

THE SCENOGRAPHY OF SERPOTTA STUCCOES REVISITED - MATERIAL AND FORM

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1. Introduction

In order to develop an effective scientific investigation process in the field of diagnostics, conservation, protection and valorisation applied to Cultural Heritage, it is essential to promote the formation of interdisciplinary groups with different professional competences and test, define and propose specific methodologies and operative protocols.

In the specific field of architectural survey and restoration, particular techniques and the use of non-invasive equipment are becoming increasingly more common. Numerous scientific and technological advances have been achieved through projects financed by research authorities, universities, companies and firms specialised in the sector [1].

Focusing on our experience, the acquisition, processing and understanding of heterogeneous data extrapolated from the application of specific interdisciplinary instrumental methods, has determined a crucial point in the methodological approach aimed at proposing an operative protocol in the specific field of protection, conservation and valorisation of cultural heritage [2].

In this paper we report the in-depth analysis conducted on the “small-scaled plastic theatres” of the *San Lorenzo Oratory* in Palermo, which are emblematic evidence of Serpotta’s stucco workmanship and admirably combine geometry, art and architecture.¹

The architectural-compositional complexity of the object of the research and the interesting scenographic-spatial expedients utilised to create the micro-architectures of these incredible truncated pyramidal “boxes”, constituted the basis for this study (Figure 1).

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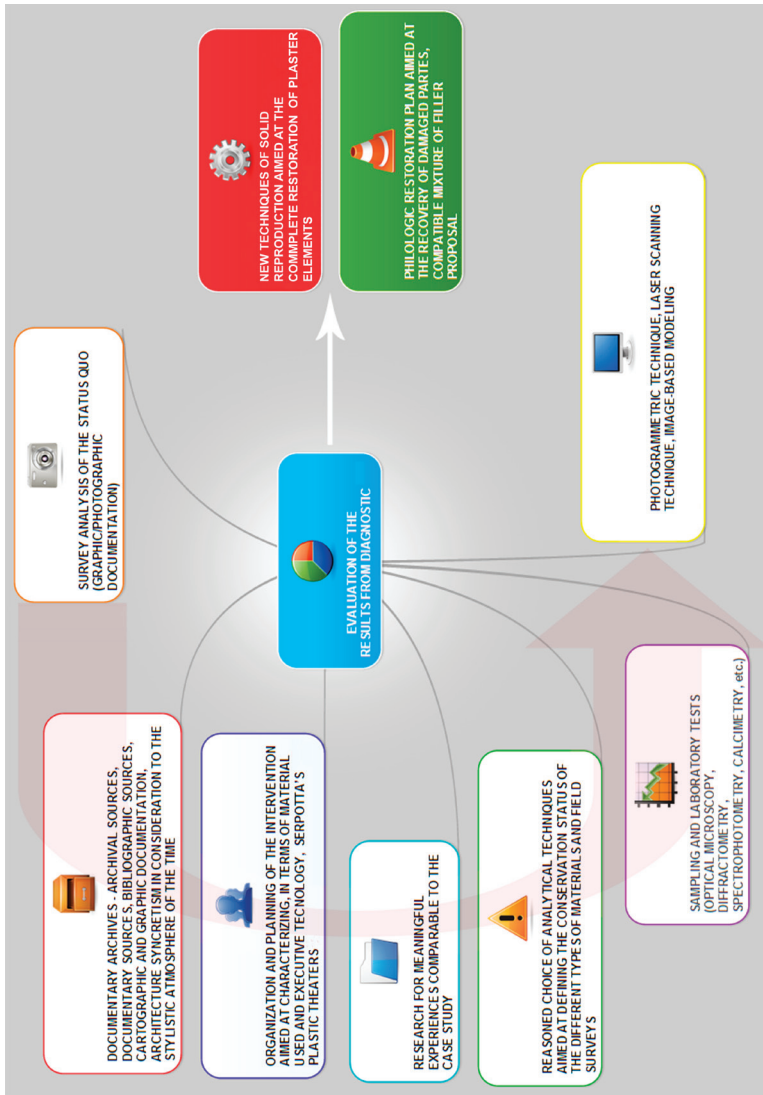


Figure 1. Methodological approach and proposal for an operative protocol in the specific field of Cultural Heritage protection, conservation and valorisation. The “small-scaled plastic theatres” of the sculptor Giacomo Serpotta.

For more than 70 years, the Serpotta family represented the best of stucco art in Sicily between the 17th and 18th centuries. Although the progenitor was Gaspare Serpotta, his son Giacomo is recognized as the most refined and famous artist of the family. The activity of the school continued with Giacomo’s son, Procopio, and then with his son, Giovanni. However, Giacomo’s expressive refinement would remain unequaled.

