



# ARCHEOLOGIA E CALCOLATORI

32.2

2021

*All'Insegna del Giglio*

ARCHEOLOGIA E CALCOLATORI



CNR – DIPARTIMENTO SCIENZE UMANE E SOCIALI, PATRIMONIO CULTURALE

ISTITUTO DI SCIENZE DEL PATRIMONIO CULTURALE

Rivista annuale open access e peer reviewed  
fondata da Mauro Cristofani e Riccardo Francovich

Comitato Scientifico: Giovanni Azzena, John Boardman, Robin B. Boast, Francisco Burillo Mozota, Alessandra Caravale, Christopher Carr, Martin O.H. Carver, Francesco D'Andria, François Djindjian, James E. Doran, Virginie Fromageot-Laniece, Salvatore Garraffo, Filippo Giudice, Antonio Gottarelli, Maria Pia Guermandi, Anne-Marie Guimier-Sorbets, Ian Hodder, F. Roy Hodson, Donna C. Kurtz, Adriano Maggiani, Daniele Manacorda, Costanza Miliani, Paola Moscati, Tito Orlandi, Clive R. Orton, Maria Cecilia Parra, Xavier Rodier, Francesco Roncalli, Grazia Semeraro, Paolo Sommella, Gianluca Tagliamonte, Marco Valenti

Direttore responsabile: Paola Moscati

Redazione: Claudio Barchesi, Francesca Buscemi, Letizia Ceccarelli, Sara Di Marcello, Alessandra Piergrossi, Irene Rossi

Policy and Guidelines: <http://www.archcalc.cnr.it/pages/guidelines.php>

Autorizzazione del presidente del Tribunale di Firenze n. 3894 del 6/11/1989

Indirizzo Redazione: Rivista «Archeologia e Calcolatori», CNR – ISPC, Area della Ricerca di Roma 1, Via Salaria Km 29,300, 00015 Monterotondo Stazione (RM)  
Tel. +39.06.90672670 – Fax +39.06.90672818  
E-mail: [redazioneac.ispc@ispc.cnr.it](mailto:redazioneac.ispc@ispc.cnr.it)  
<http://www.archcalc.cnr.it/>

Edizione e distribuzione: Edizioni ALL'INSEGNA DEL GIGLIO s.a.s.,  
Via Arrigo Boito 50-52, 50019 Sesto Fiorentino (FI)  
Tel. +39.055.6142675  
E-mail: [redazione@insegnadelgiglio.it](mailto:redazione@insegnadelgiglio.it) – [ordini@insegnadelgiglio.it](mailto:ordini@insegnadelgiglio.it)  
<https://www.insegnadelgiglio.it/>

# ARCHEOLOGIA E CALCOLATORI

32.2

2021

*All'Insegna del Giglio*

Realizzazione grafica della sovracoperta di Marcello Bellisario  
Rivista «Archeologia e Calcolatori» (ISSN 1120-6861, e-ISSN 2385-1953)  
ISBN 978-88-9285-066-8, e-ISBN 978-88-9285-067-5  
© 2021 – All’Insegna del Giglio s.a.s. – [www.insegnadelgiglio.it](http://www.insegnadelgiglio.it)  
Sesto Fiorentino (FI), dicembre 2021  
Stampa, MDF print

Abbonamento 2021: 2 volumi, 32.1 e 32.2, € 60,00.  
Spedizione: Italia, gratuita; estero, a carico del destinatario.  
<https://www.insegnadelgiglio.it/categoria-prodotto/abbonamenti/>

## INDICE

### FROM POTTERY TO CONTEXT. ARCHAEOLOGY AND VIRTUAL MODELLING, edited by VINCENZO BALDONI

VINCENZO BALDONI, *Introduction* 9

#### THE 'ALMA IDEA' NUMANA PROJECT

VINCENZO BALDONI, *From finds to landscape: archaeological analysis and virtual modelling of the Davanzali necropolis in the Picenian emporion of Numana (AN)* 17

ANDREA GAUCCI, *Virtual Archaeology and the study of necropolises as a system: methodology and practice in the case study of Numana (AN), Italy* 27

ENRICO ZAMPIERI, *The Davanzali necropolis of Numana (AN): from the archaeological context to the virtual environment* 35

MICHELE SILANI, *Reconstructing the funerary landscape: natural environment and topography of the necropolis* 45

SIMONE GARAGNANI, *Quick digitization techniques: the case study of Numana necropolis* 53

#### FROM POTTERY TO CONTEXT: METHODOLOGIES, PRACTICES, CASE STUDIES

ISABELLE ALGRAIN, DELPHINE TONGLET, *Studying the shapes of Greek vases: historiography and new methodologies* 65

ALESSANDRO PACE, DANIELE BURSICH, *New perspectives on documenting Attic pottery* 83

MARTA NATALUCCI, *The rediscovery of colors at Kainua-Marzabotto* 95

MARTA ESPOSITO, *Antefixes from Museo Provinciale Campano in Capua. A proposal for a virtual reconstruction* 105

MONICA SALVADORI, EMANUELA FARESIN, LUCA ZAMPARO, *Classical pottery in collection: the MemO Project and the recreation of a 'context'* 121

EMANUELE TACCOLA, LISA ROSSELLI, NICCOLÒ ALBERTINI, MARTA MARTINO, *Etruscan hypogea in 3D: a proposal for an immersive and interactive visualization of Volterra's funerary contexts* 135

