



Digitalization of Bernini's drawing Tondo depicting St. Joseph with the Baby Jesus. Increasing knowledge and monitoring Surface Cracks

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The project

The photogrammetric campaign whose results are going to be shown in this presentation was carried out by the ENEA ICT Laboratory for CH within the ADAMO Project (2019-2020), financed by the Lazio Region, through the Technological District for Cultural Heritage – DTC. The District has planned some diagnostic investigations aimed at improving knowledge and preservation of some artworks on the Lazio territory.

ADAMO Project involved different cultural and scientific institutions, universities, and research centres that applied some advanced non-destructive and non-invasive technologies, also on some ancient manufactures hosted in the Baroque Museum in Ariccia. One of these is the Tondo, a drawing made by Gian Lorenzo Bernini, object of our photogrammetric campaign.



<https://dtclazio.it/>



A·D·A·M·O

<https://progettoadamo.enea.it/>

The site

The Bernini's drawing is located on a wall in the chapel on the first floor of Palazzo Chigi in Ariccia (a village near Rome) - today site of the Baroque Museum - where Bernini worked in the second half of the seventeenth century, at the service of the Chigi family.



The artwork

The Tondo depicts Saint Joseph with the Child Jesus and was realized in 1663. It measures 1.11 m by 1.10 m. The technique of realization is sanguine. The autograph would seem to be demonstrated by the inscription located on the drawing.

The Tondo has been described for the first time by Stanislao Frascchetti in the nineteenth century as "very curious for its originality" ; in fact, to find Saint Joseph and the Child in such pose must be considered a rarity.

According to previous studies, its execution was carried out without a preparatory drawing. However, in the recent thermographic investigations (carried out by the Department of Industrial Engineering of the University of Rome Tor Vergata) during the diagnostic campaigns conducted for the ADAMO Project, a graphite section below the more evident sanguine drawing was revealed, which would attest the existence of a further **preparatory sketch**.



Shape and framework



Also the choice of the **round shape** seems to be singular: in fact, since the Renaissance it was used more commonly to contain depictions both of saints and prophets, and scenes of the Holy Family and the Motherhood.

Bernini used it with a certain frequency to contain portraits, especially reliefs placed on tombs. Based on these observations, it could be possible that the round shape of the sanguine initially may have had a different purpose, such as to contain a portrait of a member of the Chigi family.

Otherwise, it could be that the original shape was changed afterwards when the framework was added in 1771, painted in fake marble by Luigi Baldi.



monumento funebre di Bernini Gian Lorenzo, Fedeli Tommaso detto Tommaso del porfido (sec. XVII)

Condizioni d'uso: [Beni Culturali Standard \(BCS\)](#)

The portrait

According to the experts Bernini's choice of this iconography would be linked to the birth of Augusto Chigi, the first son of Agostino Chigi; therefore, the two – father and son – would be identifiable with the sacred figures, portrayed in a gesture of great humanity and naturalness.

Even though the profile of the old Saint seems to reveal evident affinities with another artwork of the artist ('Portrait of frate cappuccino'), from a comparison made during the present research, a remarkable similarity seems to be emerged between the profile of the Saint in the Tondo and the marble relief of Agostino Chigi, placed on his tomb, sculpted by Bernini in 1652 (in the Basilica of Santa Maria del Popolo in Rome).



