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Conservation, Restoration, and Analysis of Architectural and Archaeological Heritage

Carlo Inglese and Alfonso Ippolito

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Table of Contents

Chapter 7
Ephemeral Architecture and Painted Architecture:
The Reconstruction of Baroque Illusory Space

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ABSTRACT

The object of this study is a group of architectural perspectives painted on the domes and walls of noble palaces in Apulia, in particular that the baronial palace in Botrugno, the Broquier palace in Trani, and the Manes palace in Bisceglie. The perspectives belong to the "Quadratura" genre that developed in Italy and Europe in the Baroque period, but the architectural solutions represented are specific of the Apulian regional context, of Neapolitan derivation, rather than linked to the noble models of the Emilian and Roman master experiences. These architectural perspectives can be considered belonging to that "immaterial cultural heritage," as defined by the UNESCO Convention for the Protection of the Intangible Cultural Heritage of 2003, if we consider the cultural significance of these painting representations—as previously mentioned—for their relationship with the 16th-17th century painting season of "Quadratura," for the massive production of treatises on perspective, as well as for the Baroque experiences and for the tradition in the use of "Festa" ephemeral architectures.

INTRODUCTION

The architectural perspectives that in the baroque period were painted on the domes and walls of noble palaces in Apulia - in the South of Italy - can be put as limit between the concepts of "tangible" and "intangible" cultural heritage. These painting representations - pertaining to the tangible cultural heritage - belong to the genre called "*Quadratura*", which spreads in Italy and Europe mainly between the

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sixteenth and 18th centuries. Painted on large walls and domes of civil and religious buildings, "*Quadratura*" paintings are representations of an illusory architecture that dilate the real/physical room space into an illusive and "virtual" space. The perspective painters of the 15th century are the genre forerunners. However the "*Quadratura*" painters of successive centuries made an extensive use of perspective to decorate rooms in order to create spectacular inexistent spaces. To implement the prospective images they refer to the Renaissance treatises and also to the Father's Andrea Pozzo studies in the 17th century.

In the Baroque culture the search for surprising and wondering effects is realized in city squares and streets space with the "*Festa*" arrangements composed by ephemeral and scenic architectures, which involved directly the common spectator sensorially and emotionally.

The "gallery" becomes the place of "*Mirabilia*" for a rich or cultured elite where the "*Quadratura*" painters work, creating a "material" spectacle on vaults or ceilings.

In Apulia, in southern Italy, "*Quadratura*" spreads in 18th century with results that both appear not very refined from the technical point of view and for their formal and painting aspects (Castagnolo, 2016, pp. 149-162), if compared with the national and the European production. However, some today known examples are to be considered significant for the symbolic value they acquire, since they are placed both in the halls of noble palaces and for the artistic relationship with the Neapolitan and Florentine schools. Moreover they are inserted in the Baroque cultural context with articulated architectures in complex volumes and marked by a large profusion of decorative themes.

These are the "*Quadratura*" paintings in the Broquier and Manes palaces in Bari territory and that Botrugno Baronial palace, in Salento. Though they do not reach the figurative results of Emilian or Roman masters - let us think about Mitelli and Colonna, Bibiena (Galli Bibiena, 1711) and the Father Pozzo himself (Pozzo, 1693) - these architectural perspectives can be considered belonging to that "immaterial cultural heritage", as defined by the UNESCO Convention for the Protection of the Intangible Cultural Heritage of 2003. In fact, they include "practices, representations, expressions, knowledge, skills that communities, groups and, in some cases, individuals recognize as part of their cultural heritage" (Tucci, 2013, pp. 183-189).

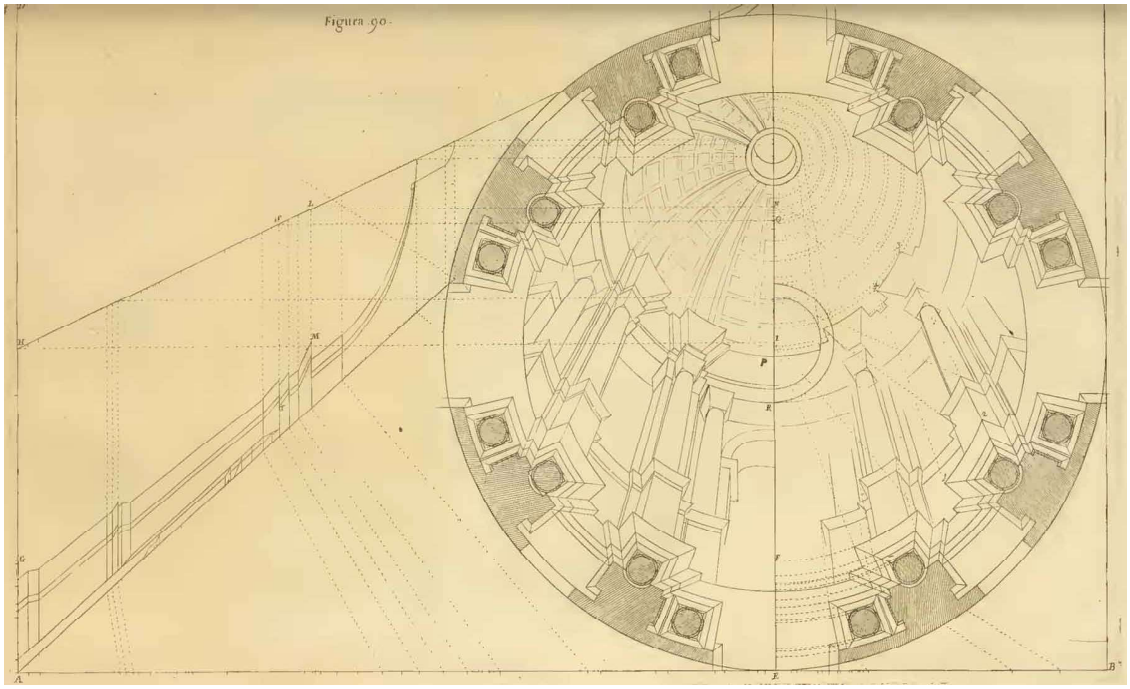
This definition can be accepted if we consider the cultural significance of these painting representations - as previously mentioned - for their relationship with the 16th-17th century painting season of "*Quadratura*" in Europe, for the massive production of treatises on perspective, as well as for the Baroque experiences and for the tradition in the use of "*Festa*" ephemeral architectures in Salento. The architectural perspectives in the noble palace domes in Apulia represent an upwards dilation obtained through the extension of the walls and the repetition of plan roofs at different heights, standing on arches and topped by domes and semi-domes. These are multiple architectures, absolute representation protagonists where human figures are absent. Illusory architectures are bold and often unrealizable; in their language they allude to other painting or scenographic models rather than to real architectures, because of their unlikely structural solutions. Not only the representation of spaces contiguous with the real ones is pursued, but also a surprisingly rich space effect is searched just to emphasize client economic and cultural power.

This study starts with the survey of illusory architectures in the three already mentioned "*gallerie*", carried out the celerimetric support and using the photo-modeling technique.

Final aim is to reconstruct, through the perspective restitution, architectural spaces and to find the halls morphology by covering that, in the drawings, - rather than the true vaults - with roofs and domes represented in the painted ceilings.

With this paper it is intended to contribute to improve, from a different point of view, the studies on the Apulian "*Quadratura*" paintings.

Figure 1. Image entitled "Cupola in prospettiva di sotto in su" from the treatise "Prospettiva de' pittori e architetti" by Andrea Pozzo (Pozzo, 1693, fig. 90).



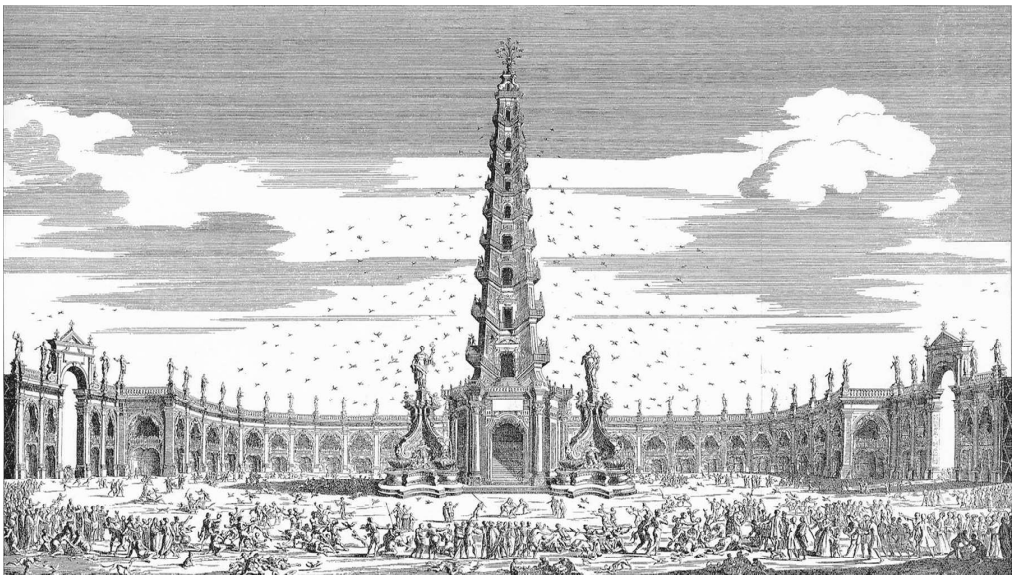
ILLUSORY ARCHITECTURES BETWEEN THE EPHEMERALITY/ STABILITY AND THE MATERIALITY/ IMMATERIALITY

Search for astonishment, wonder and surprise through exaggeration, grandiose, impressive and stunning - typical of the Baroque culture - finds its concretization in a "*Festa*" ephemeral array. These material structures are built to have an extremely limited duration - just the time of the "*Festa*"- and to be immediately dismantled, to be handed down in some rare views of the event or to remain in the memory as testimonies of a collective immaterial past culture.