\*  
\* \*

### ARCHAEOLOGICAL COMPUTING: SELECTED PAPERS FROM THE 2020 IMEKO TC-4 METROARCHAEO INTERNATIONAL CONFERENCE, edited by ALESSANDRA CARVALE

ALESSANDRA CARVALE, *Archaeological Computing and the MetroArcheo International Conference Award: an introduction* 155

ELISA COSTA, CARLO BELTRAME, <i>3D modelling from archive and legacy data: preliminary data processing on the Roman shipwreck Grado I</i>	157
ANGELA BOSCO, LAURA CARPENTIERO, ANDREA D'ANDREA, ELEONORA MINUCCI, ROSARIO VALENTINI, <i>Developing an ABIM system: a new prospective for archaeological data management</i>	167
EMANUELE BRIENZA, LORENZO FORNACIARI, <i>Rome: NE slopes of the Palatine hill. Archaeology of architecture and ancient masonries deep analysis</i>	177
ANDREA TAVELLA, MARIKA CIELA, PAOLO CHISTÈ, ANNALUISA PEDROTTI, <i>Preliminary studies on the volumetric capacity of ceramic from the Neolithic site of Lugo di Grezzana (VR) through 3D graphics software</i>	187
ENEJ GUČEK PUHAR, ALEŠ JAKLIČ, FRANC SOLINA, LIDIJA KORAT, MIRAN ERIČ, <i>Anatomical-morphological analysis of a volumetric 3D model of an archaeological object</i>	197
ANDREA AQUINO, STEFANO PAGNOTTA, MARCO LEZZERINI, ELENA PECCHIONI, VANNI MOGGI CECCHI, STEFANO COLUMBU, <i>From minerals to artefacts: the role and challenges of 3D modelling</i>	209
PAOLO TRIOLO, LUCIANO MARRAS, GLORIA ADINOLFI, RODOLFO CARMAGNOLA, STEFANO LEGNAIOLI, SIMONA RANERI, VINCENZO PALLESCHI, <i>Imaging as a first step for Cultural Heritage and archaeology analyses</i>	219
SARA MAZZOCATO, CLAUDIA DAFFARA, GIACOMO MARCHIORO, ALESSANDRA MENEGAZZI, <i>Optical microprofilometry optimized for surface analysis and 3D printing of archaeological objects</i>	227
DARIO GIUFFRIDA, VIVIANA MOLLI CA NARDO, ROSINA CELESTE PONTERIO, ORESTE ADINOLFI, MARIA AMALIA MASTELLONI, <i>Testing a mobile laboratory at the Aeolian Museum of Lipari (Messina) for the 3D survey and the chemical characterization of archaeological materials: practice and further developments</i>	237
DEVI TAE LMAN, DIMITRI VAN LIMBERGEN, FABRIZIO ANTONELLI, <i>Architectural and sculptural decoration of Roman central Adriatic Italy: an archaeological and archaeometric approach to region-wide marble trade</i>	249
SALVATORE PIRO, DANIELA ZAMUNER, STEFANIA QUILICI GIGLI, <i>High resolution geophysical surveys to characterise Norba archaeological site (Norma, Central Italy)</i>	261
GIOVANNI LEUCCI, LARA DE GIORGI, GIOVANNI FRAGALÀ, ANTONINO MAZZAGLIA, DANIELE MALFITANA, <i>New data about the Cathedral of Catania by geophysical investigations</i>	271

FROM POTTERY TO CONTEXT.  
ARCHAEOLOGY AND VIRTUAL MODELLING

edited by  
Vincenzo Baldoni



*Special issue published with the financial support of the University of Bologna,  
Alma Idea Grant - Junior 2017 project “Dal reperto al paesaggio: analisi  
archeologica e modellazione virtuale delle necropoli picene di Numana (AN)”*



## CLASSICAL POTTERY IN COLLECTION: THE MEMO PROJECT AND THE RECREATION OF A 'CONTEXT'

### 1. INTRODUCTION: HOW TO UNDERSTAND AND DISSEMINATE THE COMPLEXITY

«At present, there is no existing science whose special interest is the combining of pieces of information [...]. Every evolutionary step is an addition of information to an already existing system». This is what Gregory Bateson wrote in 1984 (BATESON 1984, 21). Today these words can be a useful tool to understand the complexity and the extent of the definition of 'virtual' and, specifically, of 'virtual archaeology', understood as experimental classification of new contexts with cognitive and connective interactions. The great communicative and experimental impact belonging to archaeology study is enhanced by the digital interfaces and their intelligibility beyond the limited space of the scientific community.

The virtual space, in an archaeological dimension, must be hierarchically contextualized in order to identify the information units onto the geometry of the models: theoretically, the models should be 'disassembled' and 'reassembled' to verify the geometry and the function.

The geometrical complexity of an object indicates something very articulate and this is the reason why, in the past, some mathematicians tried to relate the concepts of beauty, order and complexity. In particular, in 1933, the mathematician George Birkhoff (1884-1944) proposed the following formula:

$$M = \frac{C}{O}$$

where: M is the aesthetic measure, O the order and C the complexity (BIRKHOFF 1933; GUIDI *et al.* 2010, 338).

About the same topic, in 1999 Jean-Louis Le Moigne, a specialist in theory systems and constructive epistemology, wrote (LE MOIGNE 1999, 196; GUIDI, RUSSO, BERARDIN 2010, 339): «The complexity of a system is not necessarily a property of such system (whether it be natural or artificial), it is rather a property of the representation currently available of such a system, described according to one or many codes (or languages), our representation of complexity transforms itself and, with it, the modalities of apprehension that we can give to ourselves. Complexity is in the code and not in the nature of things» (LE MOIGNE 1999, p. 196).

