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THE VATICAN LIBRARY REVIEW 2 (2023) 103–117

The Vatican Library Review
brill.com/vlr

The Vatican Library's "Statue of Saint Hippolytus" Revisited

An Interdisciplinary Project for a Multifaceted Problem

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Abstract

An archaeologist-art historian and an IT scientist specialised in the restoration of architectural and artistic heritage present the scheme of a multidisciplinary research project concerning a long-debated monument, the so-called St. Hippolytus' statue of the Vatican Library. Inspired by some questions and observations arising from different fields of humanistic sciences, we created a virtual 3D model of the statue. In this paper we propose some ways to exploit it as a research instrument.

Keywords

St. Hippolytus' statue – 3D modelling – epigraphy – Patristics – Renaissance – Pirro Ligorio – marble sculpture

1 Introduction

1.1 *"Hippolytus": A Name for an Early Ecclesiastic Author and for the Presumed First Christian Portrait Statue*

The "statue of Saint Hippolytus" has graced the entrance of the Vatican Library since 1959, when Pope John XXIII transferred it from the Lateran collection. (Fig. 1) In the late 1900s, the impressive, but enigmatic marble monument began to arouse the interest of scholars, particularly with regard to what it could tell us about Hippolytus himself. In effect, Hippolytus has long since been the subject of intense scholarly debate. A Christian author, who may have attained a high rank in the early Church, his name has been associated with a number of early Christian theological writings and a handful of intriguing, but contradictory biographical remarks.[1] The writings, thoughts and events attributed to him are all to be placed within the first decades of the 3rd century AD, a period which was marked by the affirmation of several Christian communities, like the one which would later become the head of the Catholic Church, the *ecclesia Romana*. It is also the age in which we see the first decisive steps being taken towards the elaboration of a Christian science, that is to say a systematic and philosophically founded way of describing the history of salvation, theological teaching and Christianity's relationship to other doctrines. The theological works which are hypothetically linked to Hippolytus range from *Philosophoumena* alias *Refutatio*

1 It would be both arduous and superfluous to try to give an exhaustive historiography of the *vexata quaestio* in this occasion. I limit myself to point out some landmarks of the complex history of relationship between the statue and the philological and historical problem of reconstructing the ancient author. On the one hand, the monument, considered to be a likeness of Hippolytus of Rome, was defined as the earliest Christian portrait statue already by J.J. Winckelmann (Winckelmann 1766, 2: 86). On the other, modern scholarly debate about an important Christian author named Hippolytus, who lived between the second and the third century, started decisively with Döllinger 1853. Both this author and those who attempted critics or revisions of his reconstruction used to include the statue in their argumentations, as the only extant epigraphical source. The statue itself regained new attention due to a series of publications by M. Guarducci: Guarducci 1974–1975, Guarducci 1977, Guarducci 1989, Guarducci 1991. From this period on, a thorough reconsideration of the statue is unavoidable for anyone, who wants to discuss the "Hippolytan question". To mention only the most influential works: *Ricerche su Ippolito* (1977), followed a dozen of years later by *Nuove Ricerche su Ippolito* (1989); Brent 1995; Cerrato 2002; Mosshammer 2008, 117–125.

Published with license by Koninklijke Brill NV | DOI:10.1163/27728641-00201003
 | ISSN: 2772-8633 (print) 2772-8641 (online)

FIGURE 1 St. Hippolytus statue in 2007 at the entrance of the Vatican Apostolic Library

omnium haeresium, a source of primary importance concerning philosophical and religious beliefs of pagan Antiquity and the early Christians' attitude to them, to eschatological writings which deal with the question of the second advent of Christ.[2] Most importantly, ecclesiastical tradition attributes to "Hippolytus" one of the earliest attempts to determine the day of Easter in a system based on a 16-years cycle: his Easter calculations cover a 112 year period, starting with 13th April 222 A.D., the first year of Alexander Severus' reign.[3]

It was mainly due to Hippolytus' Easter cycle that the statue was recognized as a representation of this specific Christian author. In fact, the two sides of his throne carry two apparently similar versions of a *tabella*, both of which are incised with Greek letters, which correspond, as stated by their titles, to the Easter calculation beginning with the first year of Alexander Severus' reign. Furthermore, on a narrower band, linking one side to the back of the throne, one can see a series of titles in Greek, apparently of Christian theological works, some of which correspond to those listed under the name of "Hippolytus" by later ecclesiastical writers.[4] In particular the *tabellae* engraved on the two sides confer upon the statue a unique importance: thanks to them, this object represents the only third century epigraphical source to illustrate the calculation of Easter.

In contrast to its importance as an epigraphical source, the debate concerning the statue in the last decades of the 20th century has been marked by doubts, many of which have been due to a series of discoveries, observations and hypothesis formulated by Margherita Guarducci between 1974 and 1991. Identifying the statue as a sixteenth-century creation, the eminent Greek epigraphist was able to trace its history back to 1551 and to 1565, finding some key pieces of evidence regarding its creation in Pirro Ligorio's manuscripts. As it was revealed by the discovery of the manuscript Napoli, Bibl. Naz. XIII B 7 of the Renaissance artist and antiquarian, the "Saint Hippolytus' statue", as it is known today, comprises a fragmentary lower part of Roman imperial date, discovered in 1551, and described by Ligorio in 1553, and a modern upper part (bust and head), which was added before the whole *pasticcio* was displayed in the "Teatro del Belvedere" in the Vatican (1565).[5] Guarducci dedicated a series of articles to the problems related to this work and arrived at several heavily deconstructionist conclusions.[6] According to her, there was almost nothing true about the statue. According to one of her main statements, judging from the garment covering the legs, the statue's lower portion originally belonged to a female figure. Thus, according to Guarducci, a Christian community must have recycled a second-century AD statue of a seated lady—as Guarducci thought, the Epicurean Themista—adding the two *tabellae* and the list of titles on its sides. Although the inscriptions on the sides refer to the same Easter calculation, even if in a slightly different way, in Guarducci's view they belong doubtlessly to the same historical moment and are "evidently incised by the same hand". They were thus put down during the first half of the 3rd century, overlapping with the supposed lifetime of "Hippolytus of Rome" and with the reign of Alexander Severus. Later the statue must have been damaged, thus reducing it to the throne and lower body, after which it would have been integrated by Ligorio or his "restorer" into a newly made upper part (bust, hands and a bearded head), with the missing portion of the legs, taken from another Roman female (!) statue. The laconic remarks left by Pirro Ligorio about the vicissitudes of the statue[7] correspond in large part to this reconstruction. As a consequence, Guarducci had no other option but to conclude that the stately marble effigy was in effect a clamorous forgery, which has led to a long-lasting deception. Not only does this reconstruction deliver a severe condemnation of the Renaissance artist, it is also suggestive of a desire to brush away a lot of "old commonplaces" while at the same time, reaffirming the portrayal of a female philosopher in Antiquity.

