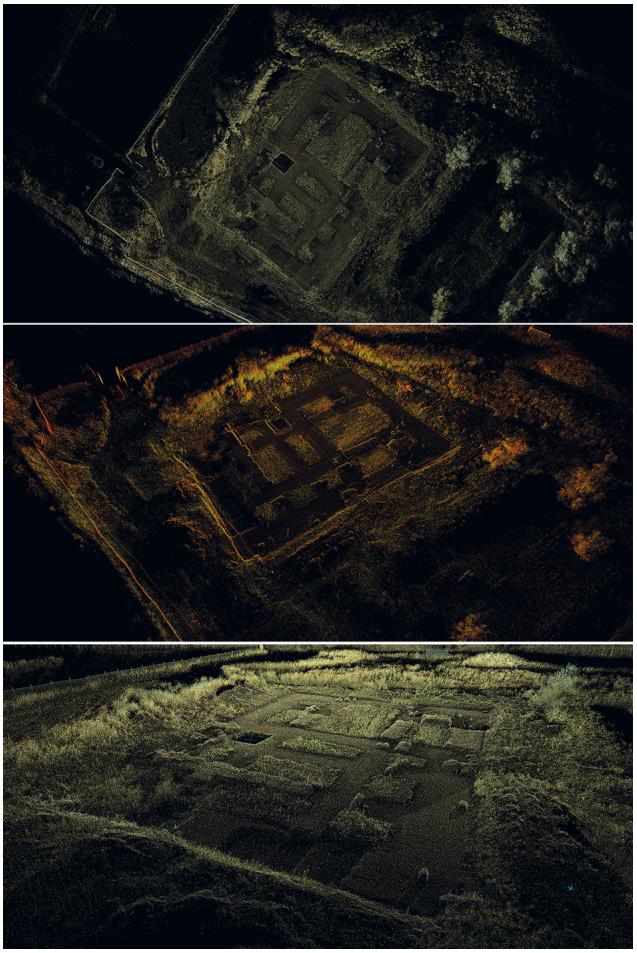


Figure 4. Analysis of available documentation for extraction of categories (surveying of Temple A).

Figure 5. Survey of Mythological high relief (Temple A).

hierarchical or not -- obtained among various classes of elements.

Issues in Model Construction

A complete and organized collection of archived documentation – graphic and textual – as well as the cataloguing of data at our disposal were necessary to maintain unchanged the informative contents while passing from archaeological documentation, mainly textual, to that with a large number of graphic models. The criteria adopted for cataloguing objects (Batley 2005) are strictly connected to the characteristic properties of archaeological objects: registered name, historical period to which the object belongs, a list of documents concerning Temple A and Temple B. Such a classification made it possible to structure out a documentation that having started with semantic classification of the component parts of the object of study links indissolubly their cognition to the study of the sources at our disposal and to archaeological interpretation. The goal is the construction of models that are as objective as possible (Apollonio et al. 2013; Brunetaud et al. 2012). Familiarity with the methods and techniques for data acquisition legitimized an a priori assessment of the results to be obtained through surveying various existing objects (structural remains and fragments of architectural terracotta), which in turn constitute a solid basis for understanding the whole structure but also through the survey of the intangible carried out by studying texts for the purpose of constructing theoretical models. The processes of acquiring and elaborating data have been conducted through integrated surveying: 3D laser scanning for structural elements, SfM – and direct surveying for controlling measurements – to construct models (Cipriani and Fantini 2015) of architectural terracotta (see Figure 4). Data acquisition and processing through SfM concerned two types of elements. On the one hand there were those useful for the ideal reconstruction of Temple A