Following the devastating and destructive events of the Second World War, many churches and oratories decorated with Serpotta stuccoes were heavily damaged; some restoration work was done, but they then fell into oblivion for decades. As a result, some

of the decorative elements fell into a state of deterioration that reached a point of almost no return.

Fortunately, at the end of the 20th century, the entire cycle of stuccoes received due attention; firstly, thanks to the impassioned interest of Donald Garstang and secondly, to the so called “Serpotta Project”, initiated in 1999 by the *Soprintendenza BB. CC.* (Monuments and Fine Arts Office) of Palermo which, in its first stages, dealt with the restoration of the decorative elements of ten monumental buildings [3].

The “Serpotta Project” represented a unique opportunity for systematically sampling the stuccoes and carrying out a comparative analysis of the results obtained from the physical chemical investigation, thus highlighting new elements in this extraordinary artistic heritage that until now had been studied above all from a historical and artistic point of view.

For some of the more seriously damaged works, a number of them with missing parts, it was possible to acquire first-hand knowledge. This was done by visually observing and photo-documenting the mass stratigraphy of the stucco, thus identifying the sequence of steps followed by the Serpottas in realising their sculptures and recognizing the materials used for reinforcement, such as wood, iron, or reed, chosen according to the features of the figurative work of art.

This enabled the stratigraphic succession of the Serpottas’ work in its entirety to be studied in depth, starting from the materials used for the framework and gradually going through the different layers of stucco used for the allegorical figures. These included angels and *putti* as well as the frames and refined decorative elements which were all first roughly drafted, then beautifully finished.

Identification of the wood species used for the supporting ribs was carried out and the stuccoes underwent mineralogical and petrographic analyses.

The obtained results contributed to defining a “material” interpretation of the Serpotta work, by providing insight into cases of uncertain attribution and crediting the artists with an undeniable though empirical, deep knowledge of the materials used. Characterization of the constitutive materials, moreover, provided the basis of the knowledge, essential in defining the right intervention of restoration.

Unfortunately however, conservation work cannot completely restore the original reading to those parts of the decorative features that have been stolen. The thieves’ attention focused on those elements which could easily be sold on the black market. For this reason, the missing elements that were removed were, for the most part, heads of *putti*, the musical instruments of the angel musicians and the figurines of the “small-scaled plastic theatres”, as in the case of the *San Lorenzo Oratory* (Figure 2).



Figure 2. *San Lorenzo Oratory, Palermo. Side and background walls from the altar.*

2. Material composition of the stuccoes: stratigraphic succession

What is generically called stucco, when referring to the Serpotta works of art is, in reality, a material with a variable composition and is not at all random. It is astonishing to observe the ability of the Serpottas in adapting the characteristics of their mixtures to the different phases of their work.

For large works they used a wooden structure around which a first volume was drafted, we will call it Layer C. Its main quality was that it had to harden quickly to prevent it from sliding downwards under the effect of gravity.

For this reason, Layer C consisted mainly of gypsum, identified both in the binder matrix and in the aggregates and secondarily of calcite and other minor minerals that are occasionally present.

The shape of the work was then modeled by overlaying a less consistent second layer, Layer B, measuring from a few millimeters to several centimeters in thickness, of a mixture that had to give the artist time to refine all the parts of the figure and for this reason both lime and gypsum were used as binders.

The mineralogical petrographic analysis of Layer B evidences calcite as the main phase, associated with quartz and, at times, with a variety of other secondary mineralogical phases.

Finally, a white mortar a few millimeters thick was applied, Layer A, a finishing stratum that constituted a sort of "skin" to which the figurative expressiveness was entrusted. It is made of a magnesium-rich lime as binder, with marble powder as aggregate, so that after hardening, it consisted of calcite, as a main phase and magnesite.

Some examples of the stratigraphic succession are shown in Figure 3.



Figure 3. The wooden reinforcement and the succession of different layers of stucco in damaged statues from the S. Mercurio Oratory (A) and the Stigmata Monastery (B). Technical file for electronic storage of the results of the mineralogical petrographic analysis.

During the "Serpotta Project" more than 150 thin or polished cross sections were prepared, observed and analyzed. Furthermore, the following physical chemical analyses

were performed: optical microscopy in both reflected and transmitted light, X Ray diffractometry, simultaneous thermal analysis, ionic chromatography, gas chromatography.

The results are collected in the form of tables and technical files, as shown in Figure 3. An evident evolution in Giacomo Serpotta's artistic production can be observed both in his artistic expression and his choice of materials.

In later works of art, such as in the *San Lorenzo Oratory* (1699-1707), there is just one layer of body adherent to the wooden structure, whereas the finishing Layer A, again made using a magnesium-rich lime as binder, is slightly different in both the amount and the particle size distribution of the marble dust, as reported in Figure 4.

