èkphrasis

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Form through Time. Reconfiguration for the Musealisation of the Artefacts of the Wooden Villanovan Throne, Moroni Tomb, Verucchio Archaeological Museum in Rimini

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Abstract

Time surely is a boulder, resting on one's desire for interpretation, governing the process of unveiling, which representation allows. An ancient wooden throne, buried, hidden, crushed under the transformation of the land, lost in form; millenary remains recently shattered and trampled by fate, proposed in the ritual and celebratory definition that a millenary tomb requires. The *èkphrasis* seeks to govern the dialogue of the memory of a young Villanovan noblewoman, dealing with how much can be symbolically and materially modelled, giving shape to time. The research traces, in compliance with the utmost distinguishability and reversibility of the interpretative process, the stages for the creation of a support for the findings of the *Moroni throne* in the Archaeological Museum of Verucchio in Rimini. A path that becomes a progressive discovery of form and dimension, of the language of protection and the methods of conservation.

Keywords:
Memory, archaeology, villanovan period, museum heritage, 3D printing.

Archaeological specimens from Trono Moroni, Verucchio in Rimini, pre-damage (image by the authors).

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Introduction

As part of a research strand that aims to define protocols for the implementation of optimised digital 3D models to support the conservation and restoration of museum cultural heritage, the case study of the archaeological finds of a wooden throne from the Villanovan era is the context for the verification and application of the methods and procedures adopted.
The throne of the Moroni Tomb 26 represents an emblematic case of fragile cultural heritage, due to its material characteristics, which have already undergone incongruous restoration interventions over time, or in any case related to outdated techniques and methods and has now undergone a process of reconfiguration in order to be enjoyed again.
The artefacts under study belong to the wooden throne identified with inventory number 8641, an archaeological artefact found in 1969 inside Tomb 26 at the Villanovan Necropolis known as 'Moroni-Semprini' at Verucchio in Rimini and are dated between the end of the 8th and the early decades of the 7th century BC.
The history and importance of Verucchio "brings us back to a historical-archaeological issue related to the ancient history of central-northern Italy, the peopling and events of the Umbrians, the dynamics of Etruscan expansion, and the trade circuits of the Adriatic" [von Eles 2010]. The orography of the Verucchio territory, and particularly its accessibility to the sea, is closely connected to the central economic role played by the Verucchio community in the Villanovan period, as is well documented by the artefacts found in the four distinct necropolises [von Eles 2012a].
Intended, in all probability, for members of aristocratic families, the gender attribution has, in the course of the numerous excavations, been made predominantly based on anthropometry, as well as with reference to the characteristics of the grave goods [von Eles 2012b]. Of the four burial grounds, the two that can be attributed to the dominant aristocratic groups are the Lippi and Moroni burial grounds.
Among the various preserved objects made of fragile and perishable materials, such as textiles and amber, belonging to the grave goods, the wooden thrones with which different connotations were associated are of particular importance. Thrones, both female and male, were related as much to indicators of rank as to the cult of ancestors or the practice of banqueting.
Located in the east/south-east area on the slopes of the rocky spur, on the Pian del Monte plateau, in the area of the Moroni and Semprini farms, Tomb 26/1969, also known as the 'Tomb of the Little Princess', and discovered by G.V. Gentili in 1969, had an oval shaft morphology of approximately 2 metres by 1 metre in depth [von Eles 2012c].
The tomb can be dated between the end of the 8th century and the first decades of the 7th century BC. Morphometric characteristics and the type of grave goods place the above-mentioned tomb with throne in a group of three burials attributable to two adult deceased (Moroni Tombs 24/1969 and 25/1969) and an infant, Moroni Tomb 26/1969, all female [Mazzoli 2015].
Subsequently and following the first restoration by recomposition, carried out at the laboratory of the former Soprintendenza Archeologica dell'Emilia-Romagna in Bologna, the throne of the Moroni Tomb 26 was loaned to the exhibition *Princesses of the Mediterranean at the Dawn of History*, organised by the Nicholas P. Goulandris Foundation at the Museum of Cycladic Art in Athens in 2012. On the way back to Italy and before even arriving at the museum in Verucchio, the crate containing the object fell.