Today, some three decades after the publication of Guarducci's summary, we had a fortunate occasion to examine the Vatican statue again, armed with new tools and with a dose of agnosticism towards the theses for-

2 Primary literary sources on a certain Hippolytus, Christian theological writer and bishop of an unidentified community are Eusebius, *Historia Ecclesiastica* 6.20 and 6.46, and Jerome, *De viris illustribus* 61. Furthermore, a number of later, Byzantine authors mention and list writings attributed to the same name and there are also some local hints to the cult of a martyr named Hippolytus in Rome and Portus. Cfr. Brent 1995, 115–197; a good, concise summary in Mosshammer 2008, 118–119. While there seems to be too much and too variable in these sources to correspond to only one historic person, the Hippolytan corpus was enriched by Döllinger 1853 with the attribution of the so-called *Philosophoumena* or *Refutation of all Heresies*. For a recent summary on this last point see Cosentino 2018;

3 Mosshammer 2008, 117–125. The importance of the Easter calculations goes far beyond the problem of organizing the calendar of Christian feasts, since it is inseparably linked to the calculations of the basic historical events of Christianity, as the birth of Jesus, *in primis*. In this sense these calculations are a starting point of the Christian view of time, as something linear and measurable, a prerequisite also of modern historiography.

4 See e.g. V. Saxer in *Nuove ricerche su Ippolito* 1989, 45–48.

5 Guarducci 1974–1975, 166–167.

6 Guarducci 1974–1975 and further developments, resumed and updated in Guarducci 1991, 111–140.

7 Naples, Bibl. Naz. XIII. B. 7; Torino, Archivio di Stato, J.A. II. 10 and III. 11 (references from Guarducci 1977, 17).

mulated by previous scholars. In recent years humanistic studies have begun to embrace innovative methodologies, comprising "crossover" approaches, that is to say, the search for subjects which can help us link problems of thought with written memories and material evidence. The renewed interest in the statue of the Vatican Library can be ascribed, in part, to these new trends. Inspired by new questions, which go beyond the already generally accepted affirmation of Renaissance counterfeiting, specialists in the history of the Church, in the history of philosophy and science, in classical and late antique art or in Renaissance art and thought all find themselves united in front of this same object.

It is appropriate to mention here some of the more interesting problems that have recently come to light in connection with this monument. (1) Notwithstanding her outstanding importance as an epigraphist, Margherita Guarducci was surprisingly hasty concerning the statue's inscriptions. Nevertheless, these latter seem to be worthy of reconsideration, not just within the framework of the history of the whole object, but as inscriptions in their own, since there seems to be still much to understand about the coherence of their contents and form, as well as their chronology. (2) Another issue concerns a better understanding of the technical (re)construction of the statue, a question which was only outlined by Guarducci: in fact, the restructuring may have been more complicated and contrived than she thought. Looking at the final result today, it seems highly implausible that the creator would have been so poorly aware of the nature of the components of his artefact as to accidentally assemble a female lower body with a patriarch's head. Thanks to the modern tools at our disposal, an in-depth examination reveals how the technical details are much more complex than was previously thought. (3) More generally in the light of a renewed assessment of Pirro Ligorio's personality and talent, which has been gaining momentum since the end of the 20th century, the time seems ripe for a deeper understanding of the statue as a work of art in its own right.[8] Put succinctly the most important question is how and why "the first Christian portrait statue" was invented around 1560 and what was the historical and cultural background of this invention.

In the last few years, different scholars, coming from different fields, have been drawn to the monument and all the unsolved mysteries surrounding it. The ensuing debate eventually led, in 2020, to the creation of a high resolution, digital 3D model of the statue. The model gave us an extraordinary instrument for a series of investigations, many of which could not have been conducted before. This instrument, used with an appropriate methodological approach, should constitute the technical basis for an innovative project on "Saint Hippolytus' statue".

In this paper, we focus only on the statue as a material object and as a work of art. Our objective is to illustrate some of the new possibilities of a visual exploration, which can help us to better understand this complicated artefact from a technical point of view. Our hope is to lay the ground for a new phase of multidisciplinary debate about the complex Hippolytan problem as a whole, through this recently acquired tool and the new observations linked to its application.

Á.B.

1.2 *The Digital 3D Model: Technical Features*

The project to survey the statue was immediately directed towards the most modern analytical photomodelling techniques, which currently represent the *state-of-the-art* for precision, chromatic accuracy of the information produced, and the portability of the results obtained, as well as to make possible the open access of the resulting model.

Photomodelling, also known as "structure from motion", is based on software capable of reconstructing the spatial orientation of a set of images of any scene, deriving a 3D model as the final result. Initially, the model is realized by a "dense" cloud of separate points (in our case some 15 Mln points) obtained by the reprojection of the homologue points in the different images. Afterward, the program interpolates an average surface, called "mesh," consisting of small triangles that approximate the actual surface of the object. (Fig. 2) The redundancy of available measurements and the robustness of the statistical algorithms assure the high quality of the proceedings, both on the geometric and chromatic levels. In the case of this statue, the software *Epic Reality Capture* was applied.[9]

8 Out of the abundant literature dedicated to Pirro Ligorio's personality, work and commitment I would point out first of all the initiative of a critical edition of the imponent patrimony of Ligorio's manuscripts: https://www.culturaimmagineroma.it/tematiche/pirro-ligorio-e-lantico/edizione-nazionale/ (consulted on 2/2/2023) and the series of editions directed by B. Palma Venetucci (starting with Palma Venetucci 1992). See also Gaston 1988; Schreurs 2000; Coffin 2004; Occhipinti 2007; Loffredo & Vagenheim 2019.