Due to the small size of the figures in the so called "small-scaled plastic theatres", the frame is made of a thin iron rod, wrapped in hemp fibers or strings.

The same iron reinforcement is used for the thin parts of the statues, such as the fingers, and for some protruding decorative elements, such as the acanthus leaves (see Figure 4).

This coating, used also for the wooden frames, as already shown in Figure 3, is extremely effective in making the stucco work more durable, as the hemp not only prevents direct contact of the iron or wood with the plaster, but also acts as a soft joint which is effective in compensating the differential expansion of the different materials caused by changes in temperature and humidity.

This is only one example of the technical skill of the Serpotta School, definitely surprising when compared to their opportunities for technical education and training [4-5-6].

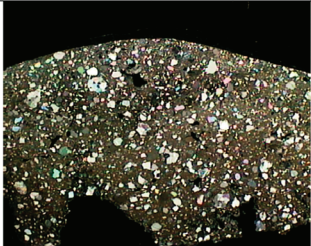
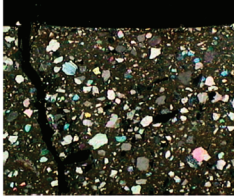
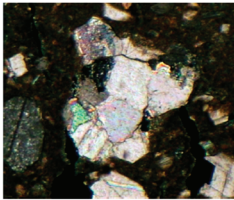
  	Sample SL 03 : shred of stucco Thin section in transmitted light, 7x	
	LOCATION	(SAN LORENZO ORATORY)
	STRATUM	A
	AUTHOR	Giacomo Serpotta
COMMENTS		
<p>-Carbonatic binder with cryptocrystalline texture; -Aggregates: marble powder with both mono- and polycrystalline grains, bimodal size distribution: medium grains 0.15 - 0.25mm, small grains 0.05-0.07mm; -Scattered porosity (<10%), average pore diameter 0.06 mm, cracks due to shrinkage.</p> <p>N.B. In this sample, as well as in SL06, SL07, SL09 samples, higher proportion of aggregates to binder matrix is observed with respect to early works, such as S. Mercurio.</p> <p>fig. A th.sect. SL03 16x N+ fig. B th. sect. SL03 90x N+: Detail of a marble grain, with its typical mosaic structure, diameter 500 μ (Maximum Grain Size 200 μ), shrinkage cracks ending at the grain surface</p>		

Figure 4. Iron rod, wrapped in hemp, as reinforcement of a missing figure in a "small-scaled plastic theatre" of the *San Lorenzo Oratory* (A) and of the finger of a statue from the *Stigmata Monastery*.

3. Stucco form: case study of the little Serpotta theatre “St. Francis in the act of clothing a poor man”

In 1600, in Palermo, religious orders and “*Companies*” used to build small outbuildings adjoining their churches as places of worship where they could perform spiritual exercises, sermons and other religious activities.

These small rooms, known as “oratories”, were initially conceived with very simple ornamental apparatus and composed of one single-aisle chamber illuminated by big rectangular windows, without chapels and with an arch between the chamber and the chancel, this last being generally square and covered by a small dome.

The baroque style and the competitiveness among Palermo “*Companies*” in adorning their oratories contributed to transforming and reviving these places through rich and luxurious decorations which conformed to the standards of that time.

The simple architectural framework of the pilaster strips, the window frames, the ledges, the bases, are wonderfully embellished and enlivened by complex decorative compositions constituted by plasters representing allegorical statues, little angels, garlands, festoons [7].

The figure of Giacomo Serpotta fitted well into this lively cultural atmosphere. The sculptor, with his brilliant flair and ability in the art of stucco, modelled and moulded sculptures that are quite unique.

Among the many city oratories, the *San Lorenzo Oratory* is certainly one of the most interesting, due to the coexistence of extraordinary works of art. The oratory was built by the “*Compagnia*” of St. Francis of Bardigli and Cordiglieri on the site of a church dedicated to St. Lawrence, given to the brothers in 1569.²

The compositional cycle covers the chamber walls completely, alternating allegorical female figures of the *Virtues* with small original perspective plastic theatres, and tells the story of the life of St. Lawrence (on the right wall from the entrance) and of St. Francis (on the left wall from the entrance). The vast repertoire of images and depictions on the walls must certainly have inspired awe and wonder in the visitor [8].

Our interest focuses on the sculptor’s meticulous realisation of the eight perspective scenes in the little magical boxes which reveal his deep knowledge of the geometrical laws governing vision and the perception of perspective.

These frames, placed at a height of almost 4.50 metres from the floor, contain some low relief hagiographic scenes of the two saints with figures in the round animating the “small-scaled plastic theatres”, and appearing out of proportion compared with the large-sized allegorical figures arranged around the edges.