From 3D survey to data models

During the survey campaign, the following were acquired and processed: a three-dimensional model, from a physical model, of the volume of the throne consistent with the configuration before the damage suffered; 72 three-dimensional models of the corresponding wooden artefacts accurately catalogued for the documentation campaign (fig. 1).
The three-dimensional point cloud model functional for the verification and overall morphological dimensional control of the artefact was carried out using laser scanner technology of the Konica Minolta Range 5 type.

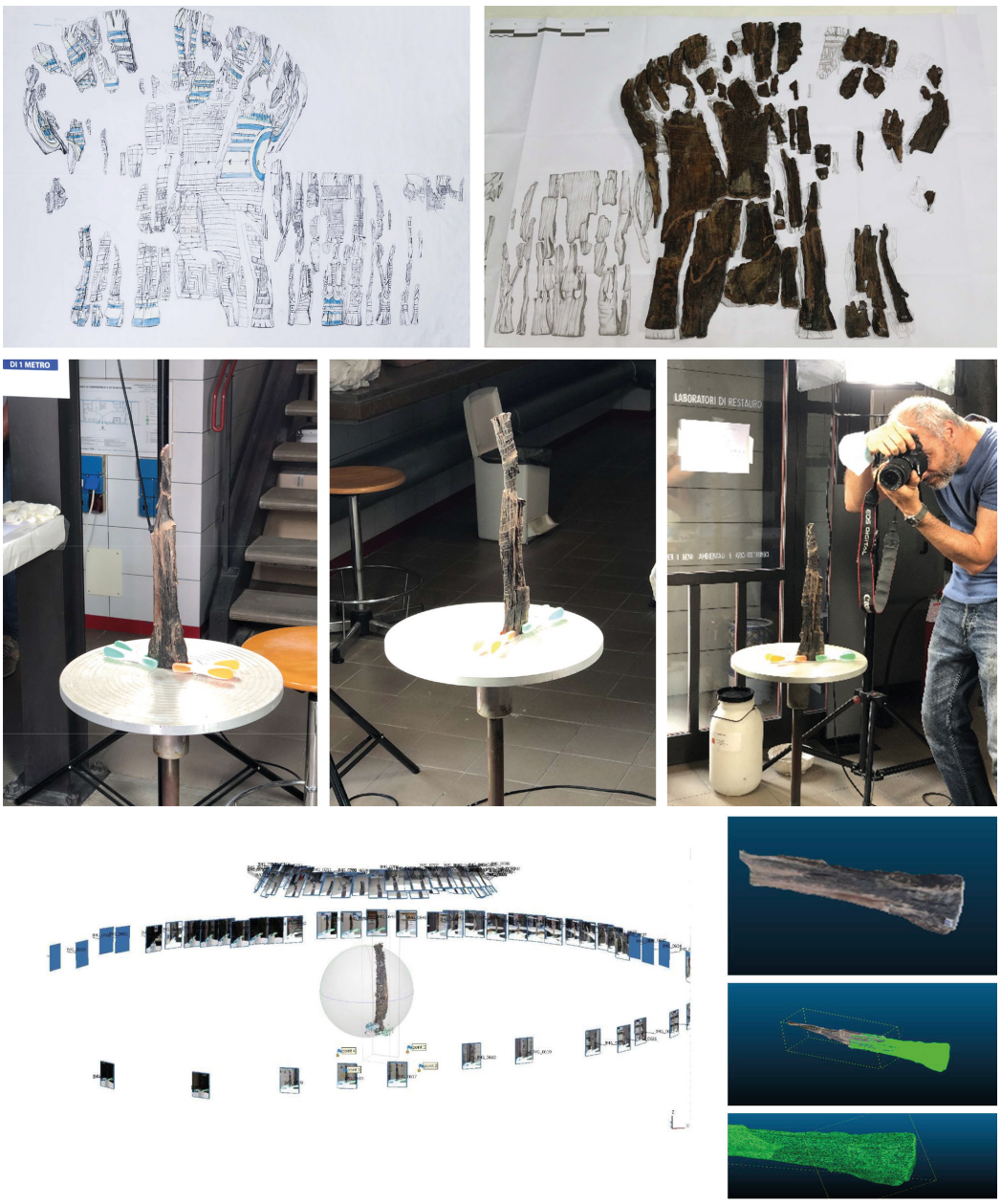

Fig. 1. Archaeological finds from *Moroni Throne*, Verucchio in Rimini, post-damage. Acquisition of data sets for processing by photo modelling of the digital model of the finds. Processing of the digital models of the individual finds: the overall data model comprises two datasets for four viewpoints per single artefact (image by the authors).

To calculate the three-dimensional models of the individual artefacts, an average of three hundred and twenty frames per artefact were acquired, corresponding to eighty frames for four pick-up points: two parallel and two inclined concerning the main development planes of the individual artefact and executed according to circular trajectories to complete the entire artefact.

For each artefact, two models were produced through a photo modelling process using *MetaShape* software in order to manage the alignment phase, verification and optimisation of morphometric characteristics using control points (markers), calculation of the dense point cloud, mesh model and texture.

The calculation phases of the overall data models and digital reconstruction were therefore aimed at calculation of the models from photo modelling of the acquired elements to formulate three-dimensional models through inverse projection; simulation of the juxtaposition and digital assembly of the parts aimed at the digital reconstruction of the wooden throne (at the current state of the finds) through the models of the individual fragments,

appropriately catalogued, to carry out an initial study of the gaps in the three dimensions and the verification of the stereometries necessary for the formulation of a complete model through compensation or surface and solid completion development, in a digital environment, of the support model, generated from the morphological and morphometric knowledge of the individual reconfigured artefacts and the study of the three-dimensional model of the volume of the throne before the damage suffered.

From the formulation of the digital model to the physical model

