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## Anthropic units in Baroque Architecture, the Gallery of the Palazzo Spada and the roman palm

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## **Anthropic units in Baroque Architecture, the *Gallery of the Palazzo Spada* and the roman palm**

### **Introduction**

Historically, measurement units have been linked to bodily proportions. From the ancient cubit based on the length between the elbow and the middle finger used by the Sumerians and the ancient Egyptians, to the foot still in use in a minority of nations today, human-based systems of units allowed for straight forward representations of scale. No tools were needed to apprehend the surrounding environment. The dimensions were quite literally incorporated within humans, in the Latin *corpus*, the body. Measurements were consequences of a palpable reality linked to a close material universe. After the French Revolution, the Age of Enlightenment looked for a unified way of measuring lengths and weights. During the 1875 *General Conference on Weights and Measures*, seventeen states adopted the international system of units (Moreau, 1953) which brought the question of scale to an astronomical division with its primary measurement of length, the meter, determined by a subdivision of the earth perimeter along the Paris meridian. The search for a unified unit has also caused a standardization of our perception of measurements (Lugli, 2019). The physicality of our relationship to scale has tailed off.

Considering the determining role of measurement and scale in architectural design, questioning the shift from a unit of measurement based on the body (and apprehensible on a human scale) to a unit based on a fraction of the earth seems necessary. As an extension, understanding the impact of historical dimensional systems on compositional logics constitutes a telling way of reinvestigating references from architecture history. Why is a precise understanding of the link between scale and measurement necessary to apprehend composition in its proportions? We will study Baroque architecture as it offers many avenues to explore the singular relationship that links body and scale to proportions, space and representation.

The aim is to reinvestigate the link between body and composition through a drawing-based analysis of a case study which makes use of anthropic units of measurement, directly linking architecture to human proportions. This analysis will focus on Borromini's Gallery of the Palazzo Spada (Fig.01) with the aim of capturing, through the re-drawing of original documents, the impact of the Roman palm and its resulting drawing scales on the proportional logics, the geometric lines, and the design process. The gallery has been studied through multiple lenses as one of Baroque's most emblematic anamorphosis. We will shed a new light on it, by offering a reading of this historical Baroque building through the architect's tools, research in history by copying, by re-drawing, as a way to understand.



Fig. 01. View of the Galleria del Palazzo Spada from the courtyard.

Source: *The authors, November 2022.*

## Learning through copying and Baroque representation

### *A Renaissance Heritage & Copying as a Teaching Resource*

In the western world, the Renaissance marked a passage from builder architect to design architect. Ever since, buildings have been conceptualized through drawings and composition has started on paper. Representation techniques have become the heart of the architectural practice as they constitute the architect's ability to generate forms (Evans, 1997). Throughout modern history, copying was used to share knowledge in diverse fields and manners. The *imitatio naturae*, the drawing after nature, was notably used to illustrate 18th century encyclopedias (Datson & Galison, 2012).

During the Renaissance, the reproduction of representations served as a teaching methodology. Visual arts were taught through the copy of Masters' drawings. During that same era, the architecture curriculum also involved copying as a learning tool. As the current was considered the pinnacle of arts, the *imitatio auctorum*, the redrawing of man-made objects, became an essential teaching resource (Fransen, Reinhart 2019). The practice of copying, coupled with the democratization of printing, rendered the junction of theoretical writings and graphic representations possible, linking, from then on, drawing to research in architecture.

Even though redrawing in architecture has, since the Renaissance onwards, been used in higher education, it is only in recent years that the heritage of copying has been explored as a research tool in our field.

### ***The Practice of Copying as Knowledge Production***

Recent works in anthropology, art history and applied arts have focused on the practice of copying as a relevant methodology in research (Lucas, 2019; Fransen, Reinhart 2019). The act of redrawing conveys different forms of knowledge and grants access to new perspectives on the original works. The copies of existing works produce a part of newness due in part to choices operated by the drafter. Whether it be the decisions in elements to reproduce, in layouts, in methods or in how the resulting drawings are presented, each choice alters the final works. The act of reproducing each specific quality in a drawing implies its prior analysis. The modes of projection, the view point, the quality of the lines (Lucas, 2019), or the drawing scale, need to be understood in order to be relayed. The copies are not meant to be exact, the researcher is not a forger, the reproduction of each quality of an original drawing carries out knowledge. These qualities are key elements in the design of the architectural project and their mobilization through the reproduction of representations renders the use of re-drawing as a heuristic device for research in architecture history possible. The reproduced works become objects of discussion, their relationship with the original work gives way to a new dialogue, they allow us to re-examine a newly acquired knowledge. It is in search of this knowledge, in understanding projection as a process of design, that our study relies on copying. As making exact copies is not of interest to us, we will, from now on, use the term *re-presentation* to address our work.