The signature

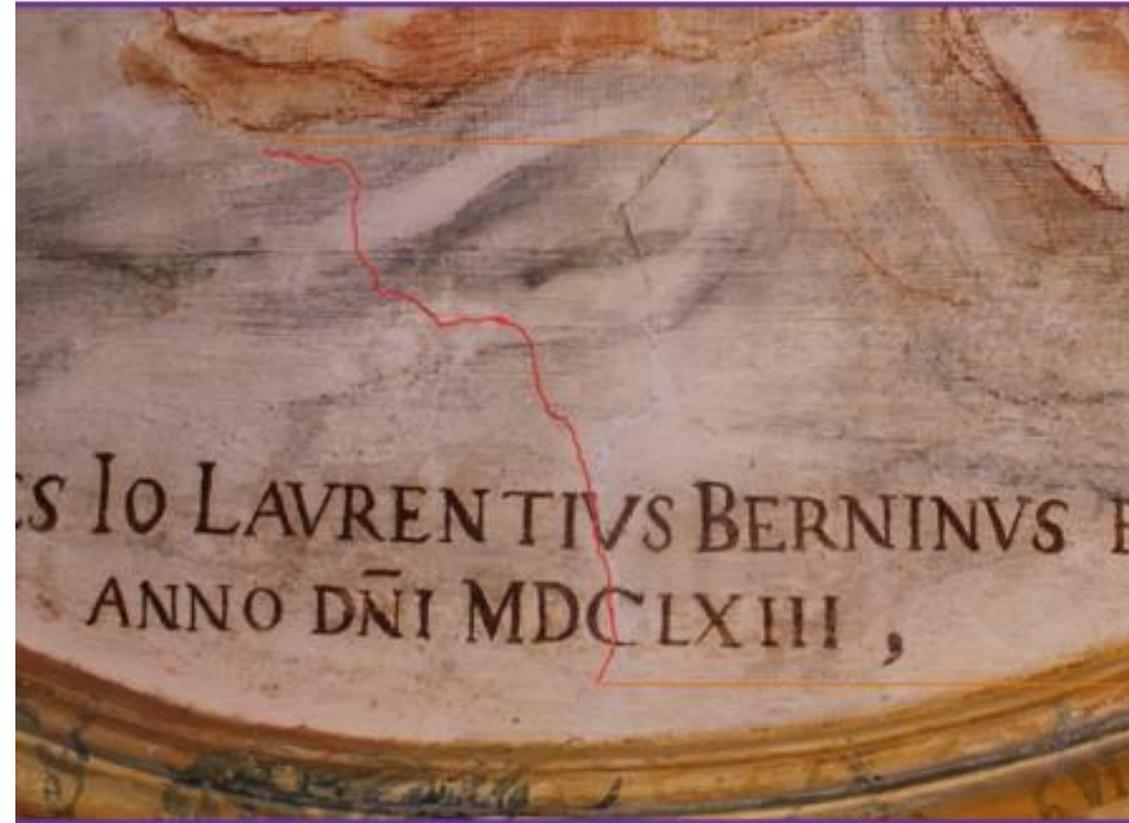
The autography would seem to be demonstrated both by the inscription

«EQUES IO LAURENTIUS BERNINI FAC: ANNO DNI MDCLXIII, »

which means «Me Cavaliere Bernini done: Anno Domini 1663», that can be read inside the Tondo, and by the comparison with another autograph drawing of Bernini, depicting the same iconographic theme, preserved in the Chigi Archive of the Vatican Apostolic Library.

However, the results of the survey made by Roma Tre University and The National Institute for Nuclear Physics (INFN) reveal something different. They applied specific tools and methods on the drawing: XRF (X-ray Fluorescence), LIF (Laser-induced Fluorescence) and FT-IR (Raman and Infrared vibrational spectroscopies), in order to collecting data on the chemical composition of the materials and pigments used by the artist.

In particular, the different elements detected in the background would probably mean that the 'signature' was affixed later, which could suggest that it was not written by Bernini himself.



Photogrammetry

Method for diagnostic and knowledge processes

Main goals:

- To define the conservation status of the artwork
- To facilitate the medium and long-term monitoring activities carried on by the museum staff
- To foster the knowledge of the drawing