During the processing phases outlined, the solid prototyping (layer by layer) of the individual artefacts first and of the support to complete the gaps later was used for various purposes (fig. 2) verification of the geometric control in the acquisition phase, digital modelling of the individual fragments and digital reconstruction of the juxtaposition of the fragments; identification of the printing material concerning the available technologies, time and costs of the prototyping phase; identification of the material characterised by the best chemical-physical compatibility and the least qualitative alteration over time, also about the environmental conditions of the museum context, evaluating the structural and basic colour characteristics.

Fig. 2. Overall digital data models for the solid prototyping of the individual finds. Solid prototyping of the finds for morphometric verification of the processed models (image by the authors).

The specimens of the Throne of the Moroni 26 Tomb can be divided, from a morphological point of view, into four distinct categories fragments belonging to the seat volume that present superficial workings of a decorative character on a single visible surface; fragments belonging to the back volume that present superficial workings of a decorative character on both visible surfaces, front and back; fragments belonging to the seat/back volume that present portions of superficial workings of a decorative character on a single visible surface and portions on both, front and back. In addition to the fragment types described, there is a fourth type of smaller fragments, characterised by few, if any, decorative traces, whose location remains uncertain.
During the design, execution of the digital survey and formulation of the overall data model, the validation and geometric control of the artefact models followed the same organisation and structuring of data and metadata.
The three-dimensional survey campaign of the artefacts and the subsequent modelling phases allowed the elaboration of accurate digital models with the morphometric characteristics of the individual fragment and the purposes of the documentation and digital reconstruction of the artefact. The geometries of the artefacts under study show deformations in space, which can be traced back to rotation and quadric surfaces, the result of the environmental conditions in which the wooden material was preserved before being found, and the artefact's original and processing characteristics.
The procedures and technologies employed therefore pursued the aim of stereometric control of the fragments, particularly in the portions of the joint corresponding to the minimum thicknesses of the material, to ensure their control in the subsequent reconfiguration phases. On the contrary, the survey and digital documentation of the characterisation of the surfaces of the finds pursued the aim of figurative reconfiguration of the decorative characters. The survey of surface processing techniques was not, on the contrary, considered the object and purpose of the protocol employed, as it would have required the use of more expensive techniques such as tomography.