9 *RealityCapture* is a general-purpose fully-featured photogrammetry software for creating virtual reality scenes, textured 3D meshes, orthographic projections and much more from images and/or laser scans automatically, while allowing complete and rigorous control of the overall process. The first version of *RealityCapture* was released by Slovak company *Capturing Reality* (founded in 2013), on February, 2 2016. *Capturing Reality* was acquired by *Epic Games* in March 2021; *Epic* plans to integrate *RealityCapture* into their rendering environment *Unreal Engine*. The acquisition has lead to a general

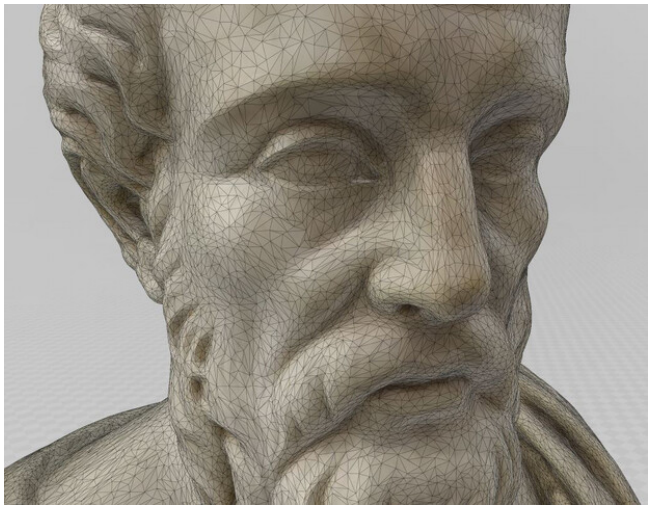

FIGURE 2 Triangular mesh superimposed upon the rendered model. This is a simplified mesh, about a 10 to 1 scale in comparison with the original, which means 3.5 million triangles compared to the 35 million of the original model.

In addition, the availability of powerful hardware, appropriate for the realistic rendering techniques required by the modern frontiers of gaming, guarantees the possibility to visually explore the object of interest at a very high level of detail, even exceeding, sometimes, what is allowed by direct examination with the naked eye. It is, indeed, rare to have such easy access to artworks from every possible point of view and, more importantly, under the best possible illumination (in this case simulated rather than actual). Finally, the possibility to consult an artwork *in situ* is obviously limited by space, time, and safety conditions.

The ultimate aim of the survey was to make available complete visual documentation of the monument together with an instrument to perform any type of measurement in a 3D environment. The survey of the statue required two days of shooting, organized at the Vatican Apostolic Library with the extraordinary collaboration of the staff who made it possible to operate efficiently and flawlessly.[10]

The survey was carried out at two different levels of detail: the first to acquire the entirety of the monument as a whole, and the second, at even greater detail, to focus on the lateral inscriptions. The photographic cover-

FIGURE 3 Visualization of the absolute positioning and orientation of the 419 shots used for the realization of the 3D model

age required, for the first step, 419 images (Fig. 3) and, for the second, two sets of 98 and 96 closer images. The resulting digital model consists of a topologically verified and optimized triangular mesh made up of about 25 million faces, capable of quite faithfully reproducing the entire surface of the monument.

To ensure the correct scaling of the model, markers have been used, with 12-bit coding that the program can identify in a semi-automatic way in the different frames. The distances between the markers have been detected with high precision by direct measurements and then implemented in the general workflow. The program operates by forcing the final model to fit the acquired data rigorously by a "least-square adjustment" procedure. We refer to the difference between the *a priori* distances and the ones that can be withdrawn from the model as "residuals." The analysis of these results leads to a rigorous evaluation of the parameters for the assessment of the final results.

The precision achieved is quite high: the average residual error on the control points is equal, in absolute value,

reduction of pricing and solid perspective for further development. Cfr. https://www.capturingreality.com/, consulted on 2/2/2023.

10 Special thanks to Dr. Irmgard Schuler, head of the photographic department, to her collaborators, to Dr. Timothy Janz, a discreet and efficient presence, and, last but not least, to András Németh, the real organizing engine for the entire operation.

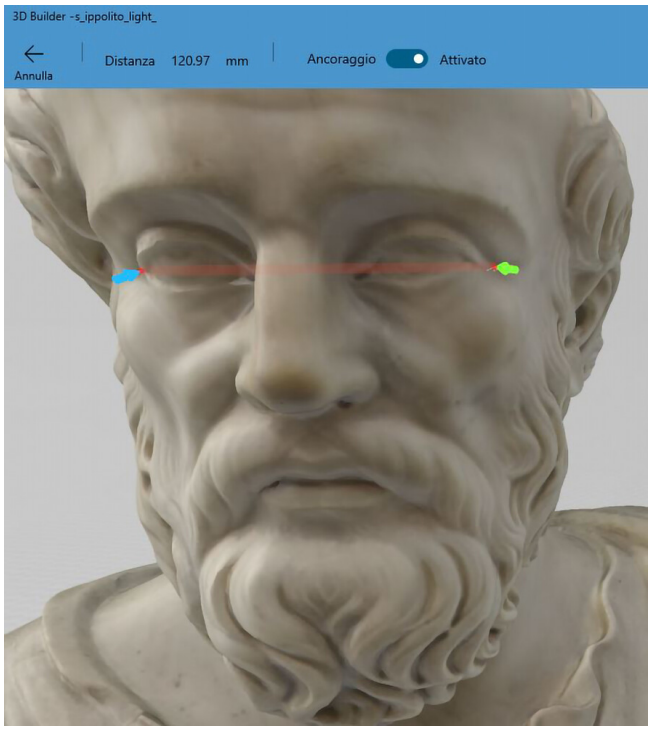

FIGURE 4 Very precise measures can be taken directly from the tridimensional model, allowing a much more exact choice of the points of interest and the repeatability of the measuring operation.

FIGURE 5 Three quarter view of the statue captured from the 3D model showing possibilities of visual analysis of its composition by colouring

to 0.3375 millimetres and the worst value is equal to 0.59 millimetres, which allows the geometric analysis to be kept reliable up to scale 1:1, even in the strict terms of metric and graphical tolerance.

F.P.