Complexity becomes intelligible if the observer has the tool to understand it. So, an archaeological find can be considered and studied as a complex system containing information not immediately perceptible to the observer.

The language that allows the identification of them is the result of a scientific and technological evolution that allows archaeologists to ideally break down the system for and overall and an individual morphological entities study.

The 18<sup>th</sup> and 19<sup>th</sup> centuries were characterized by the antiquarian accumulation; today, one of the archaeological challenges concerns the study of the informative communicability of the numerous objects, archaeological or presumed archaeological, which decorate the richest public or private collections from all over the world which, however, the data of their context of discovery and/or origin were lost or unknown.

The complexity is not only in the archaeological characterization but also in their study and understanding of their importance for the professional audience and the general public. This is one of the challenges of Project MemO, *The Memory of Objects. A multidisciplinary approach to the study, digitalization and value enhancement of Greek and Southern Italian pottery in Veneto* (leader partner Department of Cultural Heritage of the University of Padua, supported by the Fondazione Cassa di Risparmio di Padova e Rovigo), has decided to capture and to take on for an increase in the accessibility of the archaeological data.

E.F.

## 2. THE MEMO PROJECT

The MemO Project is focused on the archaeological collections preserved in Veneto (SALVADORI, BAGGIO 2017; BAGGIO 2019; SALVADORI 2019). These collections include a rich heritage of Greek and Southern Italian pottery, of which social and cultural role is very important, with regards to ceramic studies and, simultaneously, in terms of defining our modern identity.

As a matter of fact, Venice and Veneto witnessed a very early form of Greek- and Southern Italian-vase collecting and, as these items were considered a symbol of cultural and social distinction, their presence in the collections of several Venetian notables was documented as early as the 16<sup>th</sup> century (DE PAOLI 2006): in Padua, in the collection of jurist Marco Mantova Benavides (*Museo di Antichità nella Padova del Cinquecento* 2013); in Venice, in the collections of the Grimani di Santa Maria Formosa family, of Apostolo Zeno, of Jacopo Contarini and Onorio Arrigoni (FAVARETTO 2004); in Verona, in the collection of Scipione Maffei; in Adria, in the Bocchi's collection (WIELMARIN 2005) and in Rovigo, in the Silvestri's collection.

While the better part of these items now belongs to several European museums, another part has contributed to the formation of the Veneto Region Museums, which over the years have become 'recipients of private collections': the Museo Archeologico Nazionale di Adria has incorporated the Bocchi collection (CVA Italia 28, Adria Museo civico I; 65, Adria, Museo Archeologico

Nazionale II) and, in the 18<sup>th</sup> century, Andrea Vallisneri donated the Mantova Benavides collection to the Museo di Scienze Archeologiche e Arte in Palazzo Liviano, which was further enriched in the 2000s by the bequest of the Merlin and Marchetti collections, of recent formation (MENEGAZZI 2013; SALVADORI, BAGGIO 2017).

Starting from this situation, the great patrimony of Greek and Southern Italian vases, belonging to various museum collections in Veneto, will be brought back to light through investigation and by enhancing their value, using a multidisciplinary approach that integrates traditional archaeological methods of investigation with new high-resolution and photorealistic 3D scanning, digital image processing techniques and archaeometric analyses.

The advance in archaeological studies of the last few decades requires a new examination of the materials, whose semantic and communicative potential can nowadays be analyzed in innovative ways. MemO's scientific structure innovatively aims to cross-check the data on collection items (with no origin context) with those on items coming from recent stratigraphic contexts, on the basis of scientific excavations carried out in Italy. It will then be possible to map the finding contexts and, consequently, to refine dating and to study material associations.

Moreover, recent discoveries have further enriched the patrimony of artifacts that, in themselves, are the basis for studies on the figures of vase painters and potters, on workshop structure and on the relation between artisanal production and buyers. Furthermore, they are key to the reconstruction of iconography dissemination dynamics and to understanding the link between iconographic theme and vase shape and function and, lastly, to the symbolic ideology behind figurative choices.

Going back to the issues raised by the study of a collection, another problem concerns forging Antiquities: only a multi-disciplinary approach will allow us to distinguish authentic items from forgeries, ranging from archaeometric techniques to traditional comparative archaeological analyses. Moreover, from a social and cultural point of view, the forged artifact is a valuable source of information regarding the knowledge, tastes, techniques, art market dynamics and epistemological and axiological values at the time of its creation.

Therefore, we believe it is possible to draw advantage of the 'unprovenanced' items as some interactive 'research and teaching tools' in a double perspective: in the eyes of scholars, students, and professionals, dealing with the preservation and promotion of archaeological heritage, they could provide the chance to develop and train effective, low-cost, and non-invasive means for the authentication of the artifacts to be studied. In the eyes of academics and professionals as well as of private collectors, dealers, and the wider audience, 'unprovenanced' private collection items could be the key to enhancing the cultural, social, and historical value that authentic antiquities (with origin

context) do bear in telling ancient art history and the fortune of the Antique in the modern and contemporary period. In a broader perspective, looted antiquities and forgeries could lead to understand (and, maybe, fight) the current widespread phenomena of forgery and illicit trade in archaeological material, as well as to develop a 'community awareness' of the crimes against Cultural Heritage and the therewith-connected material and intellectual consequences for the integrity of the field of ancient art history, with the aim to contribute in the creation of a new public spirit, for the promotion of a law-abiding culture concerning Cultural Heritage.