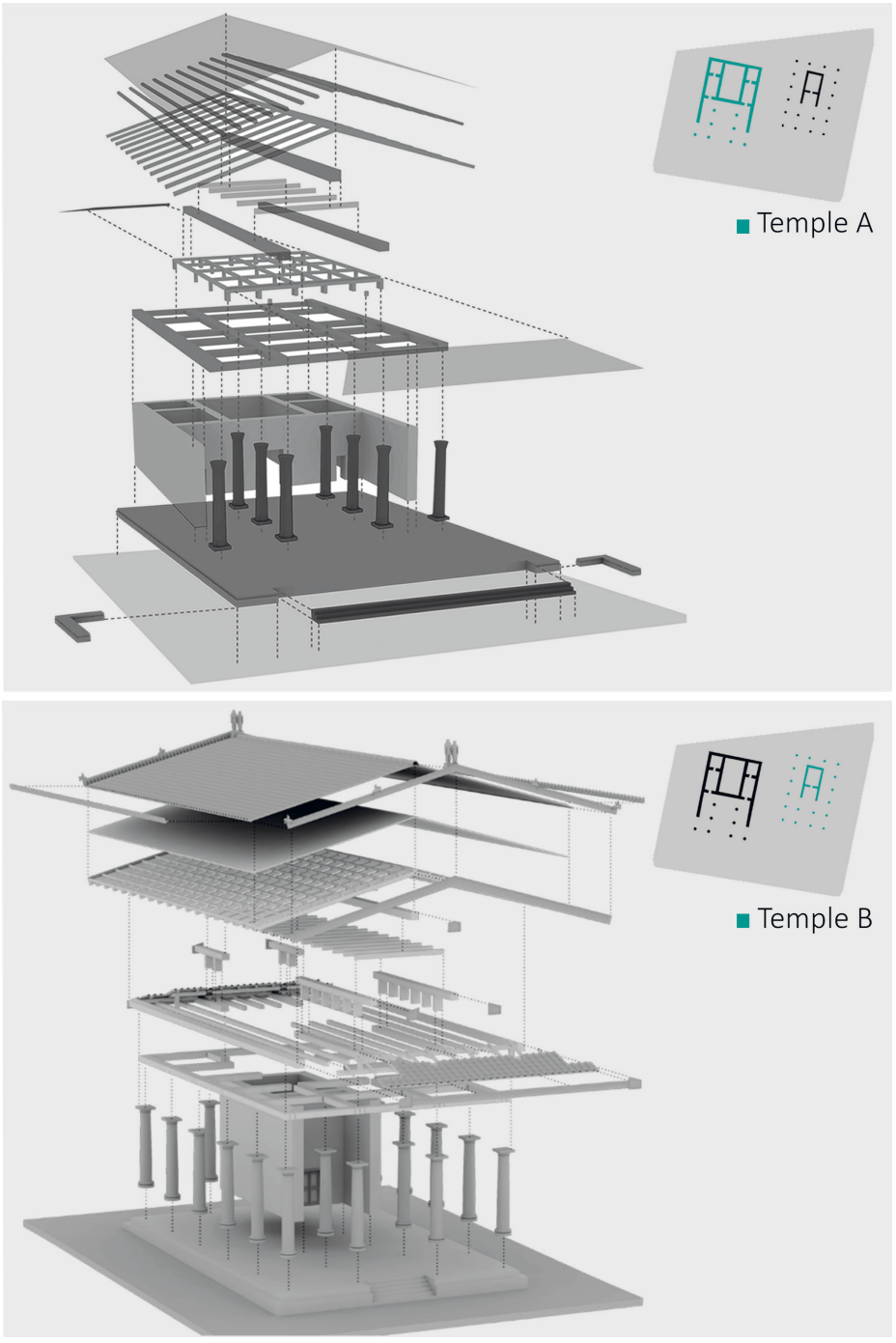


Figure 6. Philological restoration of Etruscan sanctuary of Pyrgi (Temple A and Temple B).

and Temple B, from which profiles have been extrapolated and geometries reconstructed. On the other hand, there were those sculpted, excessively fragmented and unattributable to any architectural typology. Such elements could be catalogued not only through photographic images or survey elaborations executed by applying traditional methodologies, but also with the help of three-dimensional model correctly scaled and placed in the Cartesian conception of space (Figure 5). They are useful for putting forth reconstructive hypotheses on the basis of data that are objective metrically, geometrically, chromatically and materially.