Squares and streets are the "*Festa*" places. This ephemeral and scenic arrangements are supported by lights and sounds games, dances and theatrical performance, and they conclude with spectacular pyrotechnic effects. In the "*Festa*" the common spectator is directly involved sensorially and emotionally.

To the realization of these arrangements famous architects such as Gian Lorenzo Bernini, Pietro da Cortona, Carlo Fontana in Rome, Cosimo Fanzago, Ferdinando Sanfelice in Naples participated. They made these models a real scale experimentation for future architectures that became material and stable over time. By quoting Maurizio Fagiolo dell'Arco (1997) "*si può arrivare a dire che la festa è addirittura un raffinato diaframma (elaborato ad arte) che permette di vedere in nuova luce lo stesso corpo della città e che per la città progetta (non sempre in modo utopico) nuove forme e luoghi*" (p. 13) and "*lascia tracce permanenti nello spazio della città*" (p. 13), which later become tangible and stable heritage in the architectures and urban furnishing.

Figure 2. Engraving by A. Baldi representing the "Largo di Palazzo Reale" in Naples on the occasion of the "Festa" for the royal Infanta Maria Elisabetta birth in 1740. Exhibition is by Ferdinando Sanfelice (Mancini, 1968).



If streets and squares are places where Baroque architects experiment with ephemeral arrays future architectures, instead gallery is an exclusive place for a cultured elite in which "perspective" or "ornamentists"[1] painters work in the search for the Baroque culture "*Mirabilia*".

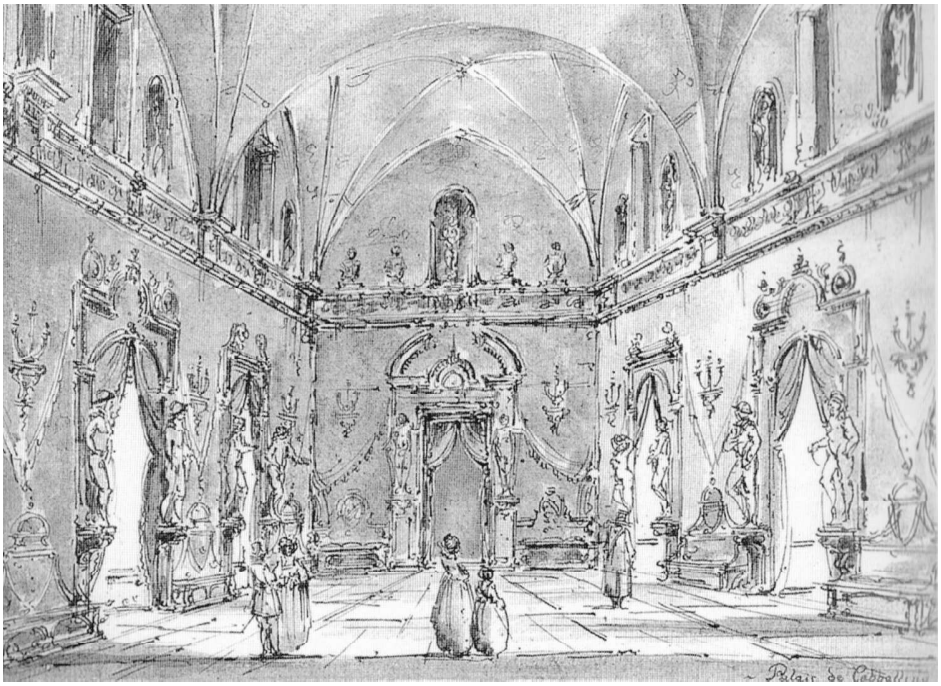
The "*galleria*", a French-speaking neologism, is described by Scamozzi (1615) at the beginning of the 17th century in the "*Idea dell'Architettura Universale* ": "*Hoggidì si usano molto a Roma e a Genova e in altre città d'Italia quel genere di fabbriche che si dicono Gallerie porsi per essere state introdotte prima nella Gallia o Francia*" (p. 305), in these rooms they collected "*raccolte, e studij d'Anticagli di Marmi, e Bronzi, e Medaglie, e altri bassi rilievi, e parimente di Pitture de'più celebri, e diligenti maestri, che siano stati sino all'età nostra*" (p. 305). This gallery description changes the "hall" or the "large hall" in the previous centuries military structures as a representation and celebration place of family glories. It is thus transformed from a work of art collection and exhibition place in an eclectic collecting aristocrat's place to arise wonder with rare, monstrous, marvelous and exotic quotations coming from the plant and animal world (Cazzato, 2010, pp. 268-280).

At the "*galerie*" word in the *Dictionnaire historique d'architecture*, Quatremere de Quincy (1832) describes an image of this representative space of the aristocratic house corresponding to what it might have in the 18th century Baroque models.

In this "*galerie*" "*l'architecte y éprouve beaucoup moins de sujétions qu'ailleurs et y déploie librement ses ressources"* (p. 655) and he can decorate it *"soit en colonnes, soit en pilastres, comme la galerie du palais Colonna à Rome et celle de Versailles; ou ornée de niches et de compartimens de marbre, comme celle du palais Farnèse ou de la villa Albani"* (p. 655).

The dictionary author dedicates an articulate reflection on the painting and architecture role have in the gallery: *"Malgré les ècarts où le gènie décoratif de la peinture a pu faire quelquefois tomber*

Figure 3. Jean Louis Desprez "Palais de Cabballino. Interieur" (de Saint-Non, 1786).



l'architecture dans l'ornament des galeries, on ne sauroit trop désirer que l'union des deux arts se renouvelle en ce genre, et fasse rentrer la painture dans une de ses plus nobles carrières" (pp. 655). That is to take again paintings and architectures to harmony and right agreement of spaces and measures, demonstrating that the *"deux arts peuvent s'associer dans cette sorte de composition sans se combattre, et unir leurs ressource sans compromettre leurs interèts"* (p. 655).

Then Quatremere de Quincy (p. 655) then concludes the dictionary word distinguishing between the painted gallery and the gallery of paintings. In the first one painted subjects are all the same with the general composition - as the "*Quadratura*" paintings - in the second, paintings are an accessory and removable element.

In the 18th century, gallery - in particular its vaulted or suspended ceiling - became the diffusion place of the great Neapolitan decorative season themes in southern Italy (Rago, 2010, pp. 97-102). The happy combination of architecture and painting, desired by Quatremere de Quincy (1832, p. 655), can be found in the historical documents where a division of work between "figure painters" and "ornament painters" is written. This paradigmatic subdivision separates the architectural from decorations ornaments (Rago, 2010, p. 97).

The surprise effect of the Baroque culture carried out in the streets and squares with ephemeral architectures is resolved in the gallery with the illusory spaces dilation: in fact masonry surfaces and roofs are used as theatrical scenes. A relationship do exist between those dealing with architectural decorations and who is involved in theatrical scenes and between the respective works. In 1731 the San Carlo theater in Naples was founded; for its scenographies artists work who are also involved in the creation of architectural perspectives for the aristocratic galleries (Rago, 2010, p. 97).

Disproportioned architectural cornices, corbel and pillar systems, arches and bowl-shaped vaults, fastigium and balustrades propose an illusory spatial circularity contrasting with the cubic gallery volume. The best solutions are those having effect to the real space architectural configuration, modifying it illusory and overcoming the planimetric and altimetric spatial dimension limits (Rago, 2010, p. 98).

The use of bright colors underlines the illusory architecture multiple levels; the upper lighter shades suggest an ever greater airiness, helping to expand further the space, often ending with a central breakthrough.

With these artifices, the gallery creates a "material" spectacle on vaults and ceilings, involving the spectator with illusory and intangible architectures and spaces. This peculiar relationship between the tangibility and the intangibility marks the baroque research of wonder and amazement. If in the city ephemeral architectures become stable, in the "gallery", on the contrary, the architectural perspectives become illusory architectures.

At the beginning of the 18th century the analogy of themes, of stylistic and cultural solutions, of techniques and construction methods marks more painters generation and allows to speak of a Campania region "*Quadratura*" painting as a proper school spreading in the southern territories in strict dependence from the Parthenopean capital cultural heritage (Rago, 2010, p. 101).