2 The Ways of an Interdisciplinary Research: Some Examples

The visual exploration of the model, therefore, allows one to examine "closely", so to speak, the most interesting details of the monument without worrying about physical accessibility, lighting, or even cleanliness. There is no need to actually touch the statue, and one can take measurements with extreme ease and great precision, even between points that cannot be directly connected in a straight line. (Fig. 4) The program even allows one to draw interactively on the model, to "take notes", to emphasize visually different elements of the statue, etc. (Fig. 5)

Another fundamental advantage arises from both the nature and the high resolution of the data. The images obtained from the model are not simply "photographs" but rather "digital graphic works" that exclude, as we mentioned, any perspective aberration. The images themselves derive from the orthogonal projection of the model onto planes that can be freely defined. (Fig. 6a–d) It is even possible to unwrap the surfaces (for example the curved back part of the right epigraph), to be able to carry out rigorous measurements on non-regular surfaces. This projection takes place parametrically, and it is possible, therefore, to define the final width of a single "pixel" of the *synthetic image*. In our case, a dimension of one-tenth of a millimetre was set, thus generating an orthophoto that includes the entire image of the statue measuring 11164×20839 pixels, equivalent to 230 Megapixels. The final image file has been produced in TIFF format (893 MB Tiff file) and becomes immediately measurable even without specialized graphics software. It is sufficient to "count" the number of pixels contained in a certain space and multiply it by the indicated value of 0.1 millimetres. It may seem strange to think that it is possible to derive "3D" measures from a bi-dimensional image. If, for example, we would like to know what is the interpupillary distance, by taking the

FIGURE 6 Orthographic projection of the four principal views of the statue on vertical planes: a) Front view; b) Lateral view (right); c) Lateral view (left); d) Backside view. Although it may look like a traditional photographic image, it is, indeed, a very high-resolution synthetic image that excludes any perspectival deformation proper of the traditional photo: each pixel is equivalent to 1 tenth of a millimetre in real scale

FIGURE 7 Orthoprojection of the top view of the statue

measurements directly on the object, the nose being in the middle poses difficulties, but if it is done on an orthograph, we would have the chance to overcome perspective deformations which are typical in the photos themselves. In this case, we can have the projected real distance between the point of interest directly from the bi-dimensional view and, since it is possible to pre-determinate the real size dimension of each pixel, easily scale the image itself for subsequent use, for example, in CAD or solid modelling programs. Furthermore, if we carry out the measurements directly through the photomodelling program (*Reality Capture*), the geometric decomposition (direct and projected) of the measurements in the space is provided directly. This approach keeps all the proportions and alignments unchanged. A fair example is given by the aerial view of the statue (Fig. 7) that allows evaluation of the planimetrical shape of the throne, its irregularity, and the asymmetric alignment of different parts. Moreover, these formats provide greater portability and usability.

Finally, the model remains available for an unlimited time and can thus be recalled digitally at any time, producing infinite possible elaborations and "discussions" about the intermediate results. At the same time, the richness of the photo-realistic model makes clear the high potential that this new media puts at our disposal, far beyond the traditional architectural (or archaeological) drawing. This "new freedom" not only allows us not to predetermine the aims, quality, and quantities of the modelling activity, but also permits us to develop possible hypotheses and share them without becoming overly enamoured with the different ways of thinking that, from time to time, have led more to the reproduction of different abstract ideas about architecture (and thus the construction of real "ideological cages") than to the evaluation of the architectural objects as such.

In this regard it is worth recalling the beautiful booklet by Waldemar Deonna, *L'archéologue et le photographe* from 1922:[11]

> La photographie a détrôné le dessin … Le dessin est maintenant subordonné à la photographie, et il ne la remplacera plus jamais … Le procédé mécanique est nécessaire pour la reproduction, car il supprime cet élément subjectif …
>
> F.P.

2.1 *A Substitute for Autoptic Inquiry: The Advantages of a High Resolution, Rotatable Image for "Archaeological" Exploration*

The most evident benefit of the 3D model is that it provides us with a tool to better examine the monument, simulating the conditions of a face to face, autoptic examination. (Fig. 8) It must be noted, however, that its efficiency depends largely on the quality of the model. A low resolution or a less detailed reproduction of the mass and surfaces might be interesting for an overall view, but will help little with any archaeological inquiry, where minor details can reveal much about the techniques and tools.

While archaeologists and art historians might have had limited access to view the statue up close, or been without the necessary light, the virtual reproduction furnishes the expert with practically all the details, and from any angle. Furthermore, the virtual reproduction can be visualized on the screen or on several screens simultaneously, and in the most comfortable conditions. Not only does such an asset permit a "virtual on-the-spot investigation", it also allows for numerous specialists of different disciplines to examine the artefact, without any problems of space. On the following pages we will illustrate some of the possibilities provided by this mode of observation, with some static images, captured from the dynamic 3D model.

11 Deonna 1922, 89; see also Puche Fontanilles 2017, 189.

FIGURE 8 General axonometric view of the final model

Since one of the main issues with the statue concerns its fabrication, with a special regard to the chronology and original look of its components, the technical details are vitally important. Even at a distance, one can see that the statue is undoubtedly a *pasticcio*, resulting from the amalgamation of a number of different pieces of sculpture, heterogeneous in colour. At several points of the assemblage gaps are clearly visible.

The most instructive way to analyse such an artefact would be to disassemble it. Failing this, a thorough examination of a rotatable model can provide precious insights. Moreover, such an approach has the advantage of being non invasive. The following three detailed observations are useful, since they give some hint as to the type of question that can be asked even in the current, preliminary state of the research.

Although the difference in colour between the central portion, comprising the throne and the pelvis of the figure, and the legs is conspicuous, it was initially overlooked by Guarducci.[12] In her subsequent publications, she recognized that the basic fragment, registered by Pirro Ligorio's drawing in 1553, was completed not only with an upper part (from waist to head), but with two additions, the second one being the lower piece, representing the legs and feet, together with an additional portion of pedestal. She hastily added, however, that this lower addition was also the fragment of a Roman seated statue and, what is more, that it was a female one.[13] Closer observation suggests, however, that the real difference, both in the quality of the marbles and in the treatment of the surfaces, is to be found between the central part and the legs, while the legs themselves are very similar to the bust. (Fig. 9a–c)

The most conspicuous feature of the carving, observable both on the drapery covering the legs and on the bust, resides in the treatment of the surfaces, which are left rough, with evident traces of the chisel, recognizable along the edges of the folds in the drapery. There is nothing similar to be seen on the polished surfaces of the throne and on the central part of the figure. Although the groin is also covered by a folded drapery, the carving is smoother and much less perceptible. That said, the same kind of folds, with rough, chisel-traced surfaces can be seen on the drapery of the bust. Fig. 9c illustrates a view of the groin from above and reveals the differences in the carving technique. In fact, in this area, the point of union is disguised by the addition of folds, which were also used to integrate the probably fragmentary folds and to cover the gaps (today three dowel-holes can be seen clearly on them). Here, once more, the carving of the additional folds corresponds to the drapery on the legs and diverges conspicuously from that of the gently crinkling, smoother folds belonging to the older portion.