Spatial reconfigurations of archaeological finds using digital models and physical models

Nevertheless, considering the specific morphological and deformation characteristics of the artefacts, the digital spatial reconfiguration protocol alone was not considered adequate for the reconfiguration of the whole of the preserved fragments of the artefact. If the subdivision into the described morphological categories allowed, together with a pre-existing, albeit not entirely coherent, survey and cataloguing, the correct placement of the fragments in the back and seat portions in the digital model, the stereometric verification of the gaps in the joint areas did not appear to be as coherent.
The deformations in space, torsions and volumetric reductions also caused by dehydration phenomena, suffered by the finds together with the characteristics of the joint portions, characterised by flaking and joints with radii of curvature in the order of millimetres, made it necessary to adopt an integrated reconfiguration protocol performed with both digital and traditional techniques.
The subsequent solid prototyping of the finds on a scale of 1:1 therefore pursued the objective of creating study models compatible with annotation processes relating to the main decorative elements, mainly of a geometric nature, to guide a reconfiguration protocol based on the integration of traditional analogue and digital techniques.
The protocol for digital reconfiguration and integration with the traditional anastylosis process was, in brief, articulated in a workflow organised in several stages: a. photogrammetric survey of the artefacts; b. calculation of the point clouds divided into two distinct portions; c. calculation of the clouds, overall data model of the single fragment; d. calculation of the dense cloud, mesh and texture; e. 3D terrestrial laser scanner survey of the physical model of the volume of the throne prior to the damage suffered; f. digital reconfiguration; g. solid prototyping of the fragments; h. recomposition of the artefacts according to traditional techniques; i. 3D terrestrial laser scanning survey of the artefact resulting from the recomposition

Fig. 3. Analysis of the figurative and decorative characteristics for the analysis of the location of the fragments concerning the definition of the new support. Studying the throne's volumetric support (image by the authors).

process in the absence of the location of the finds, in order to digitally model the support and only the gaps; l. processing of the overall data model; m. calculation of the dense cloud; n. mesh verification of the morphologies of the bezels and tolerances, in order to the subsequent housing of the finds, in relation to the process of calculating the overall data model and the accuracy and method of printing (figs. 3, 4); o. printing of the physical model of the support consisting of lacunae and joints (fig. 5); p. recomposition of the artefact by housing the fragments in the bezels (fig. 6).

Conclusions

The preservation of an asset recognised as having historical, artistic, scientific, cultural and testimonial, material and immaterial, economic and financial value, and its public fruition [D'Agostino *et al.* 2021], within a restricted circle of individuals or wider social spheres, the communities, imply a multiplicity of skills, transversal and specific, of different methods, techniques and abilities. It is also important to remember that to the missions of hoarding, protection and conservation-restoration for the transmissibility of the cultural value of heritage [UNESCO 2003] museums are recognised the new purpose of building active learning experiences capable of fully involving the user [D'Agostino *et al.* 2021]. The set of described purposes currently represents a

Fig. 4. Studying the throne's volumetric support (image by the authors).

field of great interest and experimentation for the application of integrated digital technologies [Ramm *et al.* 2022].
However, it does not seem possible to trace shared methods and protocols for the management of the acquisition, data model definition, digital content management and subsequent implementation phases. Tailor-made approaches therefore have direct consequences on the transferability of acquired skills and outcomes with regard to both traditional and established methods and techniques of restoration for subsequent musealisation and the application of digital documentation processes for the recomposition of artefacts and fragments [Comes *et al.* 2022].
The study conducted is therefore part of a line of research aimed at defining sustainable protocols for the digitisation of archaeological assets with a view to recomposition for subsequent musealisation. However, open challenges remain concerning, first of all, the skills needed to apply the described procedures, which are not always available within the public administration alone. Usability and accessibility of the digital information produced, Digital Cultural Heritage Objects [Apollonio 2021; Ciammaichella 2022; Gaiani 2011], are further challenges related to the obsolescence of digital models and the consequent methods and costs of archiving [Gavalas *et al.* 2022; Spallone *et al.* 2022], maintenance and updating.