As repeatedly highlighted by scholars [9-10-11], Serpotta succeeds in moulding an innovative and spontaneous scenographic space, relating natural and architectural elements with human figures in the round, which do not always respect perspective accuracy (undoubtedly differing in this aspect from illustrious predecessors like Gagini and Brunelleschi).

In this study, we report on our experience relating to one of the eight little Serpotta theatres, focusing in particular on the scene of “St. Francis in the act of clothing a poor man” (Figure 5).

The process of knowledge acquisition through the integration of different survey methods was performed on the sampled little theatre as an experimental test in order to structure an operative protocol to be extended to the study of all the oratory theatres.



Figure 5. San Lorenzo Oratory, Palermo. "St. Francis in the act of clothing a poor man". Giacomo Serpotta. Picture taken before the theft of the St. Francis statue, placed at the bottom right corner. A recent picture after restoration work, evidencing the theft of the St. Francis statue.

4. Integrated survey techniques

The partial results obtained constitute the continuation of a survey performed in the 80s by a team from the former Design Institute of the University of Palermo, with traditional analog stereophotogrammetric shooting and restitution techniques. The recent data acquisition and processing conducted by means of non-invasive techniques of image-based technologies (photogrammetry and photomodeling) and reverse engineering (3D scanning) took place without direct contact with the object, through the mediation of optical, mechanical and *ICT* tools, providing a representation of the object in the form of a three-dimensional model [12-13].³

The use of the tools employed in these three-dimensional metric measurement techniques, proved to be suitable for the geometrical characteristics of the object under examination, offering remarkable productivity and high precision standards compared to equipment of the past [14].

By using minimal non-invasive interventions, the survey was able to maintain the integrity and authenticity of the historical-artistic heritage, highlighting the undeniable benefits of the digital process in terms of reliability and management, in addition to creating a data bank which is consultable and implementable in view of its future conservation and transmission.

4.1 The photogrammetric survey of the 80s and photo-modeling process

As stated in the previous paragraph, in the preliminary phase we availed ourselves of a previous stereophotogrammetric survey conducted in the 1980s by a team from the former Design Institute of the University of Palermo. The shots were taken using a Wild C40 with a shooting base of 400 mm and a 1:5 scale restitution of the stereoscopic model, according to the grapho-numerical representation method with contour lines, through a Wild A40 analog restitutor (Figure 6) [15].

The non-invasive technique, which at that time was efficient and state-of-the-art, allowed only two of the little plastic theatres of the San Lorenzo Oratory to be inspected, due to the overheads of the whole process and the difficulty in accessing the premises.

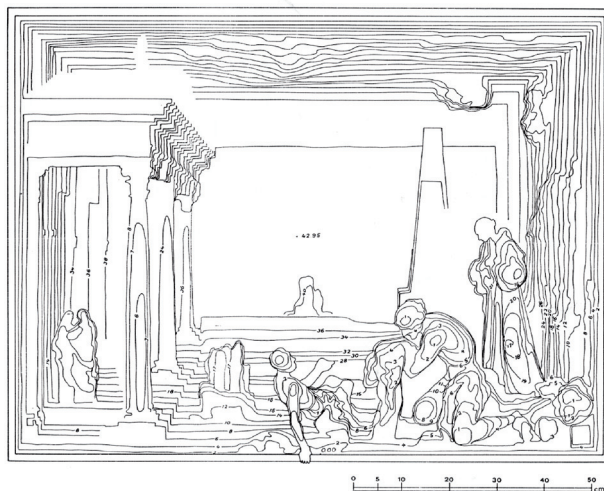


Figure 6. San Lorenzo Oratory, Palermo; "St. Francis in the act of clothing a poor man". Giacomo Serpotta. Photogrammetric restitution with contour lines. Original scale 1:5 (D'Alessandro, Pizzurro, 1989).

The restoration work of 2003, facilitated access to the oratory and made moving around in the spaces of the chamber during the acquisition phase much easier. This has allowed us to extend the practical photographic shooting to the whole ornamental decoration of the oratory and to collect a considerable amount of data (geometry and texture), encoded into high resolution images, and which will be useful for the graphic restitution of the 3D models, their analysis and digital use.

In the initial study phase, we decided to elaborate a first three-dimensional reference model with the assistance of photo-modelling, an innovative rapid digital technology which allows the creation of a three-dimensional point cloud. The processed data were integrated and implemented in the second acquisition phase with a 3D scanning technique.

Once the shooting project was designed, the photographic data were acquired with a Nikon D3200 digital camera with a CMOS 24.2 megapixel image sensor and with a 6 megapixel minimum resolution and wide-angle lens. A rolling scaffold was used for the photogrammetric survey which enabled us to reach a height of 4.30 m, thus ensuring the correct shooting of the frames.

The open source software used for the restitution of the three-dimensional scenes is the popular Autodesk 123D Catch web service based on "image-based 3D modeling" algorithms for the reconstruction of three-dimensional scenes and the reproduction of digital models which are structured on the basis of the initial raster images.