THE STUDIES

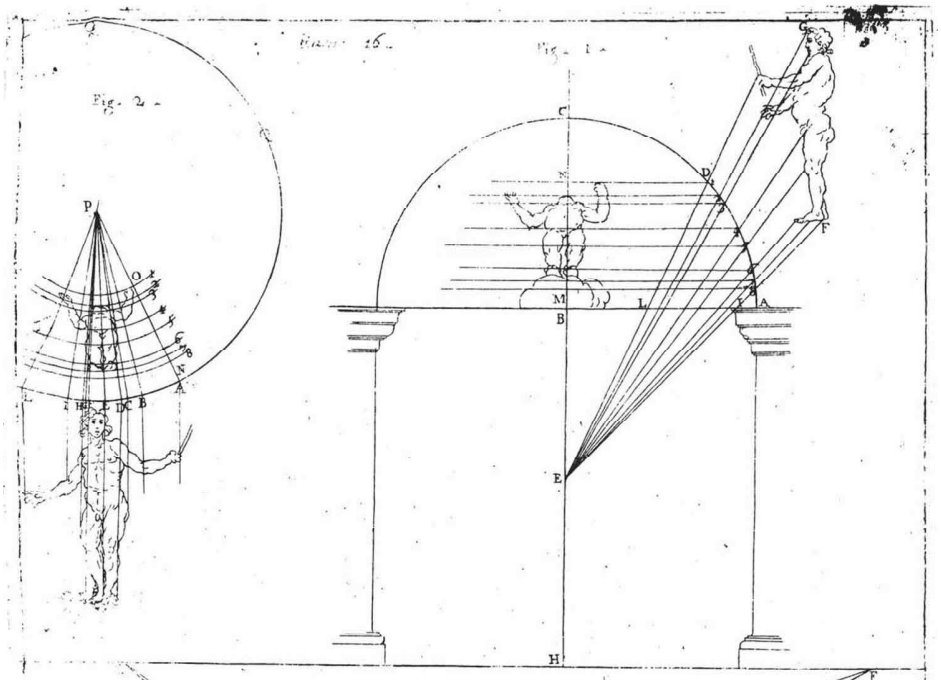
The architectural representations framed in the artistic literature with the term "Q*uadratura*" have been analyzed for years "from the outside" by the history of art, philosophy and science disciplines. Only in recent years they have been investigated with an approach that can be defined "from the inside"[2], because they are studied by the representation tools and methods, which have brought out new and significant aspects.

In fact, a great impulse to studies was due to the PRIN 2010 National Research Project "*Architectural Perspectives, digital preservation, content access and analytics*". The research was coordinated by Riccardo Migliari and involved representation scholars, at national and international level. The results are collected by Graziano Mario Valenti Ed. in two volumes, whose title re-proposes that of PRIN research "*Prospettive architettoniche: conservazione digitale, divulgazione e studio"*, published in 2014 and 2016 (Valenti 2014, Valenti 2016), and in the volume explicitly entitled "*Le teorie, le tecniche, i repertori figurativi nella prospettiva d'architettura tra il '400 e il '700. Dall'acquisizione alla lettura del dato"*, published in 2015 and edited by Maria Teresa Bartoli and Monica Lusoli (Bartoli, & Lusoli, 2015).

The proceedings of the conference "*Realtà e illusione nell'architettura dipinta. Quadraturismo e grande decorazione nella pittura di età barocca"*, edited by Fauzia Ferneti and Deanna Lenzi, held in Lucca in 2005, (Farneti, Lenzi, 2005) are added to the above studies, the more recent volume edited by Fauzia Ferneti e Stefano Bertocci "*Prospettiva, luce e colore nell'illusionismo architettonico. Quadraturismo e grande decorazione nella pittura di età barocca*", published in Florence in 2015 (Bertocci, & Farneti, 2005). In these volumes the studies on "*Quadratura*" genre, defined according to the method "from the outside" and "from the inside", seem to find a point of encounter and dialogue between the vision of the art historians and that of the representation scholars.

In the Apulian area, the studies on "*Quadratura*" paintings are due to the various contributions of Mimma Pasculli Ferrara, amongst which the essays "*Quadraturismo e grande decorazione nella pittura di età barocca in Puglia*" (Pasculli Ferrara, 2006, pp. 345-358) and *"Paolo de Matteis e la grande*

Figure 4. Image intitled "Per porre in prospettiva figure nelle volte, soffitte, cuppole, Ec." from the treatise "L'architettura civile preparata su la geometria, e ridotta alle prospettive. Considerazione pratiche" by Ferdinando Galli Bibbiena (Galli Bibiena, 1711, p. 120).



decorazione barocca in Puglia" (Pasculli Ferrara, 2008, pp. 96-116). The studies conducted by Isabella Di Liddo provide a large series of the apulian phenomenon framing it within the national panorama in the volume *"L'arte della "Quadratura". Grandi decorazioni barocche in Puglia"*, published in Fasano in 2010 (Di Liddo, 2010).

THE "QUADRATURA" GENRE IN APULIA

The perspective painters of the 15th century are precursors of "*Quadratura*" genre, although the its greatest diffusion period lies between the 16th and the 18th centuries. In this period this kind of painting gene was widely used because it is linked to the Baroque research of the surprise effect, of the unexpected and of the wonder in relationship to the stylistic themes that characterized it, that is the sense of the painterly, of the grandiose and of the impressive and massive (Wolfflin, 2010, pp. 33-66). The realization of reckless tromp-l'oeil perspectives (Abbate, 2002, pp. 227) of illusory and fantastic architectures gives rise to representations in which that sense of the "painterly", that the arts of the Baroque period transmit, may be found. Wolfflin (1964) defines its characteristics: *"effect of moving masses"*, that is *"the entire composition are made up of areas of light and dark; a single tone serves to hold together whole groups of object and contrasts therm with other groups. … the painterly style thinks only in masses, and its elements are light and shade."* (pp. 30-31); the *"dissolution of the regular"* (pp. 32-33); the "*elusiveness"*, that is

"individual objects should be not fully and clearly represented, but partially hidden. ... if some parts of composition remain hidden and one object overlaps another, the beholder is stimulated to imagine what he cannot see. ... the spectator, not minded to follow up individual elements, is content with a general effect" (pp. 33-34). The architectural perspectives represent illusionistic constructions that modify the limits of the physical space and its structural reality, creating rooms with a magniloquent appearance, because they are characterized by the architectural and decorative arrays redundancy.

"*This type of illusionistic painting required an extreme erudition and virtuosity of the artist, not only in controlling lights, shadows and perspective, but also in integrating and adapting the work to the surrounding space*" (Cabezos Bernal, Ballester, Molina Siles, & Fuentes 2016, p. 65). In the late examples the architectural perspectives, although designed to dilate real spaces, "sometimes lose their truthfulness", assuming a purely decorative value in total indifference for constructive aspects (Farneti, & Bertocci, 2002 p. 23). This tendency produces "*Quadratura*" paintings that represent illusory architectures rather daring and often unrealizable. In the stylistic language they refer to other pictorial or scenographic models rather than to real architectural parts, due to the improbable structural solutions represented.

Just this type of representation spread in the 18th century in the Apulia region. Studies on this theme, limited in some historical and artistic areas, do not seek the technical value of the perspective construction and limit themselves, to indicate its historical, geographical and cultural location. The most interesting apulian examples belonging to religious buildings are found in Capitanata, as the vault of the Cathedral and the paintings of the churches San Severino and San Nicola, all in Sansevero, and as the two "*Quadratura*" paintings in the church of Santa Maria degli Angeli in Brindisi, in the Salento area[3].

Amongst the most representative architectural perspectives placed in the noble residences are the "*Quadratura*" paintings, allusive to multiple architectures and domed spaces, of Broquier palace in Trani[4], the Manes palace in Bisceglie and the baronial palace in Botrugno, which is very similar to the previous ones for architectural and figurative layout, although placed in another geographical area, the Salento.

The *Arcadia Hall* in the Ducal palace in Martina Franca attributed to Domenico Carella (1721-1813) to which Francesco III Caracciolo commissioned the decoration of some halls of his palace in 1777 (Marino, 2015, pp. 449-461), are likewise interesting and similar to the previous ones for architectural and figurative solutions. The judgments on the Domenico Carella's works are contradictory. De Giorgi (1882) wrote: "*Il disegno di questo artista non è sempre né molto corretto, ma vi è però del genio nelle sue composizioni*" (p. 198), while Cesare Brandi (1968), more recently, wrote: "*Dipinti di una scala rossiccia ed evanescente, hanno una loro festosità, decorano indubbiamente con molto garbo, ma se visti da vicino, anche con notevole sciatteria: sono più che affreschi veri e propri, come delle grandi temperone a succhi d'erba, stesi in fretta, quasi per una festa, per un addobbo di una sera*" (p. 24).

The tempera decorations of two rooms on the main floor of Pantaleo palace in Taranto are also attributed to Domenico Carella.