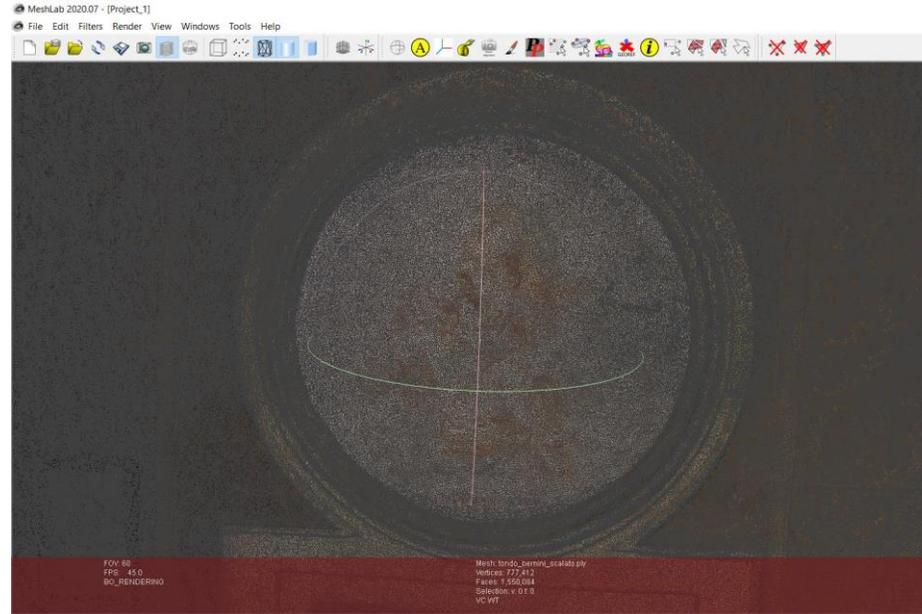
Activities:

- Measuring the dimensions of all the cracks and damages identified on the drawing
- Catching measures by using a normal photo camera
- Developing a 3D model of the artwork

Instruments HD and SW:

- Software resources (Agisoft Photoscan Pro 1.4.5; Mesh Lab) hosted in Virtual Lab IT@CHA in ENEA GRID Infrastructure, used to post-processing photogrammetric data and to create a 3D model of the drawing.
- ENEA GRID. The results of the survey campaign are stored in a safety way, into a dedicated area reserved in the same infrastructure, accessible only for authorized users.

The photogrammetric campaign



Using a Canon EOS 550, 136 images (of 5184x3456 pixels and 6MB each) were taken. The photos were postprocessed with the software Agisoft Photoscan Pro 1.4.5 following the workflow from the alignment of the individual photos to the return of the texturized 3D model in high resolution.

The **point-cloud** obtained in the post-processing phase is made of about 8 million and 500 thousand points and has been edited and cleaned with Mesh Lab software, which allowed to redefine graphically the edges of the Tondo, because they appeared irregular; then, it has been straighten in the digital model, which has facilitated the measurement of real dimensions.

Lastly, Photoshop software was used to create a **grid** that has been superimposed on the digital twin because it results useful in mapping injuries and damage present on the surface of the drawing.