What we propose is to re-evaluate the status of forgeries, not from a legal point of view (it is still an execrable phenomenon for the economic loss it causes both to private collectors and public institutions, for its ethical and psychological implications and for its hand in the falsification of history), but from an anthropological one: by un-veiling forgeries, we re-veal the truth, i.e. the instances of cultural, epistemological and aesthetic history that produced them. As a matter of fact, the reproduction was both a 'victim of' and a 'witness to' those instances and, due to its 'palimpsestic' nature, it bears their mark.

M.S.

### 3. THE DECONTEXTUALIZATION OF ARCHAEOLOGICAL ARTIFACTS: LIMITS AND POTENTIALS

Alessandro Della Seta stated that archaeologists are all those who make the subject of particular, technical, scientific and historical investigations, the individual classes of objects and monuments excavated from the subsoil or remained on the top (DELLA SETA 1913), remarking, already at the beginning of the last century, how the activity of the discipline was oriented towards a differentiated plurality of artifacts.

However, they were not (and they are not even today) attributable only to research with scientific and/or stratigraphic purposes: lack of documentation (of the excavation, of the artifacts), fortuitous finds (remained far from the clamor of the news), clandestine excavations, disfigurement of ancient monuments and thefts (from the Modern Age to the present day) are all elements to be taken into account when thinking about the nature of an object, or when thinking about the different roads that have led to the knowledge of the same.

The history of studies (e.g., see BARBANERA 2015) shows how, in the past, archaeological excavations were often not adequately documented, due to the nature of the discipline itself, which went from eighteenth-century antiques (oriented towards targeted interest in certain categories of artifacts) to scientific subject today (aimed at the global study of the products of mankind).

It often happens, in fact, that the archaeological material, or presumed as such, does not derive from investigated, safe and incontrovertible contexts

but is due to fortuitous, sporadic findings, which occurred over time and due to the resumption of the taste of the ancient, with the contextual diffusion of the collecting phenomenon in the modern and contemporary age. It was precisely this activity that led to the creation, within the legal systems of the pre-unification states (EMILIANI 2015), of legislation for the protection of the archaeological heritage which led to legislating on the exclusive property of the material found: this legislation then reaches nowadays, merging into the Code of cultural heritage and landscape.

Alongside these fortuitous finds and the lawful dissemination of these archaeological objects, there is also the spread of undue behavior, such as the practice of clandestine excavations and the illegal trafficking of objects and works of art, further elements emphasizing the loss and/or the destruction of the contexts of origin.

All these elements appear among the main causes of destruction of the contexts of discovery, isolating the artifact in an 'information limbo' that often involves the disinterest of the scholars themselves (HILGERT 2016). According to this line of thought, the artifacts lose their qualification as a historical source and their very informative potential due to this decontextualization. On the contrary, a different approach, although it recognizes the documentary damage suffered, equally identifies a strong information component intrinsic to the very nature of the artifacts such as products desired, conceived, created, used and deposited by mankind.

These considerations, valid for any type of artifact, can see a practical example in ceramics (FRANK 2007), generally considered to be the most common class of objects in archaeological contexts and generating a by now centuries-old tradition of studies, now increasingly multidisciplinary and innovative (GLIOZZO 2020).

Although, for an archaeologist, the loss of the context of provenance/discovery of an object is a real damage (with regard to ceramics, especially as regards its ability as a chronological source), even greater than the loss of the artifact itself, it, as an individual element, he can, in any case, provide different and qualified information (ZAMPARO 2019):

- on the production methods and techniques, i.e. on the knowledge and skills of the civilization that created the artifact, thanks to the combination of archaeological sciences with diagnostic disciplines;
- thanks to the technological-formal study, therefore, we arrive at the analysis of the social and economic condition of those who produced that artifact, through the serial and overall study of the production, or through the possible written, iconographic, epigraphic sources and through the tradition that has come down to the present day;
- at the same time, it is possible to reconstruct the social context in which this object was marketed and, obviously through technological considerations, to

establish its use, thus also hypothesizing the different phases of its material 'life' (use, breakage, repair/recomposition, reuse, eventual de-functionalization and relative re-functionalization, breakdown or definitive loss of the function and its deposition);

- the single artifact, moreover, can inform us about its movements, that is its place of realization (through chemical-physical and petrographic analysis) and about any movements made before its deposition, breakage or loss;
- at the same time, this single object can show us the alterations it has undergone, over time, in its context of deposition, that is, how natural agents and anthropic actions may have modified it during the years of its long and silent rest;
- contextually, finally, it is possible to reconstruct the events inherent to the 'second life' of the objects, from the moment of their discovery to the last owner (passing through acquisitions, donations, bequests, publications and exhibitions), that is, to reconstruct how society contemporary conceive and reflect itself in the ancient world.

It seems significant, at this point, to recall the words that Ranuccio Bianchi Bandinelli used to describe the work of art, referable to any type of product of mankind: «Each face of the polyhedron reflects a particular element – social, economic, political – which enters as a component of the whole and each face is both subordinate to the whole and to some extent determining for it. The whole would not be valid if one were missing [...]. Each of these guides led us to penetrate the formation of the polyhedron» (BIANCHI BANDINELLI 1974-1975, 181).

According to this logic, a systematic, scientific study of artifacts deprived of their own context of discovery or provenance that is systematic, scientific, mediated by the archaeological method and supported by diagnostic data can fill some information gaps still left without answers.

Thanks to the study of this material, on the basis of the knowledge developed also through the known and stratigraphically investigated contexts, we can increase our knowledge of the ancient world, its productions, the skills of its craftsmen and the society they addressed (LUBY, LIGHTFOOT, BRADSHAW 2013).