One of the most significant "*Quadratura*" paintings samples is that of the so-called *Hall of Glory of Olympus* in Granafei palace in Sternatia attributed Serafini Elmo (Cazzato, & Cazzato, 2015, p. 386), of which De Giorgi (1882) wrote: "*una grande sala di ricevimento tutta dipinta a fresco nelle pareti e nella soffitta, in stile barocco elegantissimo*, da *gareggiare con quelle del palazzo marchesale di Sternatia ...*" (p. 86).

Figure 5. Bottom view by photogrammetric surveys of the vaults of the palaces Broquier in Trani, Manes in Bisceglie and the Baronial palace in Botrugno (V. Castagnolo, G. Rossi).

In the D'amore palace in Ugento, architectural perspectives, dating back to the second half of the 18th century, are preserved, although in very bad conditions, in one of the rooms of the "new apartment". These simulate a complex system of loggias and balconies surmounted by statues and covered by a dome supported by columns (De Lorenzis, 2010, pp. 227-236).

"Quadratura" painting on wooden false ceilings is a technique better that develops mainly in the 18th century (Rago, 2010, pp.97-102). An example in Apulia is present in the Alberotanza palace in Mola di Bari.

INVESTIGATION METHOD

Unlike from studies by art historians, the present investigation in the architectural perspectives of Apulian buildings, is carried out by representation scholars, so it could be partial and incomplete for many aspects. The approach that we intended to develop is that of studies "from the inside" that analyze these representations by the drawing tools. The aim is to reconstruct, basing on careful survey operations, the geometric/projective matrices of paintings and, consequently, the unreal spaces which these perspectives allude to.

Surveys of galleries of the Manes palace in Bisceglie, the Broquier palace in Trani and the baronial palace in Botrugno has been carried out integrating the recent photo-modeling techniques, identified in the scientific literature as Structure from Motion systems (SfM), with a celerimetric support base. Developed at beginning of 19th century, this techniques have spread only in the very last year thanks to easy-to-use commercial software, in competition with those founded on the laser technologies (De Luca, 2011). They allow the automatic three-dimensional restitution of the subject points basing on photographic image sequences, so reconstructing the individual shots positions and orientation (Paris, 2012, pp. 56-62).

The manual identification of homologous points in image pairs, necessary with the first-generation photo-modeling software[5], is resolved thanks to the algorithm Scale-invariant features transform (SIFT) that automatically allows to identify the characteristic points (features) in the images.

Then, the use of image coupling (matching), determination of the internal and external orientations (bundel adjustment) and distortion-corrections algorithms has automated the process that is completed further by resorting to other algorithms for the thickening of points and creating a thicker cloud of points (dense image matching) (Santagati, 2013, pp. 555-560). These clouds, however, have different characteristics compared with those generated by laser scanners; in fact, if the latter have a regular arrangement of points on the basis of the established range in the acquisition phase, those generated by the SfM systems have a casual arrangement of points linked to the recognition of the features.

In the present study case the software PhotoScan of Agisoft has been used; its workflow considers the following operation sequence: Add photos - Align photos - Build Dense Cloud.

After the end of the whole processing sequence, from the obtained point cloud a mesh is generated, to which a texture is combined, obtained by photographic shots. In this way, from this texturized model orthographic or perspective views, useful for the graphic restitution, can be extracted.

The three-dimensional restitution of architectural perspectives gives rise to virtual models that duplicate the study objects. They are necessary supports to be decomposed and anatomized with the aim to recognize and identify viewpoints, axes and visual paths. In this way, a reconstruction of the ephemeral spaces, to which these views allude, it may be proposed.

THE BARONIAL PALACE IN BOTRUGNO

The conversion from castle to a palace is due to the Castriota family who took possession of the Botrugno feud in the middle of the 17th century. Works, started around 1725 by Carlo Castriota - as it may read on an interior staircase architrave - were completed by his son Francesco Saverio.

In this occasion numerous rooms of the palace are made precious by fine decorations on vaults and walls and, in the gallery, by an architectural perspective that can be related with those of Broquier palace in Trani and Manes palace in Bisceglie, for the adopted stylistic and chromatic solutions.

Ludovico Giordani is the author of the ornamental and perspective paintings, as a dedication - today no longer legible -, placed in the gallery by the same author, attested. However, the inscription is reported by De Giorgi (1888) in his book *"La Provincia di Lecce. Bozzetti di viaggio"*: "*Al mio Sig.re P.ne Oss. mo, Il Sign, Ludovico Giordani Pittore ornamentista, 1773. Lecce per Botrugno*" (pp. 86-87).

De Giorgi (1888) describes the building gallery and the frescoed halls, capturing the perspective and illusory values of the views "*Seguono due stanze dipinte con molta eleganza e decorate alla pompejana; ed a questa succede la grande sala di ricevimento tutta dipinta a fresco sulle pareti e nella soffitta, in stile barocco elegantissimo, da gareggiare con quelle del palazzo marchesale di Sternatia, supposto falsamente architettura del nostro celebre Milizia. Vi è rappresentato un grandioso effetto di prospettiva di stile rococò, e vi sono imitate delle fughe di stanze e di corridoj, volte traforate ed aperte sulle quali appajono altre volte sostenute da colonne*

Nelle quattro stanze che succedono a questa si ripetono, ma più grossolanamente, gli stessi ornati, con puttini, vasi da fiori, cartocci, fogliamo, paesaggi; tutto ciò che poté concepire la sbrigliata fantasia semi-orientale di chi la dipinse" (pp. 86-87).

Unlike the Manes and the Broquier palaces, the gallery of the baronial palace in Botrugno preserves, also, pictorial decorations and architectural perspective on the vertical wall. The same perspective view is repeated in different wall panels of the hall, although of different sizes and, from time to time, cut out according to the size of the available space. These views are framed by perspective vestibules - made up of couples of marble columns and ocher-colored pilasters - which expand the gallery surroundings, extending it to a wine-colored balcony beyond which the perspective view opens onto two different floors. The one in the foreground, green in color, alludes to a courtyard of a polylobed shape. In the middle of the curvilinear scene, a gallery further expands the space. That in background in pink shades alludes to a building volume with a rectilinear front bordered above by a tympanum and a balustrade system; in the lower part a vestibule with a barrel vault and finished with an apsidal basin, introduces in the architecture.

The repetition of this view, more or less adapted according to the dimension of gallery wall panels, suggests the use of a reference model, probably a cartoon, even if traces of its application are not recognizable on the walls.

The architectural decorations of the "*Quadratura*" painting on the vault are in continuity with those on the vertical walls, extending them vertically and alluding to a system of three distinct spaces superimposed to the real one.

In particular, the three different spaces can be identified in the central portion of the view, between the large arches.

A golden yellow system of corbels, volute, and "*orecchioni*" articulates the first illusory space just above the room cornice, and two large, heavily depressed, wine-colored arches divide in three part the view by spreading it horizontally. At the same altitude, in correspondence with the room minor axis, an arches system alludes to internal spatiality, while a rhythm of wine-colored balustrade articulates the spaces along the longitudinal axis.

A mustard colored cornice with a mixtilinear pattern, surmounted by a balustrade with wine-colored columns, separates the first from the second illusory space. Here a lighter shade tending to pink is used, lightening masses and making the room more airy. A rhythm of angular pilasters, of simple arches on the room minor axis and a system of three arches alternated with barrel vaults articulates the second space delimiting above by a cornice similar to the one below.

In the third and last space a soft shade of green is used, further distancing and lighting volumes, increasing the depth and height sense. A system of arches and apsidal basins are arranged on the room axes and contribute to dilate the space planimetrically. In the upper part, an elliptical shaped opening is framed by a cornice and surmounted by a gold-colored balustrade.

Two illusory spaces open in the lateral portions of the architectural perspective, placed beyond the large lowered arches. The first one resumes the articulation of yellow gold colored corbels and volutes of the central portion of the view and a wine-colored balustrade delimits its vertical development.

A second green colored space overlaps the first one. it alludes to an open space bordered by a front with pilasters and an arch, on the longitudinal axis, introducing an open vaulted room at the bottom. A balustrade with gold columns, surmounted by barely visible potters, concludes the perspective delimiting the illusory building scene.