Once this similarity between the carving of the legs and the bust portions has been observed, one can add some other observations, which do not require special close-up and well-illuminated images, and underline the stylistic unity of the two parts: let us observe here, for example, the very similar treatment of the folds over the mid-leg and the fore-arm, with the sleeve-like sequence of curved wrinkles and the characteristic cuff-like turnover near to the foot and to the wrist. (Fig. 10a–b)

These initial observations, made possible through the high resolution, dynamic, 3D model, allow us to reopen the investigation of how Ligorio's *pasticcio* was made and to question Guarducci's theory concerning the typology of the original fragment. In fact, every detail seems to suggest that the front leg was an addition and that it was

12 Guarducci 1974–1975.

13 Already in Guarducci 1977, 29; repeatedly, in detail, Guarducci 1991, 121–122: "Questo secondo marmo, ch'egli aveva sotto mano, era la parte anteriore di un'altra statua pagana … anch'essa femminile. Come Themista, anche la nuova figura indossava una tunica, quella con orlo frastagliato che da principio aveva richiamato la mia attenzione, ed un manto."

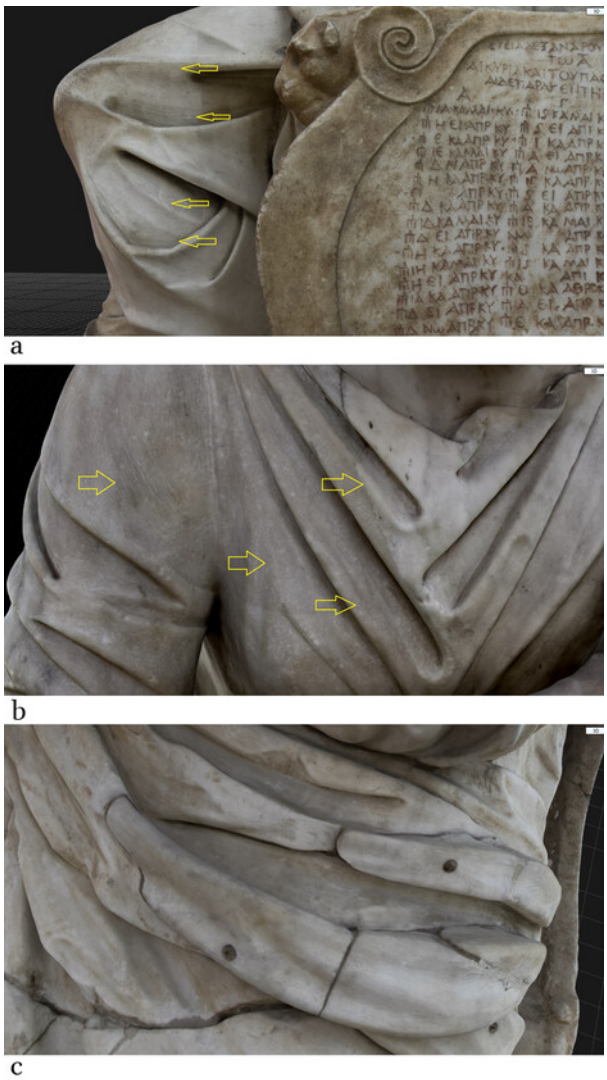

FIGURE 9
Details of the 3D model. The arrows indicate points where the described features can be observed: a) a part of the draped legs; b) a part of the bust; c) a part of the groin, with original (ancient) and added folds

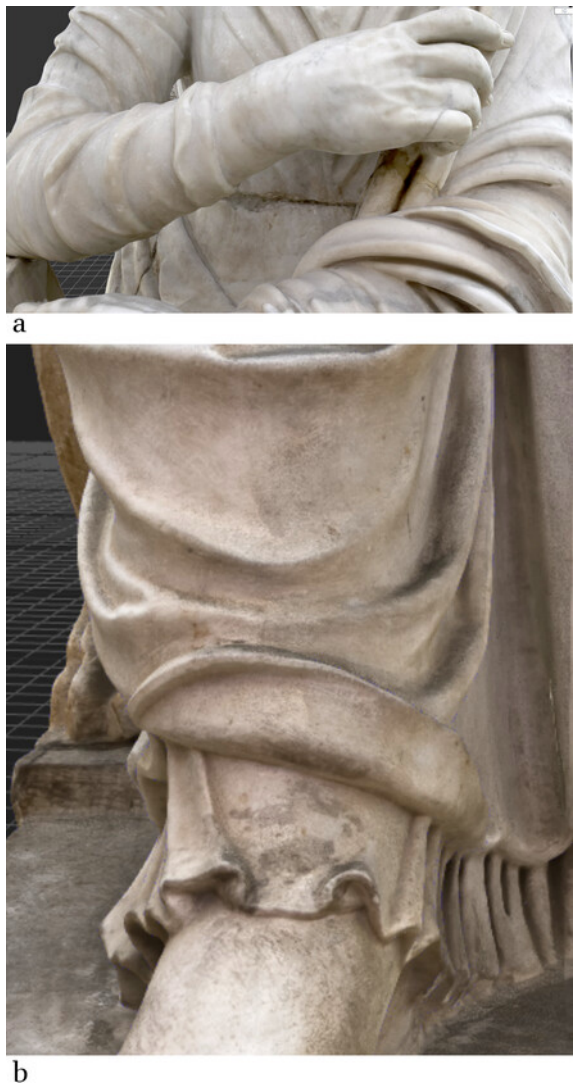

FIGURE 10
Details of the 3D model: d) the right leg with characteristic drapery folds; e) the right arm with characteristic drapery folds

carved by the same hand that also made the upper part. If this is the case, then the whole theory concerning the originally female iconography of the statue needs to be re-evaluated. In effect, there is nothing in the ancient, central part, that would be incompatible with the iconography of the seated, mantled philosopher type.[14]