Without going into the details of the procedural logic linked to technologies known in literature as Structure from Motion pipeline, the software automatically performs a correspondence among images, determines the camera calibration and finds the correspondences among the elements known from the projective geometry of the different representations [16-17-18].

Since the sculptural object of the research has a concave geometric shape, limited

metric dimensions and uniformity in the colour rendering, we expected results with formal imperfections and shadow cones which were partially corrected during the finishing operations and optimised by aligning complementary clouds.

The resulting 3D polygonal mesh, though suitable for an overall virtual visualisation of the sculptural apparatus, does not present a high level of accuracy and reliability with regard to the graphic representation scale of 1:1 and does not assure correctness of the measurement for the subsequent geometrical analyses (Figure 7).

Therefore, in a second learning phase, recourse to the 3D scanning technique was considered necessary to realise a highly informative model, as required by the survey project objectives.

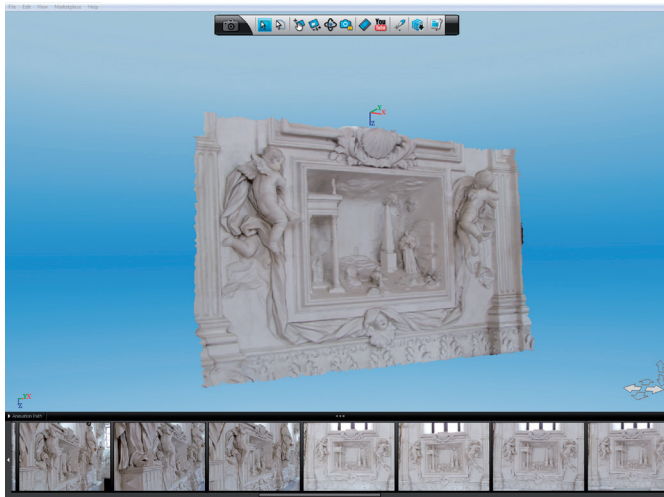


Figure 7. Screenshot of the well-known Autodesk web service 123D Catch software based on "image-based 3D modeling" algorithms. Perspective visualisation of the model of the little theatre of "St. Francis in the act of clothing a poor man", structured dataset of 26 images.

4.2 The 3D scanning technique

Among the new technologies currently proposed for application to cultural heritage, the use of 3D scanners represents a significant example of how originally very different fields, such as conservation, research and that of the advanced technologies industry, can find common ground, such as in the non-invasive experimental use of methodologies and innovative tools for analysis procedures of geometric-dimensional data, restoration and structural monitoring.

Deferring an in depth-analysis of the technique to a later date, we highlight that a variety of 3D scanners are available on the market, each with different characteristics in the principle of acquisition, achievable precision, and range and speed of acquisition.

For the survey project conducted in the oratory, we chose to use the 3D portable scanning system with an *Artec MH* structured light flash bulb (instrument supplied by the *Models Laboratory* of the Department of Civil Engineering - DICIV, of the University of Salerno).

Artec MH is a 3D scanner with a fairly simple scanning procedure, as it is sufficient to move around the object continuously and film it from various angles.⁴

The extremely versatile system (it does not need markers), functional, rapid and capable of acquiring almost 500,000 points per second, proved to be particularly suited to the geometric-dimensional features of the object (indeed the acronym "MH" indicates a "Medium" field of application, perfectly in line with the dimensions of the small-scaled plastic theatres) and the goals to reach in terms of metric precision.

By geo-referencing the acquired frames, the related proprietary software automatically joins them all in a single mesh (Figure 8).⁵

In this specific case, due to the particular shape of the object, immediately determining global alignment in one single swipe would have been difficult. Consequently, it was decided to implement a project involving a series of smaller acquisitions, of the order of a few tens of seconds, as shown in Figure 8.

Unlike the subsequent MHT model, the instrument used does not allow images to be captured, so the texturing took place during the post-processing.

Procedures for alignment, recording and texturing were carried out using the *Geomagic Studio* software. It is a reverse engineering programme that manages data from scans or photogrammetric 3D takes, deals with point clouds, generates mesh models, designs and exports CAD surfaces and automatically creates *NURBS* sections and/or surfaces for modelling.

In the little theatre model, exported in *.ply* format within the CAD modelling software *NURBS Rhinoceros*, the digital statue of St. Francis was placed in its original position (the modeling process of the statue is described later in paragraph 5).

The highly dense mesh (more than 7.7 million polygons) allows an integral reading of the perspective scene and an analysis of the scenographic sculptural composition as Serpotta conceived it.