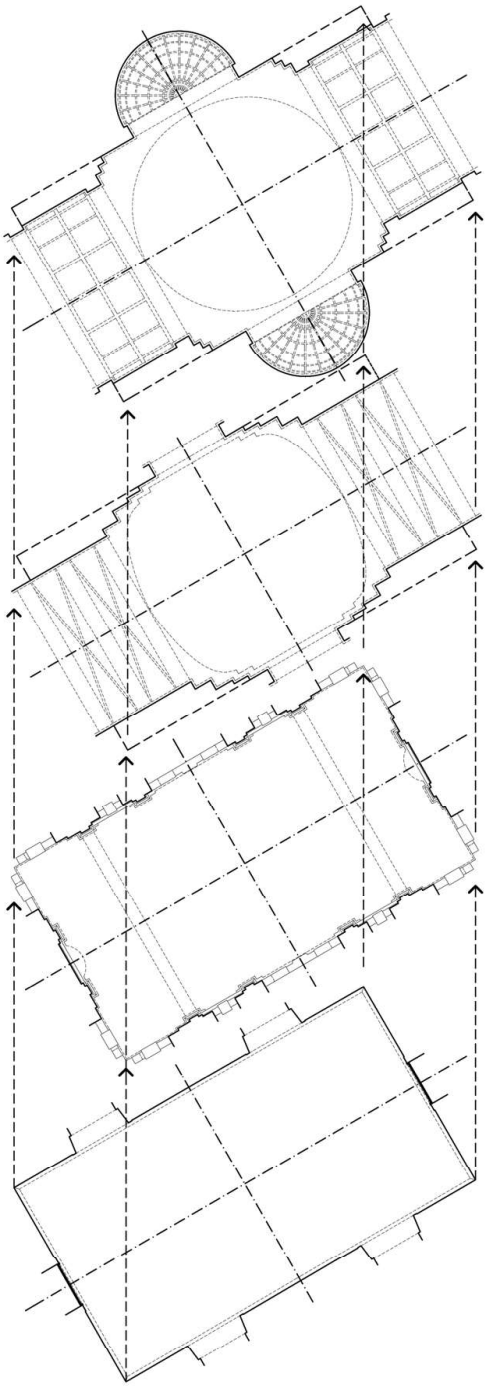
The gallery survey has been implemented integrating the recent photo-modeling techniques - which allowed the construction of a model similar to the existing ones to be anatomized and investigated - with the celerimetric support realized by a total station. In particular, eighty two photo shoots were acquired by a Nikon D5300 digital SLR - 24 Megapixel APC-C sensor - and then elaborated with Graphisoft's commercial semi-automatic Photoscan photogrammetric software.

The points cloud model obtained is transformed subsequently in a mesh surface mapped by the textures extracted from the same photographic images used for model generation. The use of surface modeling software allows to read and to analyze the real and the illusory space.

In particular, in the central portion of the architectural perspective, between the two large arches, the study, aimed to determine the perspective viewpoint, has highlighted a number of incongruities. The center of projection is identified by the intersection of planes passing through the horizontal architectural elements of the painting such as cornices and balustrades and vertical elements such as the room corners or pilasters.

This operation is carried out in the three-dimension computer simulation which, however, preserves the numerous pictorial incongruities and geometric imperfections attributable also to the conservation bad state of the vault. For the identification of a plausible viewpoint, they compel to select congruent plans and discard others (Manferdini, 2016, pp. 223-232). Plans have been identified passing them through plane curves; amongst the numerous traced plans (the red ones in figure), two, highlighted in blue colour, make it possible to determine the room transversal axis along which the center of projection could be placed. The α vertical plane passes through A and B points and the β plane passes through C and D points, so allowing to identify the observer vertical axis r. The straight line r has been intersected with a third plane γ passing through one of the painting horizontal architectural elements, to identify the viewpoint. The element selection through which the secant planes pass influences the geometric construction result: amongst all the painted horizontal sides placed in the vault coffer, the best preserved and most reliable ones have been chosen. In particular, the choice between the planes passing through the D-E-F, G-H-I, L-M-N and O-P-Q points is made. The plane curve passing through the G-H-I points has an anomalous development and therefore has not been considered suitable; the plane passing through O-P-Q identifies an almost vertical plane and the position of the viewpoint is far away. Between the

Figure 6. Reconstruction of different architectural level plans (G. Rossi).



two planes passing through the D-E-F and L-M-N points, the first one (γ in figure) is chosen, because its intersection point with the vertical axis r belongs also to the straight line intersection of the planes passing through horizontal edges, placed in the longitudinal direction of the vault (that is the planes passing through the R-S-T and U-V-Z points in figure). At the intersection of the axes r with the plane γ the viewpoint position was identified, which results to be placed in a very high position if compared to the height of a possible room user.

In fact, the center of projection is placed at the height of the vault impost, equal to 5.20 meters from the walking surface.

A similar geometric analysis was conducted for the architectural perspective portions placed beyond the large arches. Also in this case, the viewpoint is slightly higher than the vault impost.

The recognized centers of projection identify a visual axis on which all the painted vertical lines converge. In this way a poly-focal perspective system has been obtained, less rigid in comparison with a plant with a single center of projection and moreover able to attenuate the foreshortening at the architecture marginal parts (Masserano, Sdegno, 2016, pp. 312-322).

Finally, the illusory architectures heights were reconstructed by projecting from the viewpoints on the vertical wall surface of the room a series of the painting elements/points significant to define the different perspective levels. In this way, a succession of illusory room has been hypothesized, placed in perfect correspondence with the real gallery structure.

The heights grid thus constructed allows to propose a ephemeral architecture reconstruction and prefigure the real space which the "*Quadratura*" painting refers to.

Figure 7. Identification of centers of projection starting from determination and selection of the vertical and horizontal planes in the "Quadratura" painting (G. Rossi).

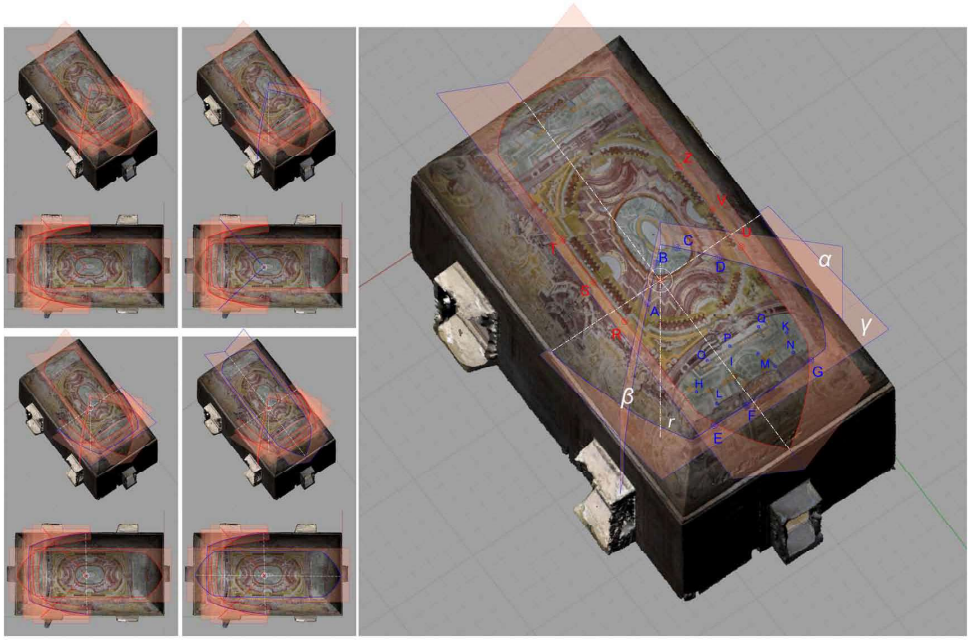
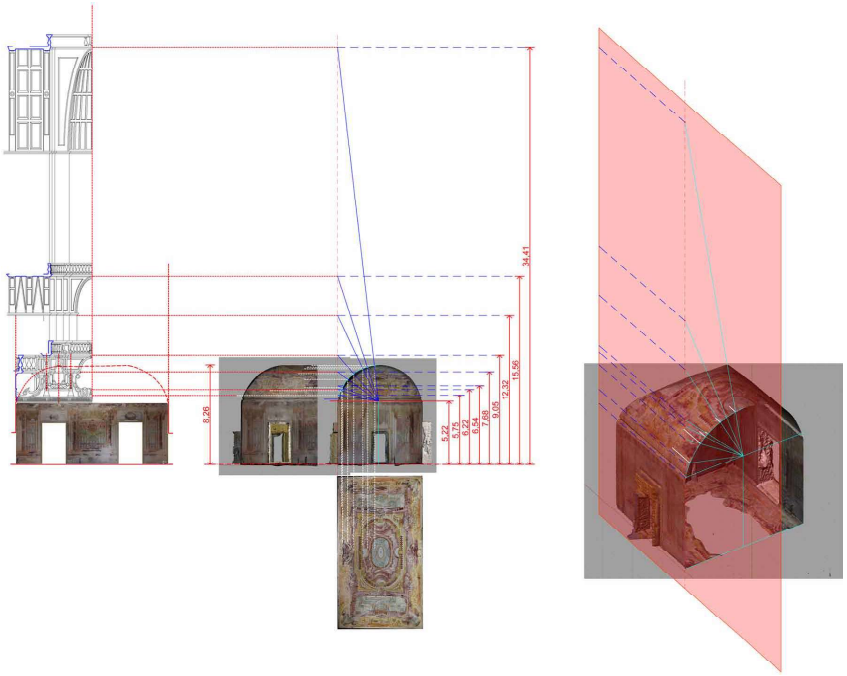


Figure 8. Position of centers of projection and identification of the level heights in the illusory architecture (G. Rossi).