Naturally, the observations described here are not the only elements that can be derived from a patient and thorough autoptic observation of this complicated *pasticcio*. By way of allusion to further possibilities, let us add one more element: the rear view of the statue seems to suggest that the bust also requires a more attentive examination (Fig. 6d). In fact, it is difficult to imagine why that roughly

14 As the last cited passage of Guarducci 1991 reveals, the theory of the female figure was suggested to her exactly by the drapery of the lower front part. Later Guarducci adopted as an additional, but decisive argument her analysis of Pirro Ligorio's 1553 drawing (Naples, Biblioteca Nazionale, ms. XIII. B. 7, ff. 424–425), in which she insisted to recognize a female figure, cfr. Guarducci 1977, 18; Guarducci 1991, 118–119, fig. 42. As a matter of fact, this conviction might have been again the result of autosuggestion, since there seems to be no specifically female trait in the drawing, either, to an unprejudiced eye. In fact, Ligorio's 1553 drawing was first published in modern times in Mandowsky & Mitchell 1963, pl. 60a, together with a textual citation of Ligorio's commentary, which clearly identifies the statue as a likeness of "quel santo Hippolito di cui fà mentione honorammente Eusebio". This proves that Ligorio had no doubt about the male iconography of the monument.

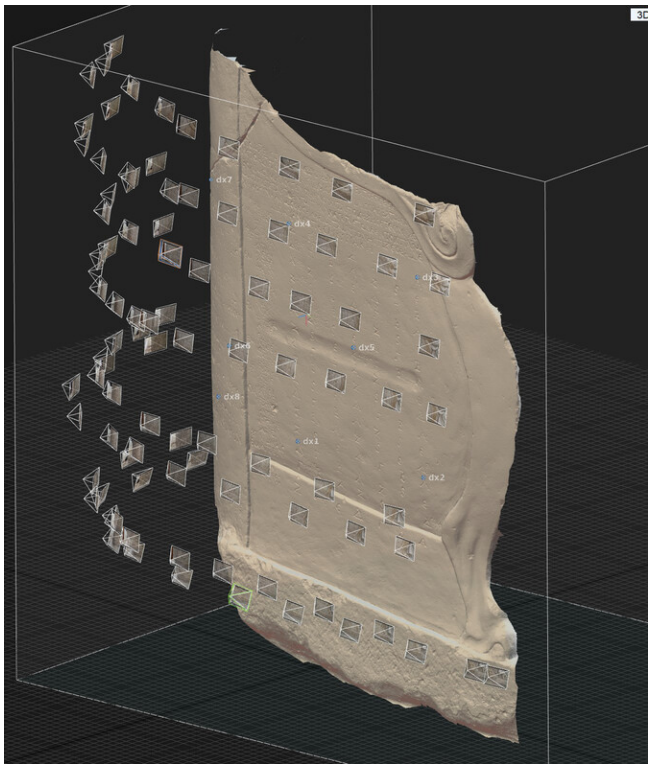

FIGURE 11 Shooting scheme for the inscriptions, leading to a 3D very high-resolution model: the actual size of each pixel has been brought up to 0.05 millimetres.

outlined back could not have been made to fit the fragmentary throne without a gap, and to judge from the incoherent treatment of the garment behind the neck and an evident filled-in gap on the right crop, it can be surmised that this part underwent important reworking, too.

To sum up, the question of how this noteworthy *pasticcio* was created is still not entirely clear. A more detailed study from several different points of view is required.[15] An overall and systematic mapping of the components would represent the first, groundbreaking step towards a real reconstruction, upon which credible hypotheses could be proposed. The virtual 3D model would constitute an indispensable tool in this procedure.

Á.B.

2.2 *Visualising the Surface: An Improved Tool for the Epigraphist*

The inscriptions incised on the two sides of the throne have drawn the attention of many scholars. Curiously, while the contents of the three inscribed panels have been abundantly discussed, they have never been thoroughly examined from the point of view of form and style, i.e., from a strictly epigraphical point of view.[16] A first glance at the two side panels inscribed with the Easter calculations suggests, however, some anomalies that unexpectedly complicate the issue.

For example, there is the difference in the organization of lines and letters that can be observed between the inscribed panels of the two sides. While these differences could simply be due to the nature of the contents (this point is in need of more detailed study), there is the possibility that the text was written by two different hands, characterized by different approaches and competences. Moreover, observation of the inscribed surfaces suggests that there might have been other inscriptions, possibly erased later to make space for the more recent Easter calculation tables. In our view, such analysis will necessarily combine the expertise of an epigraphist with the new possibilities furnished by the 3D model.

For the inscribed surfaces, i.e., the side panels of the throne, the degree of detail was increased for the digital model, using about 100 images for an area of less than one square meter. (Fig. 11) The gain in quality in this regard does not concern the geometric precision of the model, which simply remains in the more general range illustrated above, but its chromatic and volumetric accuracy. In this case, the pixel size was set to 50 microns (five-hundredths of a millimetre). Each letter is individually modelled in three dimensions, making it possible to easily analyze symmetries and alignments. (Fig. 12a–d) The use of colour is perfectly intelligible, and even the possible presence of *pentimenti* by the engraver or other precious indications become perceivable. In the same way, through the potential of the model's interactive lighting algorithms, the direction and depth of the individual gouge and chisel strokes are made evident. Another traditional technique used to analyze faint engravings is by using so-called "grazing light" that is efficiently simulated using analytical means and provides an impressive enhancement to the readability of engraved surfaces.[17]

15 Guarducci's (Guarducci 1977, 29) statements about the different marble types possibly used for the statue have not been supported by a published petrographical evidence. Nevertheless, a modern petrographical analysis of the different components, would be a basic preliminary requirement for a new research on the statue.

16 As already mentioned, Guarducci briefly concluded that they were certainly written by one and the same hand, and to be dated trustworthily to Alexander Severus' era, as stated implicitly by the inscriptions themselves. Guarducci 1974–1975; Guarducci 1977, 25–28, discusses at some length the historical context of Easter calculations in Alexander Severus' Rome but pays no attention to formal peculiarities.