The successive stage, however, concerns the 3D reconstruction of Temple A and Temple B in a virtual environment (Figure 6). At this stage a comparison between researchers who work in different fields of inquiry – archaeology and architecture – is considered fundamental (Vrubel et al. 2009). Archaeologists' contribution was fundamental in order to determine geometric matrices of objects while thanks to surveying and representation it was possible to

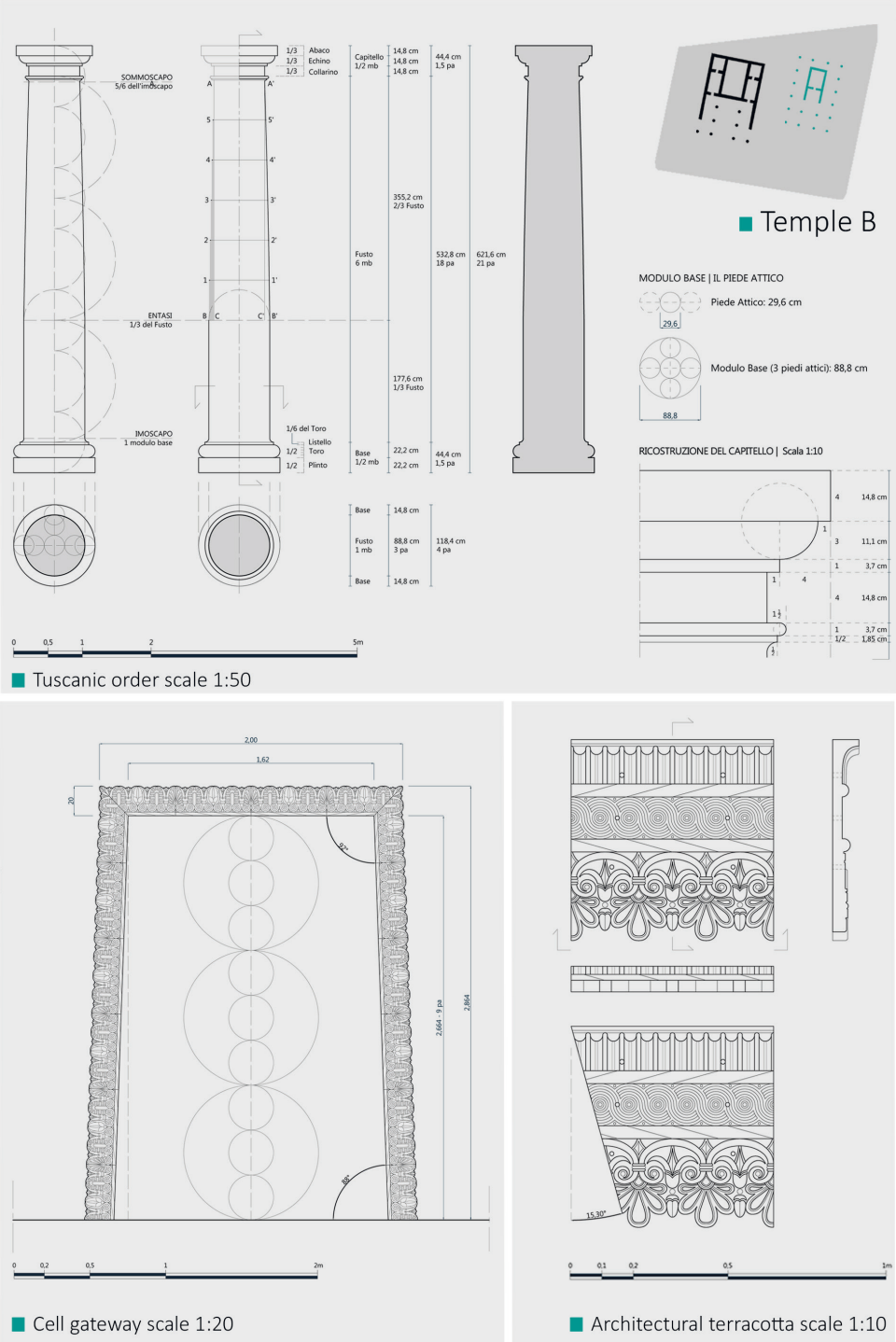


Figure 7. From textual data to 3D ideal model: composition and relation between classes of elements (Temple B).