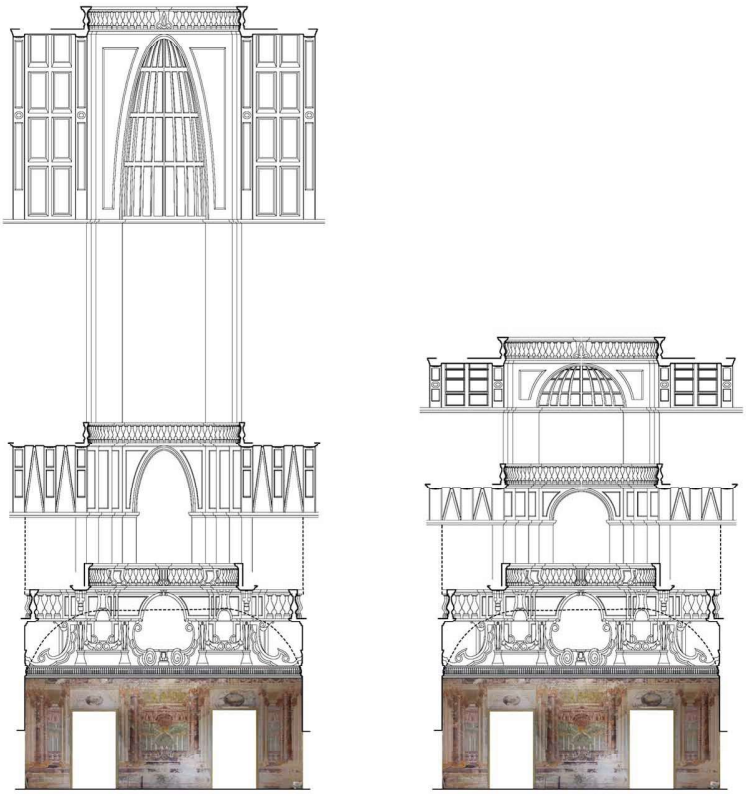


THE BROQUIER D'AMELY PALACE IN TRANI

"*La controsoffittatura della galleria del primo piano è ancora in situ; come di consueto in casi del genere, la mensolatura architettonica continua sui lati lunghi dell'opera si alterna ai grandi arconi ribassati sui lati brevi, al di sotto dei quali il motivo degli spezzoni di timpano invertiti acclude trionfi floreali; al centro, un disegno mistilineo a simulazione di una cornice in legno indorato introduce al sottinsù architettonico centrale che continua in maniera incongrua, anche presso i lati brevi, al di sotto dei grandi arconi*" (Rago 2010a, p. 85).

This description seems refer to the "*Quadratura*" paintings of the Broquier d'Amely palace in Trani or the Manes palace in nearby Bisceglie. Instead, it is about the canvas false ceiling in the gallery of the "Casa Grande" Correale in Sorrento. They are very similar both for the architectural spaces composition and for the represented decorative array. The stylistic relationship between the apulian paintings and the neapolitan school have been demonstrated amply (Pasculli Ferrara, 2006, p. 349), so that scholars attribute both the Apulian perspectives to the neapolitan "*Quadratura*" painter Filippo Pascale, author of that in Palazzo Troiano-Spinelli in Naples[6] .The Trani and Bisceglie vaults are similar for the scenes composition, in which the simulated space is decomposed in four symmetrical portions along the vault main. Decorative arrays and architectural structures are similar too. Curved broken tympanums, corbels to support open floors on the upper spaces, double arches that lead to lateral areas covered by ribbed half-domes, a dome that occupying the highest point of the representation, are some of the adopted solutions.

Figure 9. Reconstructive hypothesis of the illusory architecture (G. Rossi).



In the two Apulian examples it is possible to find clear references to stylistic elements also Florentine, as well as Neapolitan. See, for instance, the ceilings dematerialization for an effect of soarsing up an architecture, obtained with the contrast between concave and convex elements and with the succession of different planes articulated in floors, vaults and domes. The effect is emphasized by the light, which becomes increasingly clear in the upward transition, making the structures progressively lighter, and by the use of colors that are diversified by groups of architectural elements placed on the same level. Finally, the widespread and redundant use of decorative motifs is found, such as in the Florentine 18th century "*Quadratura*" paintings (Castagnolo, 2016, pp. 149-162).

In Trani, the painting decorates the vault of one of the representative halls at the first floor of the Broquier d'Amely palace. The "*Quadratura*" painting covers the vault entirely starting from its impost plane, where a real golden cornice and a virtual balustrade are placed.

Historical information about the painting - however dated (Pasculli Ferrara, 2006, p. 39) -, the building and the client, is not very certain. The palace, which was built by the family Cerdani in the 17th century and later passed to the Lepore-Campitelli and then the Broquier families, has not been object of extensive studies or research in the past[7]. Scholars have dealt only with the architectural perspective as a representative and rather genre successful example in Apulia.

The gallery has a rectangular shape and is covered by a false ceiling shaped as a "*a schifo*" vault[8]. Only the vault is decorated while walls may have been covered by a later paint.

The scene simulates the presence of several superimposed levels, first of which is located immediately above the cornice crowning the surrounding walls. Beyond it, in the representation, the real walls of the room are graphically extended following the curvature of the vault, up to a molded cornice connecting them with the first floor flat, located at the scene lateral extremes. This "*Quadratura*" painting depicts a series of illusory architectures rather daring and often unattainable, due to the improbable structural solutions represented. Moreover, there is the total absence of a visual link between the painted structures, such as the corbels supporting transverse arches, and the hall structure, a rectangular room without pillars protruding from the walls. it seems that the painting author, in simulating a magniloquent architecture, inserts impossible elements that emphasize the gallery cover importance and, at the same time, declares the its existence improbability.

At the first level of the painted architecture and, in particular, in the connecting space between the illusive cover and the real building, the visual connection is obtained by placing a virtual balustrade on the real crowning cornice of the gallery walls. The illusory connecting structures are positioned precisely in the curved part of the vaulted ceiling, so as to soars up the overlying architectures. Behind the balustrade, impressive structures, supporting the false flat floor, are raised. In this painting area the oversizing of the support corbels and the use of a rich decorative repertoire are a compositional choice with precise perceptive and technical purposes. The curvature and the objects size give the observer the sensation of being in a higher room, covered by very large floors and vaults. At the same time, the use in this space of distinctly articulated ornamental elements, such as curvilinear broken tympanums, flowers, cartouches, garlands, festoons, is functional to the construction of a perspective image that looks realistic. The perspective incongruities are solved with practical expedients, such as the insertion of flower pots in the corners, which avoid the need to construct the pictorial juncture between the vault curved corners correctly.

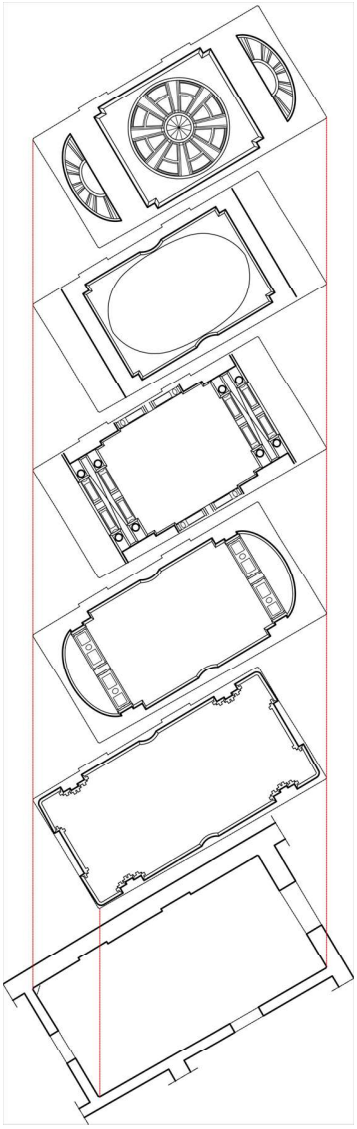
The first floor is open so as to create two views on the vaulted upper spaces. These are two semi-circular shaped balconies, symmetrical with the image center, molded along the curved profile and protected by balustrades.

In the central part the first floor is reduced becoming a string-course on which a molded trabeation and then a second floor lie, supported by two arches both symmetrical with the longitudinal representation axis. The arches are placed on the four corbels supporting the first floor. In the central part of the representation, in the center of the second floor, a large irregular oval shaped opening shows the succession of upper levels.

Beyond the opening, there are four columns with corinthian capitals supporting four arches, above which the third and last floor is rested. Two of those placed along the longitudinal axis at the representation short side, admit through a narrow cross vaults and other arches, into rooms covered by ribbed domes.

The figuration center, in the highest part, is completed by a dome with ribs and caissons, resting on the last flat floor. It is the geometric center of the vault and therefore of the gallery, but it is also the visual center of the illusory architecture, because all the decorative and structural elements of the last level converge towards it. The caissons dimensions degrade upwards while the ribs and the false white and gold stuccos are made with the repetition in a polar series, instead of converging towards the center, according to a rigorous perspective construction.

Figure 10. Reconstruction of different architectural level plans (V. Castagnolo).