At the same time, however, this decontextualized material (VOSS, KANE 2012), often synonymous with the 'second life' of objects, provides us with information on the modern and contemporary age itself, namely:

- on the revival of ancient taste in society, i.e. on its diffusion, on its consequences in artistic production and on the cultural, social and economic repercussions that the findings have entailed;
- on the birth of new productions imitating the ancient tradition, with the revival of themes, iconographies, forms, materials, knowledge and techniques, or on the ancient prototypes used in the new manufactories;

- on the contextual development of the modalities for the protection of archaeological artifacts, archaeological researches and findings, above all for the contrast of clandestine excavations, illicit trafficking and the phenomenon of forgery;
- on the history of private collecting, that is, how these artifacts entered a socio-economic system governed by the 'supply-demand' mechanism, or how they changed the art market;
- on the formation, especially in the 19<sup>th</sup> century, of archaeological museums through the direct acquisition of artifacts or deriving from bequests and donations, that is, on the ability of these artifacts to change the very perception of ancient culture through their display.

All this information, otherwise lost, provides a snapshot not only of ancient society but also of contemporary society.

L.Z.

#### 4. THE 3D MODELS OF MARCHETTI AND MERLIN COLLECTIONS

The transition from 'humanities computing' to 'digital humanities' was theorized as a positive evolution of humanistic computing. In a recent interview, released for the online periodical *Cultural Work*, Jeffrey Schnapp, founder and director of the Harvard University metaLAB, said that a definition of digital humanities reduced to a simple application of computer tools to the study of cultural heritage would be relatively trivial. Moreover, in the nineties «we stopped talking about Computational Humanities or Humanistic Computing, and we started to think about Digital Humanities». Furthermore, Schnapp highlights that: «the expression Digital Humanities marked the moment of transition in which the distinction between the world of digital technologies and culture in society does not exist anymore and there is a rethinking of what research in the human sciences could be» (interview by S. CAPEZZUTO with J. Schnapp for *Il lavoro culturale*, <http://www.lavoro-culturale.org/intervista-a-jeffrey-schnapp/>). So, humanities computing should give a new experimental model of the human sciences and a new social practice of designing culture. In the following years, the impressive technological development (personal computers, graphical interfaces, the implementation of WorldWideWeb) has deeply changed the research practices in the field of humanistic and computer science and it has significantly influenced the relationship between the representation and processing of the information.

3D survey methodologies are the protagonists of this shift towards new models of communication of knowledge with the goal of an extension of the cultural offer. It is a language that emphasizes the perceptual aspects with interactive images and 3D models in order to make easier the understanding of complex aspects not immediately readable. It is a collaborative and

multidisciplinary type of communication based on the laboratory as a research unit: it is better to work in a team where sectoral skills (such as history of art, archaeology, 3D survey) converge into the creation of a new research model.

The traditional modeling process starts with a conceptual formulation of the object defined in its details with representation methods.

During the pre-processing phase, the first question that we must be asked concerns the purpose of the model, because the applications could be different: from multimedia presentation to 3D modeling for morphometric study. Moreover, during the planning phase of the survey, the material and geometric characteristics of the object must be considered.

Marchetti and Merlin collections are characterized by a strong variability in dimensions and shapes of the artifacts and for this reason it is necessary to use a scanner that is adaptable and facilitates view planning. Moreover, in addition to the geometry, the texture has been acquired in order to obtain very high resolution 3D and photorealistic models.

For all these reasons a structured light scanner was chosen the Cronos Dual from Open Technologies<sup>1</sup>. It is a type of active sensor that projects on the surface a light pattern, sequence of black and white stripes. Their deformation is acquired with a digital camera to reconstruct the geometry of the surface. Cronos Dual works with a double field of view: far field and near field. Moreover, a turntable synchronized with the acquisition software was used to guarantee a first alignment during the acquisition phase, which is essential for continuous control of the quality of the survey.

The acquisition and data processing (Fig. 1) involve consequential but distinct phases, defined in the literature as a work pipeline:

- Data acquisition: the instrument acquires the data using the projection of patterns of light that change according to the morphology of the surface. The deformation is acquired through a camera and used for the calculation of three-dimensional coordinates (triplets of x, y and z coordinates where z represents the distance between the instrument and the acquired object) (LAGA *et al.* 2018). Moreover, in addition to the spatial information, also the chromatic information (RGB) is recorded.
- Checking of the goodness of the acquired data: using the calibrated turntable and setting a fixed rotation angle of 32° it was possible to do a rough alignment during the acquisitions. This is essential to verify in real time the goodness of the survey and identify the possible presence of non-sampled areas.
- Points filtering: in order to remove all the points (defined as spurious) not belonging to the geometry of the artifacts.

<sup>1</sup> Cronos Dual from Open Technologies with an accuracy of  $0,10 \div 0,40 \mu\text{m}$ ; camera resolution  $2 \times 1.3 \text{ MPixels}$ ; acquisition and processing software: Optical RevEng 2.4 SR 8 Pro.





Fig. 1 – Padova, Marchetti collection, CM7, pseudo-centuripine vase with lid decorated with a female figure. On the left the very high-resolution 3D model; on the right the 3D photorealistic model. The vase and its lid were acquired individually in far field with 33 scans for the lid and 44 for the vase.