construct the model in accordance with scientific criteria. The construction of an ideal model, based essentially on virtualizing archaeological data, rested upon digital methodologies for 2D representation and for 3D modelling (Figure 7). The virtual model obtained – a synthesis of the knowledge gained from the study and the analysis of data gathered – had already been defined previously in the construction elements and in the decorative ones. Defining generative and directive profiles and curves made it possible to reconstruct the most likely original appearance of Temple A and Temple B at the time of their construction.

Problems addressed in close collaboration with archaeologists are related to the interpretation of the dichotomies between the data provided by various sources to the overall composition of the object, to the process of transition from the complexity of ar-

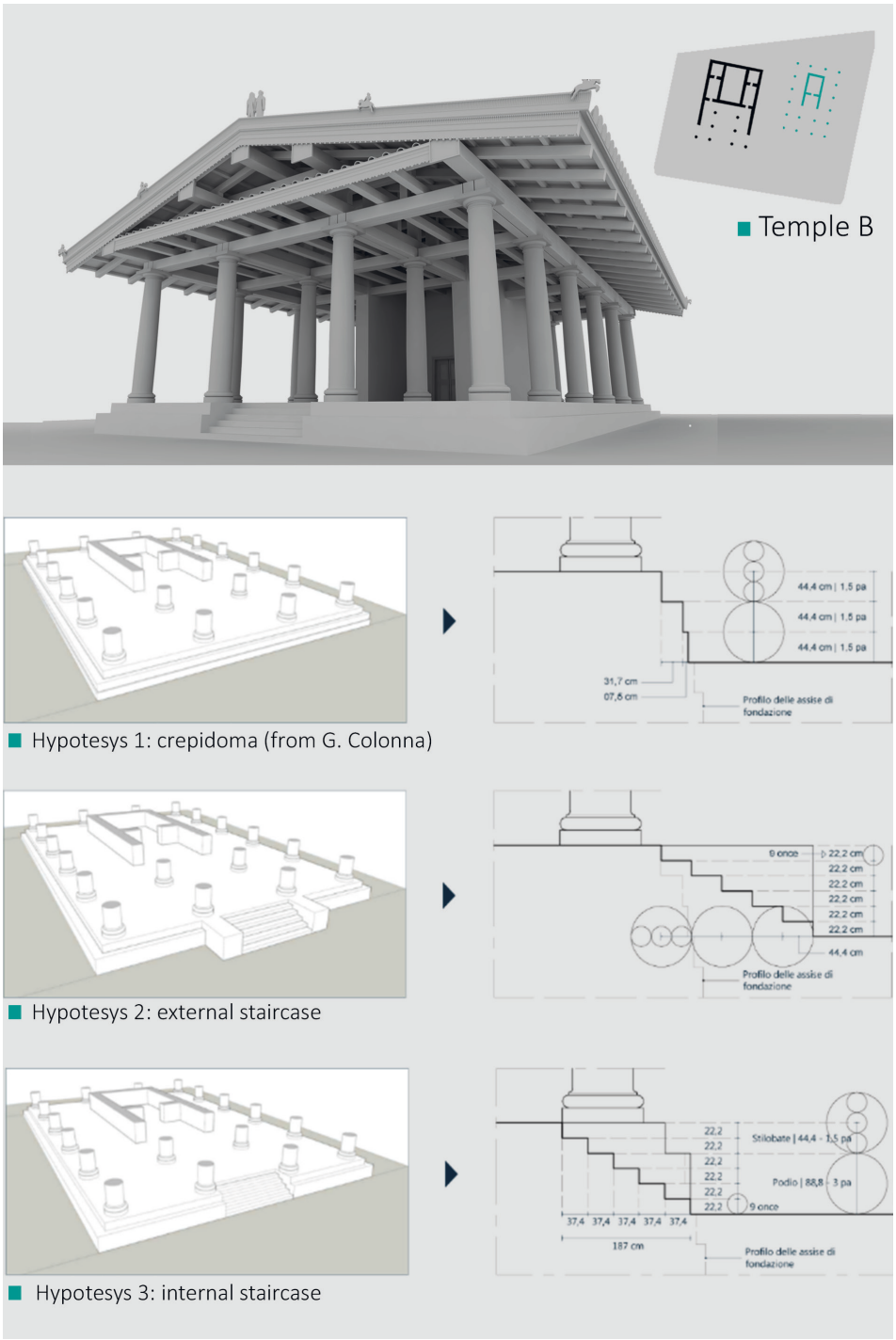


Figure 8. From textual data to 2D ideal models (Temple B).

chitectural object to the complexity of single pieces and decorative elements, as well as to the selection of the level of detail. There are three typologies of scientific validity and credibility used here: certain elements (ruins), certain or highly probable elements (repeatable or speculative), obtainable from