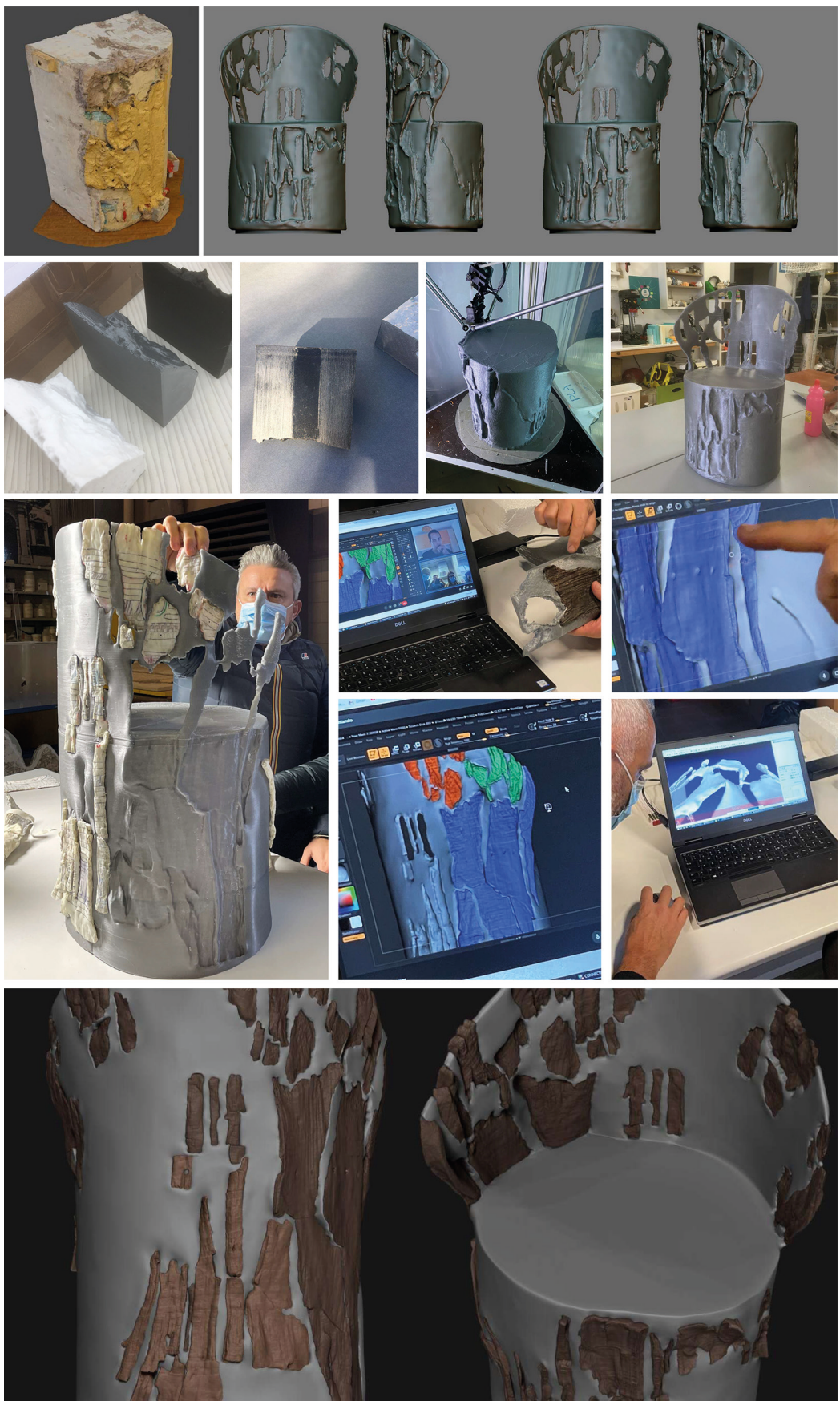

Fig. 5. Studying the throne's volumetric support. Optimisation of the digital model of the support and digital reintegration of the lacunae. Optimisation of the model for digital 'castonatura' (image by the authors).

Fig. 6 Solid prototyping, fixing of the findings and reconstruction through anastylosis of the throne model (image by the authors).

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