- Range map alignment, in order to put all the single range maps into a common coordinate system where all the scans lie aligned on their mutual overlapping region. The pairwise ICP alignment algorithm, followed by a global registration, was used.
- Range map merger (or fusion), to build a single, non-redundant triangulated mesh. After the registration, there are several overlapping partial meshes, one for each captured view. The next stage of the reconstruction pipeline must integrate them to build a single triangle mesh of the object.
- Mesh editing, to improve the quality of the reconstructed mesh. The acquisition process may have incomplete or uncorrected areas. This step requires the use of hole filling algorithms and the editing of the topological mistakes (non-manifold face, self-intersection, unstable face).
- Mesh simplification, to accurately reduce the huge number of triangles, producing 3D models with different high-quality Level of Details (LoD).
- Color mapping, to enrich the information by adding color information to the geometry representation, producing in output a high resolution 3D and photorealistic model (ZAMPARO, FARESIN 2019; SALEMI, FARESIN in press).

E.F.

## 5. CONCLUSIONS: AN APPROACH FOR THE RECONTEXTUALIZATION OF CLASSICAL CERAMICS

As seen in the previous paragraph, the affirmation of the internet as a privileged tool for accessing and sharing cultural heritage has introduced new opportunities for archaeology and cultural heritage: compared to traditional forms of academic research, digital approaches are more collaborative and multidisciplinary, while referring to traditional approaches.

The introduction of digital has led to profound transformations at a technical and cultural level. Digital Humanities, in fact, are not limited to ‘digital culture’, updating traditional knowledge (they do not represent only the ‘what’ and ‘how’), but redefine many consolidated practices such as, in this context, the study of archaeological finds.

This digital system takes shape, in the MemO Project, with the creation of a website for the communication of research, training and dissemination activities implemented thanks to the support of the Fondazione Cassa di Risparmio di Padova e Rovigo.

Parallel to the website ([www.progettomemo.it](http://www.progettomemo.it)), a 3D survey campaign was created and a database for the conservation and promotion of the data obtained during the research phases was developed.

In fact, this ultra- and inter-disciplinary path has involved, in the MemO Project, the creation of very high resolution 3D models of the collectibles involved, including – in addition to the Marchetti and Merlin collections – also

the fourteen collections preserved in the main archaeological museums of Veneto: these, as seen above, saw the use of structured light instrumentation with micrometric resolution, fundamental for the digital reconstruction of the characteristics and origins of the vessels, as well as for studying both macroscopic and micrometric details. Furthermore, by also acquiring the texture data, it was possible to create a digital archive, which aims to become a tool for the dissemination of knowledge and dissemination due to the ability of the 3D models to remain unchanged over time and the interactivity with which they can be interrogated by users for the extraction of information.

The results obtained through 3D surveying and modeling are therefore part of a sector that sees the intervention and management of cultural heritage from a formal, conservative and informative point of view as central elements, with repercussions on the museum sector, on training, on cultural tourism and on the communications industry that uses ICT (Information and Communications Technology): in fact, one of the objectives of the MemO Project consists precisely in the creation of a digital system (website and database) that can be used as a container for all information relating to the asset, a useful tool for the management of the artifacts both for cataloging (scientific research) and for virtual use in the museum environment (STYLIANIDIS, REMONDINO 2016).

The website, in fact, represents the access interface for the MemO Project database. Born on the basis of the Paduan experience gained around the TESS (GHEDINI *et al.* 2007), TECT (SALVADORI, SCAGLIARINI 2014), ADAM (KIRSCHNER 2008) and KERAMOS (DOBREVA, BAGGIO 2013) projects, the database large cataloging and digitization projects launched with the Post-Paralipomena Project (GIUDICE, BARRESI 2003) and with the Beazley Archive (KURTZ 2009), realizing what was hypothesized in 1999 by Irene Favaretto (FAVARETTO, BODON 1999).

The database, created thanks to the contribution of Marco Tognon, Paolo Kirschner and Luciano Giacomel, was designed to be usable online, to be usable by different categories of users (open-access) based on their characteristics (researchers, students, collectors, members of the public administration, museum professionals) and to provide the possibility of research on over 120 items ordered in 15 different sections (FARESIN, ZAMPARO *in press*), elaborated on the basis of the needs expressed by individual museums, by the Superintendencies involved and by the most recent legislation issued by the Istituto Centrale per il Catalogo e la Documentazione.

The database of the MemO Project, the result of the combined and multidisciplinary research that involves new technologies and scientific diagnostics from the archaeological discipline, intends to be configured as a tool: – for archaeological research, i.e. for the study of the Greek and Southern Italian material present in Veneto which from the condition of a series of objects often

decontextualized can finally provide quantitative and qualitative data for the understanding of trade (ancient and contemporary), for the transmission of images in an external context from the one in which they were generated and for the verification of the diffused material types (WINGFIELD 2017; VOSS 2012);

- for the digitization, communication and value enhancement of cultural goods currently not on display, belonging to public or private entities, in order to increase knowledge about the presence of this material and allow the launch of new studies on still unpublished artifacts;
- for the creation of a regional network between the participating museums and cultural institutes, i.e. for the systematization of the presence of Greek and Southern Italian ceramics for the purposes of value enhancing and promoting culture, therefore, for the increase of accessibility to the national cultural heritage (LUIGINI, PANCIROLI 2018);
- for the investigation of collecting, a phenomenon present in Veneto since the 15<sup>th</sup> century and still highly active today that has allowed the establishment of the main collections now preserved in the region's public museums;
- for the sharing of appraisals carried out on non-authentic objects and for the dissemination of a culture of legality in the art-historical field, i.e. with the aim of studying, digitizing and cataloging even false objects in order to document their presence and allow their easier recognition in the future;
- to improve the understanding of objects that are often difficult to understand precisely because of those multiple levels of reading previously investigated.