17 Wall grazing is a technique by which the light source is typically positioned 12" or less to the wall such that the beam will hit the wall at a narrow angle. This steep angle accentuates the eye to the texture or surface of the wall by creating a dramatic light-

a b c d

FIGURE 12 Simulation of a "grazing light" vision by proper shading of the 3D model (particular): shaded and rendered view with details

Furthermore, we can debate the potential of traditional moulding for epigraphical studies, and someone could argue that this technique is irreplaceable. Once again, however, we do not believe this to be the case. It is always possible to have a print-out, made by a very precise 3D printer, at one-to-one scale in a natural way (with the excavated letters) or, conversely, with the words in relief, even with a "digital scale multiplier" enhancing the analysis capability. Finally, the digital approach appears to be much safer than any other for the protection of heritage patrimony.

F.P.

2.3 *A Tool for Art Historical Discussion*

As we already know, the "Saint Hippolytus' statue" that we see today is a late Renaissance artwork, created around 1565. If it is not factually the earliest marble likeness of a Christian figure of the third century AD, it is at least the first modern attempt to "reconstruct" one. On the whole, its interest lies also in the fact that it illustrates a possible sixteenth-century way of conceptualizing a Christian thinker of the Roman imperial age. In Pirro Ligorio's conception this *pasticcio* served to unite a precious written testimony of a fundamental element of Christian thought, understandable for the erudite, and a human presence, expressed through a likeness, that was designed to appeal to the senses of any viewer. As for the latter, there are a number of details which will require further consideration in the future. Here, we would like to highlight only one of these stylistic elements, naturally the one which can be studied with particular efficiency through our 3D photo-modelling.

This aspect regards the problem of the perception of the artwork in the space, as it was intended in the moment of its creation. It is a problem that should be considered for every three-dimensional work, which has come down to us, and has not left any clear evidence about its original location, and therefore leaves us guessing as to how it was seen by contemporary viewers. This is a basic, although often neglected problem for almost every monument of statuary originating from remote times. In the case of our statue it is sufficient to look at it again at normal eye-level, with a full profile view (Fig. 6b–c) to realize that it is not a harmonious and not even a realistic representation of a seated human figure. Of course, anomalous elements, such as the unrealistic proportions between the legs (first of all the femur) and the upper body, or the apparently dystrophic left arm, with its almost paralytic position form the left profile view, can be explained hypothetically by the improvised and handcrafted nature of the monument. We can thus conjecture that all these features were consequences of a superficial and pragmatic creation, that lacked any deeper artistic intentions and values. However, the strong asymmetries are evident also in the construction of the face, which cannot be ascribed to accidents due to the assemblage of incoherent pieces, as it is shown by a full frontal, eye-level view of the head (Fig. 13). The most plausible possibility is that this pseudo-antique, fictitious likeness was planned to be viewed from one specific angle, which did not correspond to a full frontal or full profile view. Incidentally, this was also the case with all antique portrait statues from the Hellenistic period to the age of the Tetrarchy.

Thus, it seems legitimate to explore other possible positions of the statue, to find out how it might have appeared if observed from a certain distance or at an angle. The 3D model allows us to simulate such visual experiences. (Fig. 14)

ing effect through the use of shadows. The raking effect can be deepened or diminished by moving the light source closer to or further from the wall.

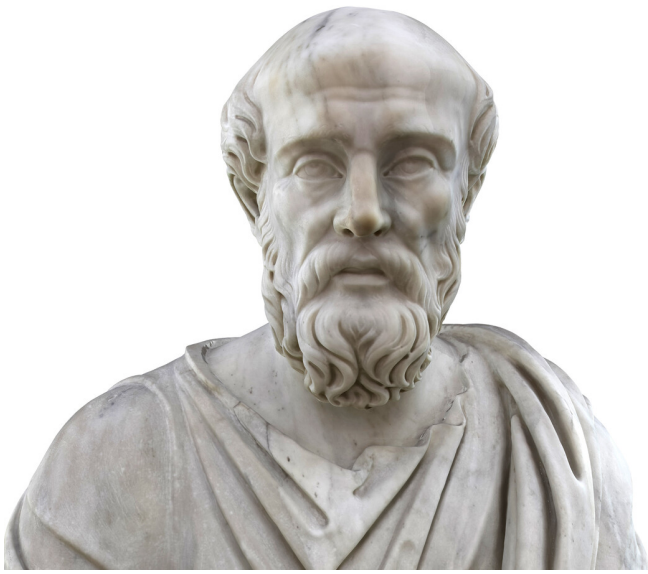

FIGURE 13 Detail of the 3D model showing the face at a nearly eye-level, full frontal view

Although the written sources make it clear that the statue, in the form as it was (re)constructed in 1565, was intended for the "Teatro del Belvedere", we know nothing more of its exact location.[18] Thanks to the 3D models, it is possible to evaluate various possibilities interactively, simulating how the statue would have been perceived in its setting. Obviously, these techniques do not have the presumption to try to "explain" the artwork, nevertheless, the simulated views, generated with the help of the model do help us understand how the craftsman might have imagined its future location. In such a way, at a time when the laws of perspective were certainly mastered, certain variations or apparent "aberrations" of the laws of perspective can be safely excluded.

What were the craftsman's intentions in shaping his creation? What was its setting? From what angle or angles was such a stern face intended to be viewed? Such questions are not easy to answer. All we can do is try to simulate the architectural space in which the statue was intended to stand, while taking into consideration any historiographical elements from the period. Not only does the modern software allow us to pursue this goal, it also allows us to proceed with infinite simulations. As a result, we can suggest what the visual perceptions would have been from different view points and with different lighting conditions.

In order not to lose ourselves in a maze of self-references, we can count on modern three-dimensional modelling software, in our case Blender®.[19] The Blender scene contains both the 3D model of the studied object and the "camera" that determines how it is displayed. The position of the camera itself is a parameter available to the operator who can decide from which point of view to simulate its perception. If the model is located in a defined space with a direct reference to the real architectural surroundings containing the statue, it would, therefore, be possible to interactively evaluate its visual impact on possible users in a two-way mode, that is to say by imposing coordinates on the "camera" (e.g. "how can one see the statue from the upper balcony?") or, otherways, to locate the position of the observer for a particular sight.

For this operation to take place effectively, there is another parameter available to the operator: the "focal length" of the camera itself. Several studies have analyzed the relationship between the camera and the human eye, trying to evaluate the focal length and angle of view for humans. Through the dimensions of the different components of the eye, based on empirical calculations, it has been determined that the focal length of the human eye is between 17 and 24 mm in a full-frame modern reflex camera. The complexity of the visual apparatus is such as to render any "overly mechanistic" modelling difficult, if not impossible. By setting these parameters for the "camera" of the Blender scene it is possible to reproduce the natural perception in a very effective way, particularly if we add to this, as mentioned, the simulated direct and indirect lighting conditions of the object itself.