GEOMETRIC AND PERCEPTIVE ASPECTS IN THE "*QUADRATURA*" PAINTING OF PALAZZO BROQUIER

In a previous study (Castagnolo, 2016, pp. 149-162) the compositional and perceptive aspects of the representation are analyzed, rather than the geometric aspects of the architectural perspective, and in the same time structural contradictions and perspective incongruities are grasped.

The study started from the search for the perspective principal point to define the position of the center of projection. To do this, the points of convergence of the lines that in the representation should be perpendicular to the image plane have been detected. The presence of a multiplicity of points, with respect

to which the different architectural and decorative parts are grouped, results in a poly-focal perspective. It has been hypothesized that one of the reasons for this construction was the painting author's purpose to emphasize some parts of the scene or to make the viewer focus his attention on a restricted area of the image. Another reason could be the need to alter the perspective, which, if constructed correctly, might not give the scene as a whole an airy effect, as some parts would have been too small.

The new study aim is to define geometrically the approximate position of the illusory architecture levels, from the balustrade - just above the impost plane - to the dome.

To do this, the position of the center of projection was identified using the methodology (Manferdini, 2015, p. 223-232; Radajevic, 2015, pp. 233-244) illustrated in the previous section[9]. In the painting three-dimensional model, the plans are built on the representation characteristic elements: the first two plans pass through the internal vertical edges of the second level room, the first plane for A and B points and the second one for C and D points, allowing to identify the observer vertical axis r; the other planes pass through the horizontal lines, which represent the limit of the intrados of the same level floor, the first plane for E, F and G points and the second one for H, I and L points. The only vertical straight lines, that is perpendicular to the image plane, which is parallel to the vault impost plane, are painted in the central area.

From the plans intersection, two centers of projection are identified, each 3.66 meters high on the floor. They are symmetrical, though not perfectly, with the representation center and placed near the painting longitudinal axis.

Figure 11. Identification of centers of projection starting from determination and selection of the vertical and horizontal planes in the "Quadratura" painting (V. Castagnolo).

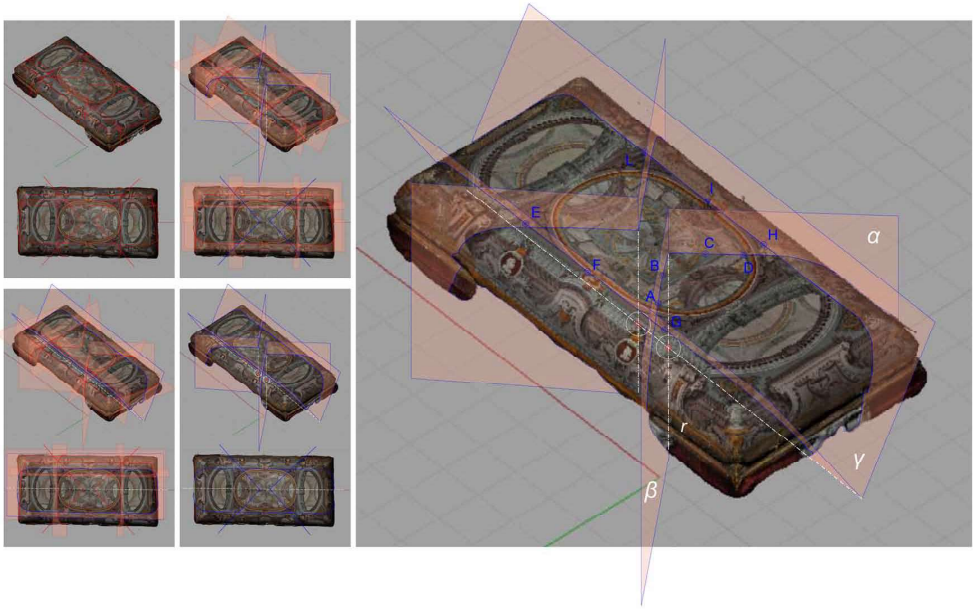
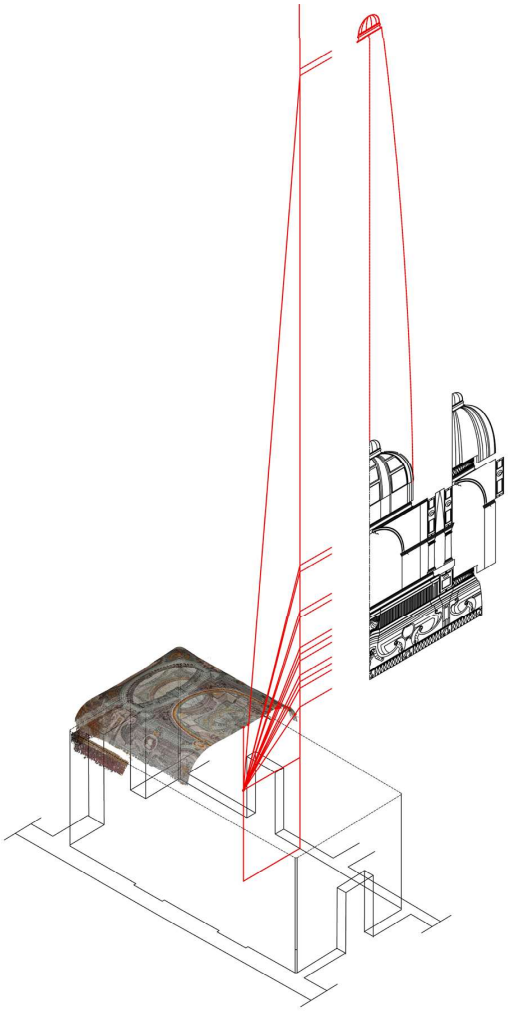


Figure 12. Position of centers of projection and identification of the level heights in the illusory architecture (V. Castagnolo).

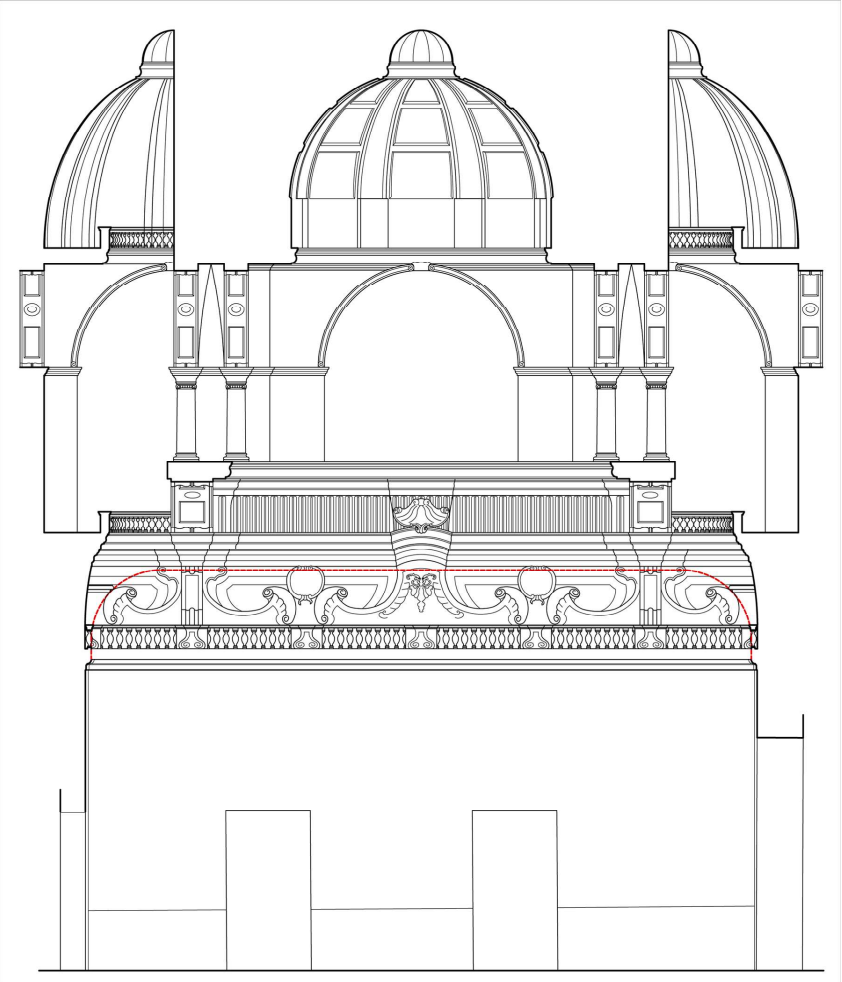


This could mean that these points were used by the "*Quadratura*" painter to construct two specular perspectives to be observed from the gallery short sides[10]. To determine the different levels heights of the illusory space, from one centers of projection some significant points placed on various architectural elements were projected on a vertical line drawn on one of the gallery walls.

The identification of the heights allowed to propose a reconstruction of the painted architecture.

However, the reconstructed architecture is not faithful to the image perspective restitution, as the author has used a poly-focal system and has altered the orientation of some elements to obtain that perspective. Therefore, fixing more viewpoints the author had the opportunity to show some painting parts better, which otherwise would have been too foreshortened. In fact, while corners of the second-level room converge towards the main centers of projection, as well as the corners of the lower level, the lines representing the angular pillars of the second level converge at other points, that are the vanishing points.