In this way, once again, archaeology appears as a fascinating book full of information but to be read with the right pair of glasses.

L.Z.

MONICA SALVADORI, EMANUELA FARESIN, LUCA ZAMPARO

Dipartimento dei Beni Culturali  
Università degli Studi di Padova  
progettomemo@unipd.it

## REFERENCES

- BAGGIO M. 2019, *Oggetti ed identità femminili dalla Magra Grecia al Veneto*, in E. DEGL'INNOCENTI, A. CONSONNI, L. DI FRANCO, L. MANCINI (eds.), *Mitomania. Storie ritrovate di uomini ed eroi. Atti della Giornata di Studi (Taranto 2019)*, Roma, Gangemi Editore, 87-99.
- BARBANERA M. 2015, *Storia dell'archeologia classica in Italia*, Roma-Bari, Gius. Laterza & Figli.
- BATESON G. 1984, *Mente e natura*, Milano, Adelphi.
- BIANCHI BANDINELLI R. 1974-1975, *Il cratere di Derveni*, «Dialoghi di Archeologia», 8, 179-200.
- BIRKHOFF G.D. 1933, *Aesthetic measure*, Cambridge, Harvard University Press.
- DE PAOLI M. 2006, *Immagini di vasi. Raffigurazioni di ceramica attica e italiota nelle collezioni venete dal XVI al XIX secolo*, «Eidola. International Journal of Classical Art History», 3, 69-89.

- DELLA SETA A. 1913, *L'archeologia dai Greci al Winckelmann e a noi*, «Nuova Antologia», 499-512.
- DOBREVA D., BAGGIO M. 2013, *La ceramica greca in Veneto: progetto di schedatura informatizzata KERAMOS*, «Eidola. International Journal of Classical Art History», 10, 19-30.
- EMILIANI A. 2015, *Leggi, bandi e provvedimenti per la tutela dei beni artistici e culturali negli antichi stati italiani, 1571-1860*, Firenze, Edizioni Polistampa.
- FARESIN E., ZAMPARO L. in press, *Documentation and Digitalization of Ceramic Collections in Veneto: The MemO Project*, in *Art Collections 2020, Cultural Heritage, Safety and Innovation. International Conference (Florence 2020)*.
- FAVARETTO I. 2004, *Il collezionismo di vasi dipinti nel Veneto*, in G. SENA CHIESA, E. ARSLAN (eds.), *Miti greci. Archeologia e pittura dalla Magna Grecia al collezionismo. Catalogo della Mostra (Milano 2004-2005)*, Milano, Electa, 63-67.
- FAVARETTO 2006, *Collezioni di antichità e studi antiquari a Venezia nell'Ottocento*, in J. BELTRÁN FORTES, B. CACCIOTTI, B. PALMA VENETUCCI (eds.), *Arqueología, Coleccionismo y Antigüedad. España e Italia en el siglo XIX*, Sevilla, Universidad de Sevilla, 183-191.
- FAVARETTO I., BODON G. 1999, *Proposta per una programmazione informatica delle collezioni veneziane di antichità*, in *Collezioni di antichità nella cultura antiquaria europea. Atti del Congresso Internazionale (Varsavia-Nieborow 1996)*, Roma, Giorgio Bretschneider, 108-117.
- FRANK B.E. 2007, *Ceramics as testaments of the past: Field research and making objects speak*, in S.J. KNELL (ed.), *Museums in the Material World*, London, Routledge, 60-64.
- GHEDINI E.F., RINALDI F., KIRSCHNER P., TOGNON M. 2007, *Tess. La banca-dati online per i investimenti a mosaico*, «Archeologia e Calcolatori», 18, 13-43 ([http://www.archcalc.cnr.it/indice/PDF18/2\\_Ghedini.pdf](http://www.archcalc.cnr.it/indice/PDF18/2_Ghedini.pdf)).
- GIUDICE F., BARRESI S. 2003, *La distribuzione della ceramica attica nell'area mediterranea: dai dati Beazley alle nuove acquisizioni*, in *Griechische Keramik im kulturellen Kontext. Akten des Internationalen Vasen-Symposiums (Kiel 2001)*, Muenster, Scriptorium, 280-286.
- GLOZZO E. 2020, *Ceramics investigation: Research questions and sampling criteria*, «Archaeological and Anthropological Sciences», 12 (<https://doi.org/10.1007/s12520-020-01128-9>).
- GUIDI G., RUSSO M., BERARDINI J.A. 2010, *Acquisizione 3D e modellazione poligonale*, Hoboken (NJ), McGraw-Hill.
- HILGERT M. 2016, "Definitely stolen?": *Why there is no alternative to provenance research in archaeological museums*, in B.L. MURPHY (ed.), *Museums, Ethics and Cultural Heritage*, New York (NY), Routledge, 210-217.
- KIRSCHNER P. 2008, *Progetto ADaM - Archeological DATA Management Progetto per la creazione di una banca dati relazionale per la gestione dei dati di scavo*, Tesi di dottorato, XX ciclo, Università degli Studi di Padova, Padova.
- KURTZ D. 2009, [www.beazley.ox.ac.uk](http://www.beazley.ox.ac.uk). *From apparatus of scholarship to web resource: The Beazley Archive 1970-2008*, «Archeologia e Calcolatori», 20, 37-46 ([http://www.archcalc.cnr.it/indice/PDF20/4\\_Kurtz.pdf](http://www.archcalc.cnr.it/indice/PDF20/4_Kurtz.pdf)).
- LAGA H., GUO Y., TABIA H., FISHER R.B., BENNAMOUN M. 2018, *3D Shape analysis: Fundamentals, Theory, and Applications*, New York (NY), John Wiley & Sons.
- LE MOIGNE J.L. 1999, *La modélisation des systèmes complexes*, Paris, Dunod.
- LUBY E.M., LIGHTFOOT K.G., BRADSHAW V. 2013, *Archaeological Curation and the Research Value of Archaeological Collections. A case study from California*, «Collections: A Journal for Museums and Archives Professionals», 9 (3), 255-282.
- LUIGINI A., PANCIROLI C. (eds.) 2018, *Ambienti digitali per l'educazione all'arte e al patrimonio*, Milano, Franco Angeli.
- MENEGAZZI A. 2013, *La Collezione dei coniugi Michelangelo Merlin e Oplinia Hieke: da raccolta privata a museo pubblico. Nota preliminare*, «Eidola. International Journal of Classical Art History», 10, 31-40.