5. The graphic-geometrical analysis

The plastic construction of the low-reliefs and the scenographic studies of Serpotta's volumetric compositions follow the geometric laws of solid homology. Homography is the process of transforming a parallelepiped prismatic space into a truncated pyramidal one by means of geometric processes of contraction. The practical purpose of this kind of perspective is to give the illusion of greater apparent depth to a given architectural environment [19].

By representing perspective in a vertical framework, the true shape and size of the walls and floor in a scene are realized in such a way as to perceive a depth greater than that which actually exists. By tilting the framework corresponding to the proscenium, the vertical and horizontal sections belonging to the planes that are perpendicular to the framework were obtained.

When the observer's viewing point overlaps with the centre of the homology, "(V)" in Figure 10, the prepared scenographic construction leads the spectator to perceive an illusory space which is different from the real one, with the effect of extending it (Figure 9).

As regards the sculptural setting of the scene, as repeatedly asserted by scholars, Serpotta does not rigidly respect the laws of scenographic solid perspective, adopting some expedients related, more often than not, to his brilliant flair. For example, the

figures and the architectural and naturalistic elements become gradually smaller while moving back towards the background and the straight classical architectural elements do not all vanish at one single point.

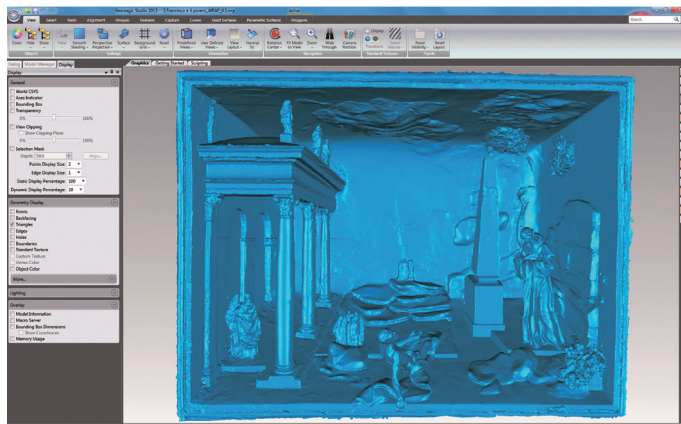
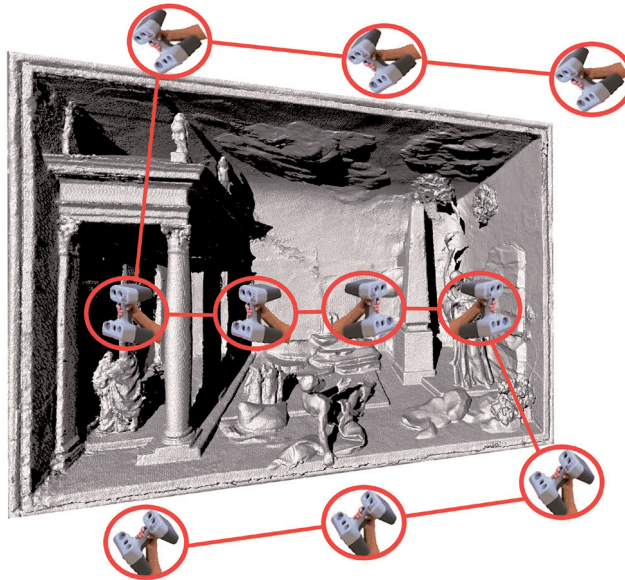


Figure 8. "St. Francis in the act of clothing a poor man". View in perspective of the polygon mesh model processed from data acquisition with 3D scanning technique. Interface of the post-processing software, Geomagic Studio.

6. The organic modeling process of the statue of St. Francis

One of the predetermined goals is to fully reconfigure the perception of perspective in the little theatres by reproducing the missing sculptures virtually.