Figure 13. Reconstructive hypothesis of the illusory architecture (V. Castagnolo).



For the reconstruction of the illusory architecture spaces, such aberrations were not taken into account, but an attempt was made to obtain a rather realistic image of the composition, so overcoming in part the structural and morphological inconsistencies evident in the "*Quadratura*" painting. In the same way the dome sizing in the last level has been carry out. In the perspective restitution of the level heights, the central oculus is positioned very high - at 31 meters on the floor level – and, consequently, the dome itself is excessively wide because it has a curvature radius of 19 meters, in contrast with the whole lower levels which does not exceed 6 meters. The "Quadratura" painter in the preparatory drawing has deliberately oversized the heights of this illusory architecture area, because if he had designed a smaller dome in perspective a very wide oculus and an excessively shortened dome would have obtained. Also in this case, a more credible solution was chosen in the reconstructive drawing.

The painting shows an architecture upward development determined by the multiple levels and spaces superimposition. In the "*quadratura*" a rooms sequence, whose articulation and structural characteristics give large and, above all, high spaces illusion, is represented. If the painter had put into perspective a

realistically proportioned architecture, as proposed by this chapter authors, he would not have obtained the same "*quadratura*", but a perspective in which many architectural elements would not have been so clearly visible. Some parts would have been excessively shortened and not so grandiose. Therefore, from the painting analysis, compared with the Botrugno Baronial palace one, it has been deduced that the preparatory drawings of both perspectives have been intentionally "deformed" (observe the domes shape). With a perfect control of the rules for the architectural perspectives geometric construction, the "*quadratura*" painters achieve to show all illusory rooms with the purpose of conveying that feeling of wonder which the Baroque architectures are supposed to provide.

CONCLUSION AND FUTURE DEVELOPMENTS

The innovative aspect of the present study consists of an investigation on significant examples of Apulian "*Quadratura*" paintings, implementing the previous historical and artistic studies with a reading " from the inside". The aim is to understand the technical and perspective skills that the artists working on the territory possess and, at the same time, to interpret the representations object, placing the attention on the illusory architecture and space.

The integration of celerimetric survey with the most recent photo-modeling techniques allows the reconstruction of a three-dimensional model of the gallery, on which it is possible to identify the geometries subtended to the architectural perspectives, the different and multiple viewpoints, and, finally, to reach a possible restitution of the represented building.

In fact, attention is placed on the geometric/perspective structure of the "*Quadratura*" paintings, being expression of a scholarly culture of the 16th-17th century, able to control the perceptive/visual effect in paintings, so that to offer illusive scenographic solutions of imaginary and surprising spaces.

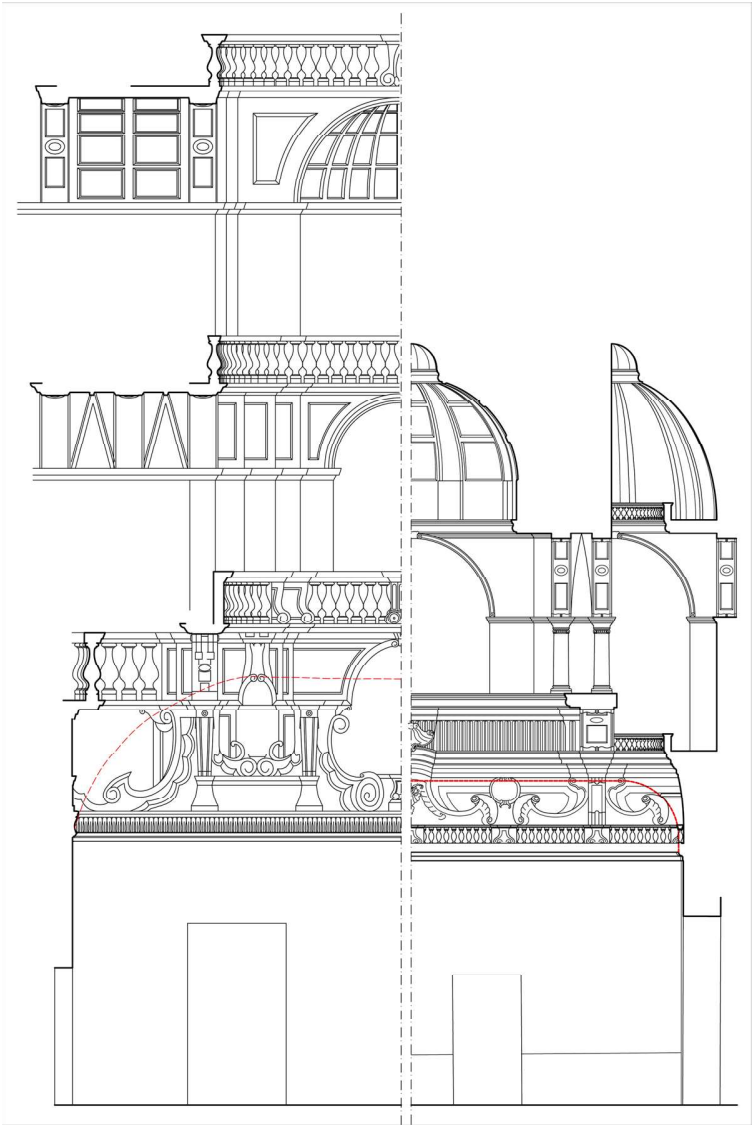
The search for the surprise effect is pursued by expanding the gallery space beyond its real ceiling with ephemeral architectures in perspective, resorting for their geometric construction to poly-focal systems: they are less rigid than those with one center of projection and, moreover, able to reduce the foreshortening in the painting marginal parts.

Although the surfaces on which the perspectives were painted are different - "*a schifo*" vault for Palazzo Broquier and a cloister vault for the baronial palace in Botrugno -, in the perspective reconstruction drawings the illusionary spaces are deformed vertically in a similar way, especially in the higher spatiality. In both cases, the centers of projection - found by the intersection of appropriately chosen planes - are placed in an elevated position with respect to the height of the gallery visitor, resulting in slowing down the perspective effects. Above all this happens in the illusory spaces below, which, with a viewpoint placed at the height of any observer, would be strongly dynamic and shortened, due to their greater perspective deformation. By raising the geometric viewpoint, a greater readability of the different scenes is obtained from the bottom, giving the opportunity to move randomly in the gallery.

Finally, the use of a poly-focal perspective system suggests a narrative path to guide the visitor in the appropriation of the real/illusory architectural space.

The study of the gallery architectural perspective of Palazzo Broquier in Trani is compared with that of the Baronial palace in Botrugno, expanding and increasing prospective studies on the Apulian "*Quadratura*" genre. Future intention is to extend the investigation to the Manes palace in Bisceglie, which proposes very similar and geometrically comparable models and solutions.

Figure 14. Comparison between the Broquier palace and the Baronial palace illusory architectures (V. Castagnolo, G. Rossi).



The studies could be further extended with the aim of understanding the technical ways that this architectural perspectives artists employed for panting vaults or false ceilings, preserving a control of the final scenic effects in the projective deformation.

These ephemeral/tangible representations, without any doubt the expression of the 16th-17th century Apulian pictorial culture, should be considered completely as a part of that material/immaterial cultural heritage, worthy of being studied and known and, therefore, safeguarded and made more valuable.

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ENDNOTES

1 For the 18th century, this distinction between "perspective" and "ornamental" painters, all belonging to the category of "painters of ornaments", is proposed by Pasculli Ferrara on the basis of documentary evidence (Pasculli Ferrara, 1996, pp. 97-116).

2 To define the expressions "from the outside" and "from the inside", see Bartoli & Lusoli, 2015, pp. XV-XVIII.

3 An interesting study on the *"Quadratura"* paintings in the church was conducted by Paolo Perfido in his paper "*Il soffitto dipinto della chiesa di Santa Maria degli Angeli a Brindisi"* (Perfido, 2016, pp. 237-248).

4 For a first analysis on the perspective of Broquier palace *"Quadratura"* painting, see Castagnolo, 2016, pp. 149-162.

5 It refers to the software Photomodeler, ImageModeler and Z-Scan too.

6 For historical informations about the Broquier palace and its architectural perspective see Pasculli Ferrara, 1996, pp. 580-585; for dating and attributions see Pasculli Ferrara, 2006, p. 349; Pasculli Ferrara, 2008, p. 107; Di Liddo, 2010, pp. 36, 76.

7 The palace is mentioned with brief notes only in some publications: Cazzato, 1992, p. 599; Lentini, 1998, pp. 94-95, 98; Safran, 2014, p. 347.

8 It is created from a cloister vault by cutting off its top part by a horizontal plane.

9 As in the case of Botrugno gallery, from a series of possible plans, those more coherent with the vault perspective construction were chosen. The limit of the search for plans is determined by the inaccuracy in tracing many lines in the painting.

10 This could explain the apparently incorrect directions of the dome ribs, described above.