- Museo di Antichità nella Padova del Cinquecento 2013, I. FAVARETTO, A. MENEGAZZI (eds.), *Un Museo di Antichità nella Padova del Cinquecento. La Raccolta di Marco Mantova Benavides all'Università di Padova*, Roma, Giorgio Bretschneider.
- SALEMI G., FARESIN E. in press, *Structured light system to destructuring fake ceramic artefact*, in M. SALVADORI, E. BERNARD, L. ZAMPARO, M. BAGGIO (eds.), *Anthropology of Forgery. Collecting, Authentication and Protection of Cultural Heritage*, Padova, Padova University Press.
- SALVADORI M. 2019, *Progetto MemO. Studio e valorizzazione della ceramica greca e magno-greca in Veneto: sul tema della dispersione della ceramica apula*, in E. DEGL'INNOCENTI, A. CONSONNI, L. DI FRANCO, L. MANCINI (eds.), *Mitomania. Storie ritrovate di uomini ed eroi. Atti della Giornata di Studi (Taranto 2019)*, Roma, Gangemi Editore, 54-65.
- SALVADORI M., BAGGIO M. 2017, *Ceramiche inedite greco e magno greche del Museo di Scienze Archeologiche dell'Università degli Studi di Padova: Collezioni Merlin e Marchetti*, in A. PONTRANDOLFO, M. SCAFURO (eds.), *Dialoghi sull'Archeologia della Magna Grecia e del Mediterraneo. Atti del I Convegno Internazionale di Studi (Paestum 2016)*, Paestum, Pandemos, 1247-1254.
- SALVADORI M., SCAGLIARINI D. 2014, *TECT. Un progetto per la conoscenza della pittura parietale romana nell'Italia settentrionale. E-book*, Padova, Padova University Press.
- STYLIANIDIS E., REMONDINO F. (eds.) 2016, *3D Recording, Documentation and Management of Cultural Heritage*, Dunbeath, Whittles Publishing.
- VOSS B.L. 2012, *Curation as research. A case study in orphaned and underreported archaeological collections*, «Archaeological Dialogues», 19 (2), 145-169.
- VOSS B.L., KANE M.S. 2012, *Re-establishing Context for Orphaned Collections. A case study from the Market Street Chinatown, San Jose, California*, «Collections: A Journal for Museums and Archives Professionals», 8 (2), 87-111.
- WIEL MARIN F. 2005, *La ceramica attica a figure rosse di Adria. La famiglia Bocchi e l'archeologia*, Padova, Cleup.
- WINGFIELD C. 2017, *Collection as (Re)assemblage: Refreshing museum archaeology*, «World Archaeology», 49 (5), 594-607.
- ZAMPARO L. 2019, *From Materiality to Authenticity: methodological observations*, in M. BAGGIO, E. BERNARD, M. SALVADORI, L. ZAMPARO (eds.), *Anthropology of Forgery. A multidisciplinary Approach to the Study of Archaeological Fakes*, Padova, Padova University Press, 131-142.
- ZAMPARO L., FARESIN E. 2019, *Lo studio, la digitalizzazione e la valorizzazione della ceramica greca e magno-greca in Veneto*, in *Ceramica 4.0: nuove esperienze e tecnologie per la comunicazione, catalogazione e musealizzazione della ceramica. Atti del LI Convegno Internazionale della Ceramica (Savona 2018)*, Sesto Fiorentino, All'Insegna del Giglio, 49-56.

## ABSTRACT

Heir to a centuries-old tradition, the phenomenon of collecting ancient pottery, especially Greek and Southern-Italian, is still particularly active, and denoting a still lively adherence to classical taste. The materials of these collections, however, often appear decontextualized, that is to say deprived of their fundamental informative component. Since 2018, through a multidisciplinary approach, the MemO Project, directed by the Department of Cultural Heritage of the University of Padova, has dealt with the study of these materials in order to reconstruct their history and origin, i.e. to systematically recount their memory. This contribution intends to analyze the complexity of the narration of the archaeological data for the decontextualized material and, above all, to detect its informative potential in order to recreate the original context. Through a multidisciplinary teamwork, we intend to present the results obtained in the context of the reconstruction of the history of inevitably inaccessible materials.

32.2  
2021

€ 40,00

ISSN 1120-6861

e-ISSN 2385-1953

ISBN 978-88-9285-066-8

e-ISBN 978-88-9285-067-5



AC-32-2

ARCHEOLOGIA  
E CALCOLATORI