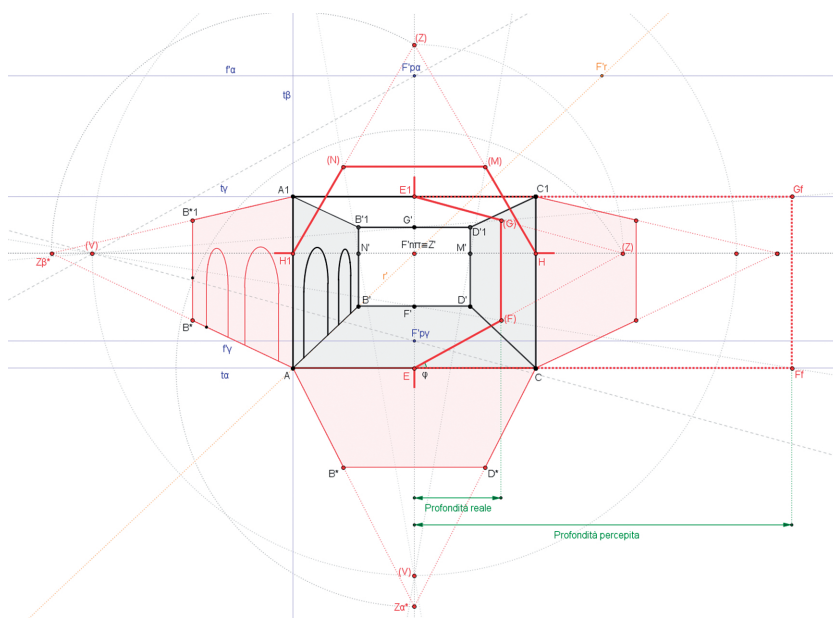


Figure 9. Study of the real shape and size of the floor and walls in a scene of the “small-scaled plastic theatres”, in the scenographic sculpture of Giacomo Serpotta.

Here we present the first results of the virtual restoration performed on one sample of the small scenes, “St. Francis in the act of clothing a poor man”, in which the statue of the saint is currently absent. As already underlined in the previous paragraphs, the scientific methodological process of reproducing the sculpture was made possible thanks to the finding of graphic-numerical restitutions processed during a previous stereo-photogrammetric survey conducted before the theft of the statue.

The 1:5 scale tables produced in the 80s represented by means of contour lines, and the historical photographs found by one of the few photographers allowed to enter the oratory, show the complexity of the organic form of the statue.

Unfortunately, the indirect sources and the scaled drawings report the volumetric-spatial information of the statue in the round, but are not exhaustive, as they only show the visible part and its outline. However, it is the only reliable scientific evidence of the complete scenographic apparatus (Figure 10).

In the field of *Computer Graphics*, the interactive digital sculpture techniques of numerical models represent the state of the art software in the field of the organic modelling of complex freeform surfaces.

Implementation of the tools allows the user to interactively paint or sculpt 3D models, enriching their geometric and surface details, demonstrating potential in terms of quality, precision and speed in preparing graphic documents, and versatility in terms of managing and controlling space.

The panorama is so rich and varied as to often generate difficulties in choosing more specific software according to personal needs, and due to the fact it requires a high level of applied knowledge.⁶

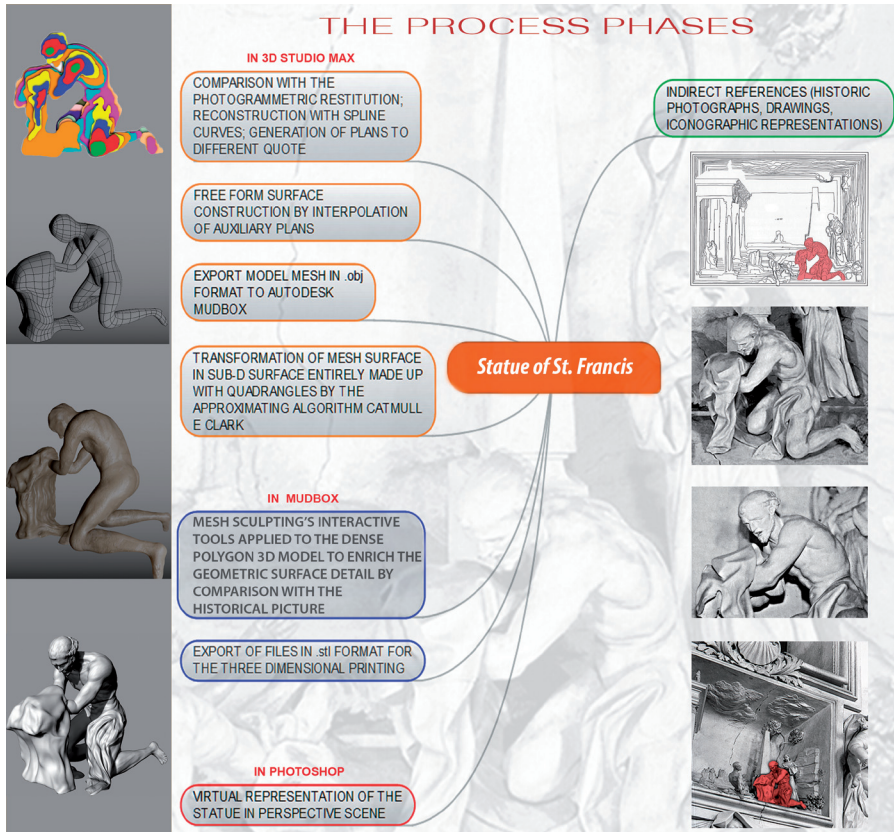


Figure 10. Synoptic table of the organic modelling process for the St. Francis statue, based on a previous stereo-photogrammetric survey from the end of the 80s.

7. Conclusions and future in-depth analyses

The investigative survey, divided into different in-depth study phases, aims to test an operative protocol which will allow some important aspects of the admirable examples analysed to be read, interpreted and validated.