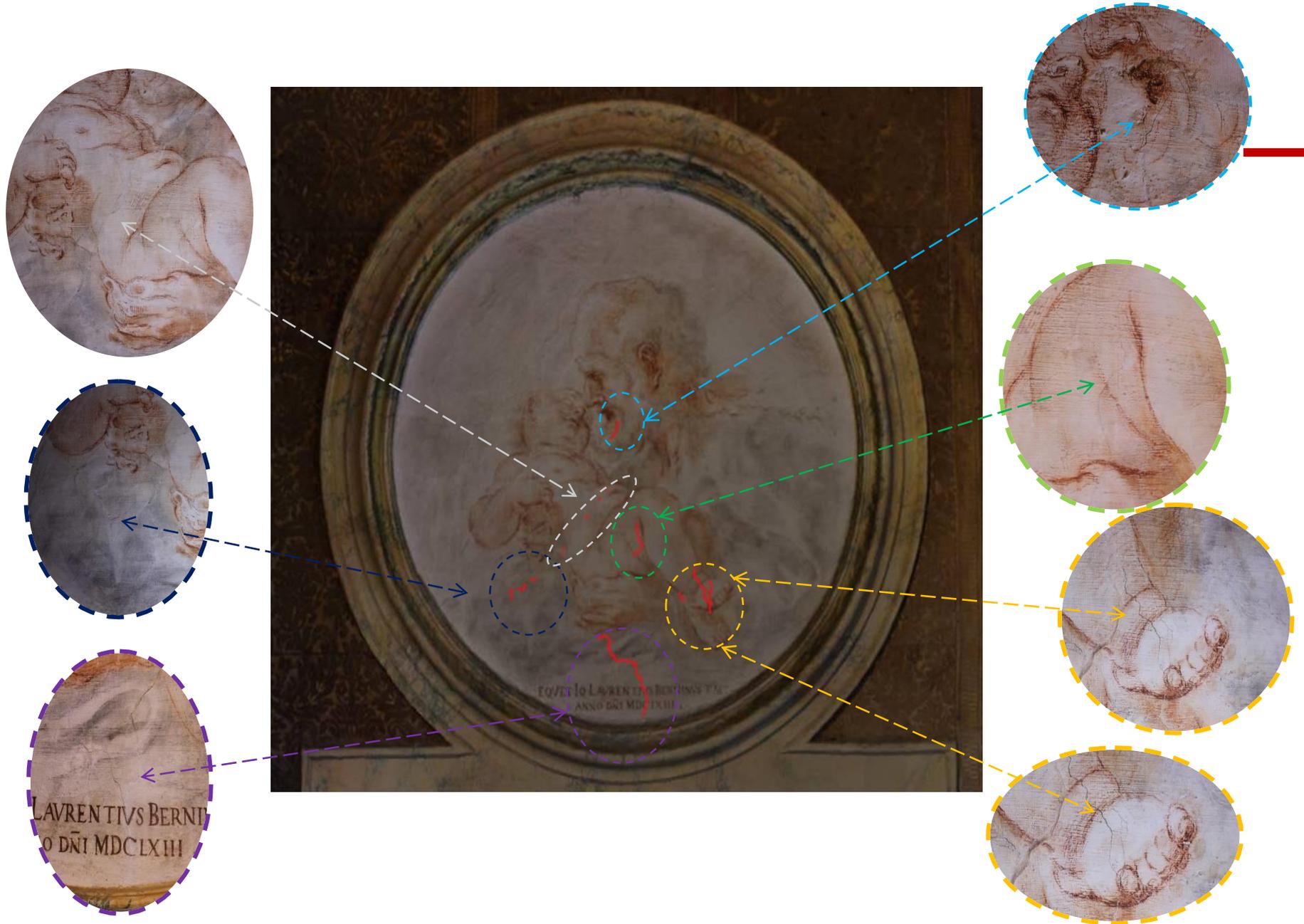
Results

Lesions of different severity have been identified on the Tondo surface:

from those of very small extent (about 0.002 m),

to others much more serious (from 0.05 m to 0.09 m)

for which it was already possible to predict a worsening in the short term.



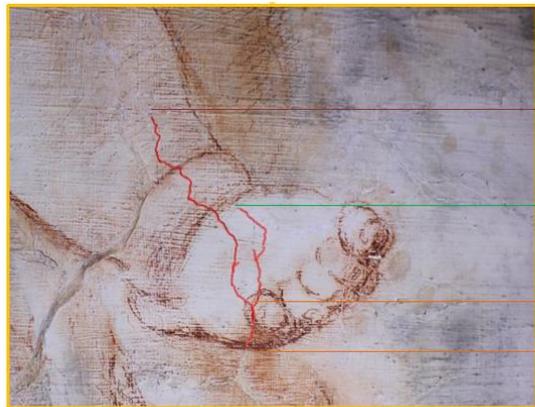
Results

For each single damage that has been found, a slide with a picture of the specific part of the drawing has been created. Thus, on each slide, the damaged can be easily enlarged to be analysed in a deeper way, even remotely, using the Virtual Lab.