preserved structures of embellishments, elements obtainable from graphic reproductions from the past that are subjected to verification for possible errors or misinterpretations, and deduced elements (obtainable from structures and decorations of similar buildings, based on typologies and features characteristic for the historical epoch).

For example, one of the issues addressed concerns the structure of the access to Temple B. The historical and archaeological sources predicted a high crepidoma (hypothesis from Giovanni Colonna) or an outside staircase. The construction of a 3D model, however, led others to hypothesize the presence of an internal staircase based on the unit of measure and

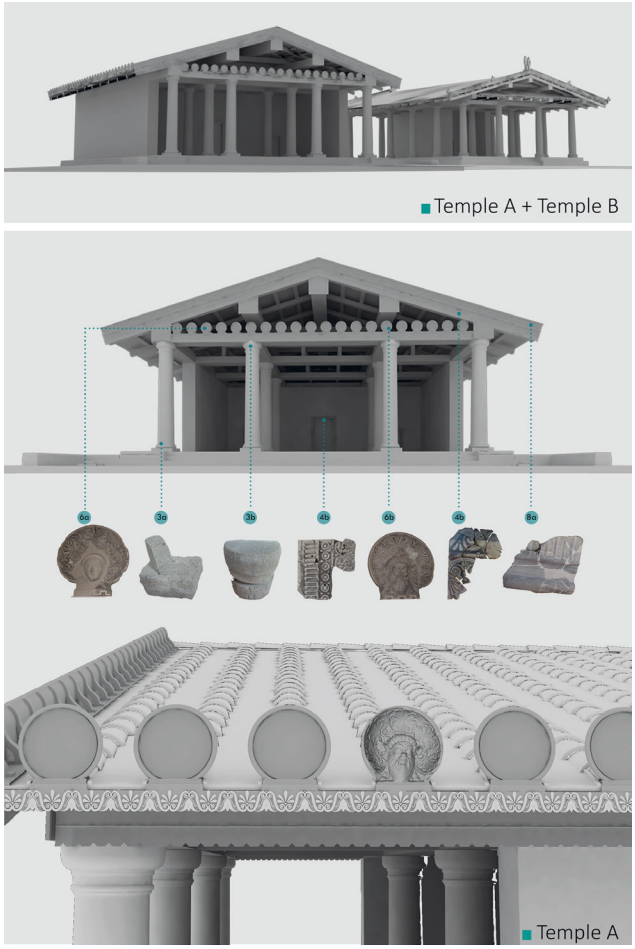


Figure 9. Philological restoration of Etruscan sanctuary of Pyrgi (Temple A and Temple B).

the size of blocks of tufa that were used (Figure 8). Another issue is related to the podium of Temple A. No remnants, descriptions, or any information about it has survived which would make it possible to determine its original structure. In order to construct its complete model, archaeological objects of the same period endowed with analogous characteristic features were taken into account (Tempio di Vulci), and on this basis its structure has been hypothesized (Figure 9).