The study examines the state of conservation of the material, the geometric-spatial shape and the constructive genesis of the scenographic structure of the “small-scaled plastic theatres”, highlighting the particular way the sculptor constructed the spaces creating effects of perceptual illusion.

This paper explains the procedural scientific path applied to one sample of a small-scaled theatre, but it is expected that the methodology be applied to the whole sculptural heritage of the *San Lorenzo Oratory*.

The restoration surveys and digital survey instrumental technologies have provided the basis for an archival database, rich in info-graphic information, which will be useful for future in-depth targeted analyses.

The three-dimensional models created and represented in virtual reality through VRML language (Virtual Reality Modeling Language), are interactively and immersively explorable (Figure 11).

From the 90s to the present day it was found that eleven statues from among the sculptures populating the “small-scaled plastic theatres”, no longer existed, making the reading and interpretation of the sculptural scenes from the lives of St. Francis and St. Lawrence difficult and at times illegible.

Among future research goals, we plan to integrate the collected digital information with *Augmented Reality (AR)* technological systems. *AR* is the set of technologies which allow a real scene to be “augmented” [20].

It is a new *ICT* discipline at an experimental stage belonging to “computer graphics”, involving the superimposition of digital contents on the observed real world.⁷

The development of an application dedicated to Serpotta’s stuccoes, usable through the latest generation mobile devices (smartphones, android devices, iPads, iPods) will allow the visitor to access additional contents in the form of videos or 3D models, and to visualise the virtual models of the statues introduced into real scenes, in perspective.

The “augmented” vision will enrich the guided visit with undeniable cultural benefits, enhancing the perception of the works of art with multimedia contents, pictures and historical information, related itineraries, organised routes, educational information about the works of art and execution processes, stucco preparation and composition, restoration and consolidation work, diagnostic investigations of the decay and conservation of the surfaces [21].

All this in a non-invasive way, thus helping to preserve the state of conservation of the building for future generations.



Figure 11. “St. Francis in the act of clothing a poor man”. View in perspective of the three-dimensional model, with a hypothesis of introducing the model of the stolen statue of St. Francis in its original position.

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Notes

¹ This work presents the first results of a wider study, which is included within a National Research Project, (PRIN 2010-2011) entitled "Architectural Perspective: digital preservation, content access and analytics". The Palermo unit is testing some instrumental hardware/software methods in order to develop a path of investigation aimed at observing, building, elaborating, managing and visualising three-dimensional models of important architectural examples of solid perspective in Giacomo Serpotta's scenographic sculpture.

² The church chamber is rich in works of art: Serpotta's stuccoes, the beautiful marble floor created in 1716 by the marble-workers Francesco Camalino and Alojsio Mira, the precious early 18th century wooden stall, inlaid with ivory and mother of pearl. Unfortunately, the vault fresco of the Martyrdom of St. Lawrence painted by Giacinto and Domenico Calandrucci between 1706 and 1708, was destroyed in the earthquake of 1823 and Caravaggio's famous painting of the Nativity and the Adoration of the Shepherds with St. Lawrence and St. Francis (1609) was stolen in 1969, and are therefore missing. The complex cycle of stucco sculptures, created by Giacomo Serpotta (1656-1732) at the height of his technical and inventive maturity (it was executed approximately in the period between 1699 and 1706, and was partly based on the project by the architect, Giacomo Amato), underwent restoration work in 2003.

³ In the last decade of the 20th century, with the development of new instrumentation, the development of dedicated software came about, enabling computer acquisition and the elaboration of 3D models with triangulated surface meshes or NURBS (3D imaging) with the inspection and analysis of the latter, aimed at the creation of digital archives, the reconstruction of complex scenarios of virtual realities (especially in the field of archaeology), and the realisation of copies through prototyping techniques.

⁴ Although the technical characteristics describe an alleged non-influence of the camera angle, it is easy to observe how rays, which are perpendicularly incident and/or not tangent, guarantee greater final accuracy (however, working with surfaces that do not reflect).

⁵ The algorithm, in fact, recognises the geometry of the object and, if the shape is "plastic" enough, as in the case in question, it allows the correct alignment of the various captured 3D frames to visualise them in a single model (therefore conserving the reference system), eliminating as much as possible the presence of holes and shadows due to back drafts.

⁶ Some of the most popular in the field of digital 3D sculpture include, the open source software *Sculptris* and the paid software *ZBrush* and *MudBox*. This panorama offers different solutions of CAD platforms with interfaces which maximise effectiveness and flexibility of the work stream.

⁷ It combines new ICT and new forms of communication, showing an incremented reality representation in which, artificial/virtual and sensorial information is superimposed on normal visualisation perceived through our senses.

⁸ <http://davidedilorenzo7.wix.com/davidedilorenzo>.

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