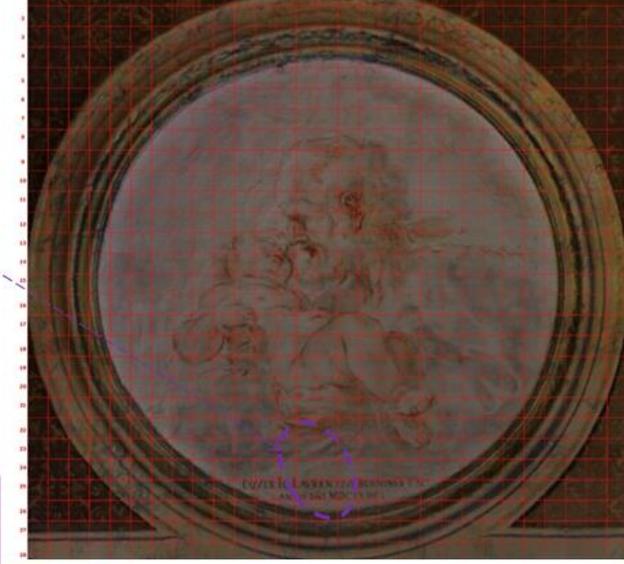
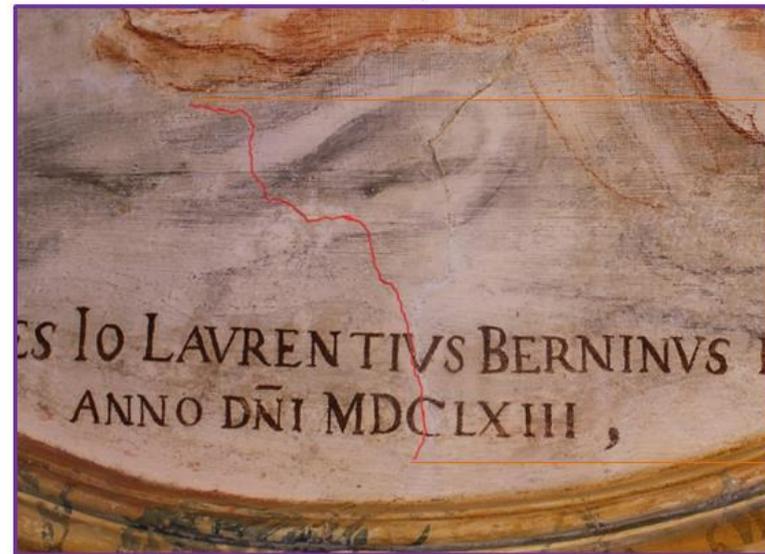
Then, the grid overlapped on each slide permits to locate exactly the single crack and to measure it.

Finally, all data and measures have been collected in a table with size in meters of the damage detected.

All these data are saved and made available in the Virtual Lab dedicated to CH which is managed by ENEA ICT, into the GRID infrastructure.



F1	F2	F3
S21	R20, S20	S20
0,015m	0,083m	0,041m



D

D
O23, O24, P24, P25
0,195m

3D Model

Using the Structure for Motion technique (SfM) a 3D model has been created with the main objective of assisting historians, restorers and experts in future studies and conservative intervention on the drawing.

In fact, it can help them in their research to improve the knowledge of this artwork, supporting, for example, the vision of details not easy to detect by naked eye.

Moreover, the 3D model will be part of a wider multimedia project for the cultural promotion of the Baroque Museum, focused, at the beginning, on the single digital twin of the wall-drawing, both inside the building, reproduced on screens for three-dimensional vision, and remotely, on a web platform.

Looking ahead, a more complete promotion plane, that would involve the entire collection, would be developed including the digitalization of other artworks, even sculptures and paintings, replicating the same methodology already applied on the Tondo.



Conclusions

The photogrammetric campaign carried out by ENEA ICT laboratory on the Bernini drawing had shown the effectiveness and the replicability of the method applied, useful for:

- collecting quickly numerical data on the current state of conservation of an artwork with tools easy to use and sw easy to access, even for no expert staff
- monitoring even artworks in conditions of limited accessibility
- enlarging the audience and fostering the fruition thanks to the three-dimensional digital twin
- Maintaining accessible all the information collected about an artwork, together with the 3D model, because they are stored safely into the ENEA-GRID infrastructure.



Thanks for attention

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