Digital Solutions for Managing Archaeological Data

All typologies of the models, totally reconstructed and partially derived from surveying, have been used as an instrument of communication between various professionals involved in the research. The sources of data described above constitute modalities for gathering and presenting - in a transparent manner - the whole reconstruction process to be carried out – the objectives, methodology, techniques, arguments, characteristics of research sources, results and conclusions. The database constituted represents the point of departure for the road leading to a complete knowledge. Digitalization makes it continuously and immediately applicable, useful for faster and simpler dissemination of heterogeneous contents: data sheets with information on existing objects, graphic 2D elaborations, 3D models, photographic images, multimedia contents, and virtual itineraries.

A digital archive – a process whose objective is to furnish the possibility of dynamic and interactive reading – constitutes an innovative modality for the unification and diffusion of heterogeneous data dispersed throughout a territory but at the same time homogeneous in relation to criteria adopted for cataloguing and virtualizing existing and non-existing elements (Figure 10). A complete and neatly organized collection of graphic and textual archive documentation was necessary to maintain intact the informative content during the transition from archaeological documentation, mainly textual, to one with a high number of graphic models. This principle (Principle 7.1 of the Siviglia Charter 2004) reconfirms the necessity to prepare an objective and exhaustive documentary basis which examines the whole research process linked to the creation of digital contents for virtual archaeology (Evans and Daly 2006). In the domain of archaeological architecture data acquisition, virtualizing and communicating are processes that ought to converse with one another. Data systematization experiences spring from the necessity to create structured information, to archive it, to put it at the disposal of users, and also from a strong necessity of cataloguing a mass of data.

The construction of a digital archive implies the necessity to ponder a few issues: how to connect heterogeneous information, how to put questions to the system, which applications to use. The fundamental subject is the definition of connections between data structured according semantic categories and able to organize different information, like texts, images, 3D/2D/1D models linked by transitive relations that make possible the transition from the general to the particular, from the simple to the complex. Much attention will be given to the choice of interface, that is an informatics means most adequate for commu-

Figure 10. Archaeological documentation of Etruscan sanctuary of Pyrgi from 1957 to 2017.

nicating and using data as broadly as possible[8]. Construction of digital archives in archaeology can have multiple effects on the spread of information, not always distributed on a large scale for reasons of space and costs. Defining an open system based on the integration of specific and heterogeneous competencies involved in the study of archaeological heritage provides the point of departure for structuring out a process whose objective is knowledge.

The launched project serves as a tool to study in-depth the problem related to the classification and communication of archaeological data through heterogeneous models. The approach adopted enabled us to analyse the question of ekphrasis linking it to the use of technologies serving digital representa-

8 Software open source for archiving heterogeneous data of the archaeological heritage (http://3dhop.net).

tion. While in the past textual description was considered superior to representation by virtue of its capacity to express contents inaccessible otherwise, nowadays the situation seems to have been reversed. Thanks to the technological evolution of informatics systems, descriptive operation has been designated to static and dynamic virtual models. Ekphrastic representation – through words – is efficacious because it can give life to a visual story (models). The choice to apply procedures based on object grouping and the articulation of concepts can be said to enrich and specify the classification operations while at the same time offering innovative forms of enjoying archaeological objects which can now be studied, analysed and related to one another. Representations become indispensable for analysing, interpreting and documenting cultural heritage on a large, medium and small scale. The application of all the most innovative technologies ensures the possibility to exchange objective data open to further interpretations. Elaboration of models for static and dynamic representations as well as creating databases for interactive use online constitute a model for managing archaeological heritage that became more accessible, complete, applicable and usable.

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