Á.B. & F.P.

3 Perspectives

What we have outlined in the preceding pages is the starting point and the scheme of an articulated research project, inspired by some new questions and observations about a long since debated monument, and encouraged by the recent acquisition of a new technological support. In recent months, as a result of multifold discussions, the research project took shape, under the aegis of the Vatican Apostolic Library and the Vatican Museums, with the participation of archaeologists, art historians, experts of Late Antique and early ecclesiastical history, epigraphists and palaeographers. The first results of our joint inquiries will be presented to the scientific community at a conference expected in 2024.

According to our expectations, the perspectives opened by this multifaceted teamwork will contribute to a better understanding of a number of problems. In the first place, a more precise view of the "St. Hippolytus' statue" as an artwork, through a possibly more objective recogni-

18 Cfr. Mandowsky & Mitchell, 1963, 105–106, No. 101 and doc. 7.
19 Cfr. http://www.blender.org, consulted on 27/03/2023.

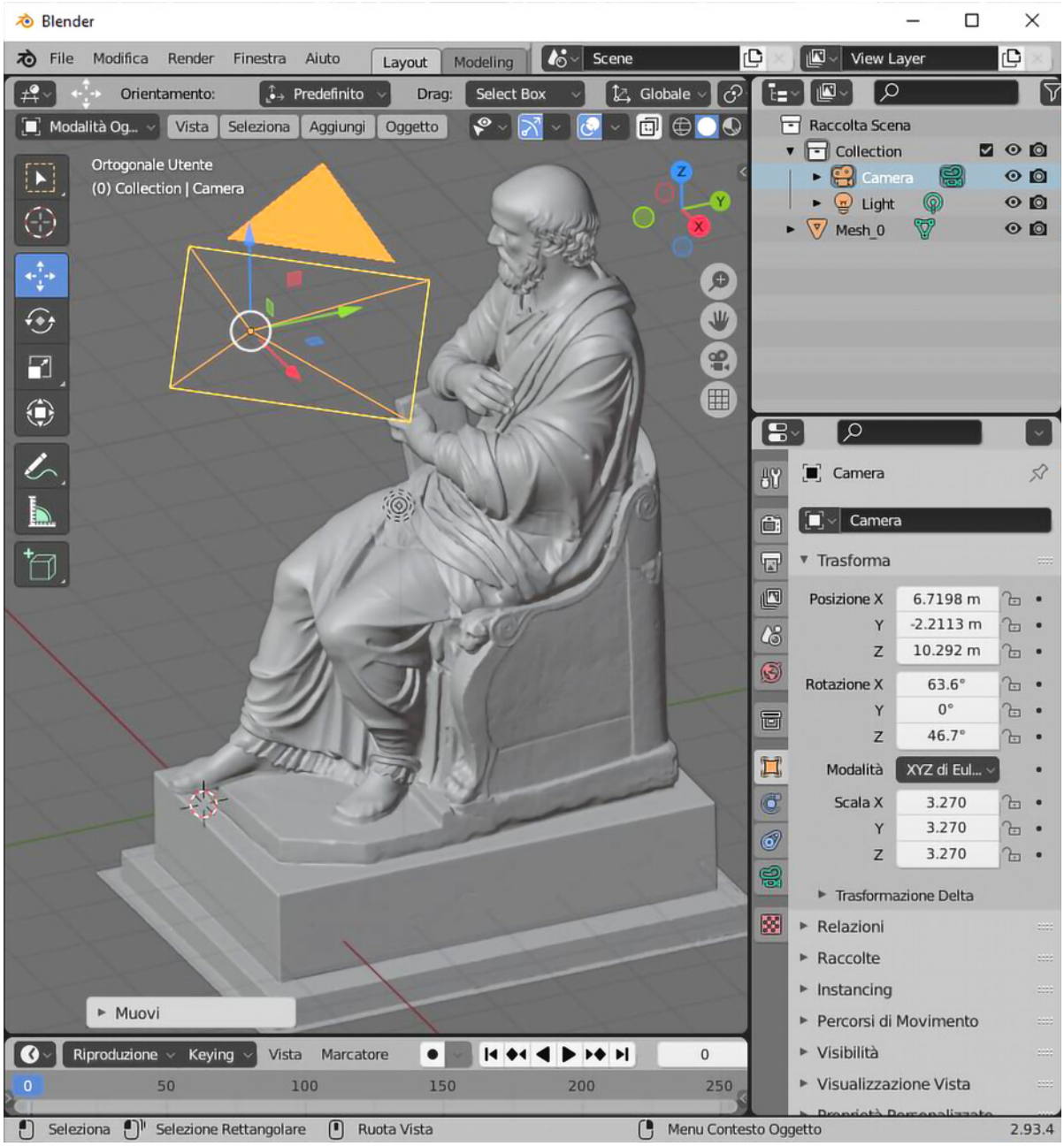

FIGURE 14 Overview of the operating environment for visual simulation and perception inquiry based on Blender® software

tion of its components and the context of its fabrication. This part of the research could also shed some light on the identity of Pirro Ligorio's collaborators, i.e. the executors of the sculptural addition. What is more important, thanks to this insight we hope to acquire a more precise view of the practice of re-using remnants of ancient monuments, as well as the reception of Classical artistic models in the Late Renaissance, with a special focus on the changes that can be observed between the first documentation (1551) and the final "restoration" of the statue fragment (1565). Furthermore, we aim to propose a new reading of the inscriptions, from an epigraphical and a linguistic point of view, as well as a reconsideration of their contents in light of what can be known about the history of early Easter calculations and the establishment of a Christian historiography. Still as far as the artefact is concerned, we will consider it also in light of Classical and Renaissance portraiture and iconography. Finally, another aspect of the project deserves mention: this study will be one of the first trials to use a virtual 3D model not only for the purpose of communication, i.e. of visual rendering of acquired results, but also as an instrument for human-

istic research itself. The success of this experiment will largely depend on patience, open mindedness and mutual understanding of different points of view, represented by scholars trained in the problems and methods of different disciplines.

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