The knowledge which can be discovered through *re-presentation* is rooted in a specific analytical device, namely abduction reasoning. The principle of the *indicial paradigm* describes a research methodology specific to disciplines that do not claim to achieve universality (Ginzburg, 1980; Peirce, 2017). This method is based on a science of clues that, like police investigations, explain identified phenomena by the formulation of successive hypotheses containing 'an irreducible margin of uncertainty' (Ginzburg, 1980). Reasoning by abduction takes on its meaning in architectural research thanks to the iterative process of design, which is materialized by the production of graphic representations (Genard, 2017). It is through the process of trial and error in drawing and modeling that the architect designs and solves their buildings. It is the link between retro-conception and projective acts that our research aims to demonstrate in regards to its methodological objectives. If there is indeed a production of knowledge from the act of drawing, it would be possible to access it by mobilizing the same medium, by producing re-presentations. This is where the analysis of architecture through the reproduction of graphic documents takes on its full meaning. Going back to iterative the traces of the architectural project will allow us to rediscover the projective processes of our case study.

These preoccupations will be addressed by discussing Baroque architecture through *re-presentation*. It is by mobilizing the tools of the architect, for a research specific to the field, that we aim to deepen our understanding of the *Galleria del Palazzo Spada*.

### ***The Baroque Representation Shift, Perspective Plays and Anamorphosis***

The Baroque is a pivotal moment for architectural representation's evolution, the Renaissance progresses in terms of geometric projections were mastered and started being played with. The use of anamorphoses and *trompe l'oeil* perspectives testify to how representation techniques and composition were intertwined. Buildings such as the *Scala Regia* (1663) by Bernini or our case study, the *Gallery of Palazzo Spada* (1632) by Francesco Borromini blur the lines between drawing and architecture of the embodied world.

The particular case of Baroque anamorphosis highlights our interest in analyzing Baroque architecture through *re-presentation*. It is through the act of drafting that the design process takes place. Canonical representations, plans, sections, elevations from the spectrum through which buildings are imagined. The drawing conventions thus have a significant influence on spatialities (Lucas, 2019). Dimensions suddenly go through a shrinking specter, measurements are reduced to fragments of what they represent. An understanding of the tools, the units and the scales used is needed to apprehend a building's composition. These notions allow us to situate the importance of representational practices not only as design tools for the architect, but also as a methodological basis for understanding our case study.

### **Borromini's Gallery of the Palazzo Spada and the Roman Palm**

During the Italian Baroque measurement units varied from one locality to another. The Roman palm, an anthropic unit based on the width of the human palm, was used by Borromini and his draughtsman Francesco Righi in design. Grasping the richness of the compositional logics of Baroque architecture without considering or analyzing the link between measurement and body seems difficult. This specific case study introduces a double complexity through its twofold relationship to corporality and the human scale. To understand these two parameters we propose to analyze the gallery through two complementary approaches. First, the analysis of the building as designed highlights the incorporation of the human observer, of their proportions as the starting point in the geometrical process. Second, the building as perceived, with its projected regularity, allows us to approach the impact of the Roman palm on the composition. The relationship between physicality and unit of measurement present in Baroque architecture is here exalted by the accelerated perspective which positions the body at the center of the projective device, integrating physiological properties within the design process.

Our research hypothesis is that a precise understanding of a unit of measure and its relationship to the body is necessary for an analysis through drawing. The practice of copying's purpose is to reveal dimensions of the project and its design that have not been explored through other specters so far. First, we will examine original drawings through their re-presentation. Then, we'll compare our findings to the building by making use of a survey. Finally, we will confront both the project as designed and the building as surveyed to the building as perceived, projected by the accelerated perspective.

### ***Re-presentation and Roman Palm***

The two archival documents at our disposal are a plan (Fig.03) and a so-called pseudo-perspective drawing (Fig.02) dating back to 1652/1653, around the years of the gallery's construction. Before diving into our renditions of Borromini and Righi's drawings, a few observations can be made. Measurements in fractions and multiples of Roman palm are annotated on both drawings and graduated lines allow us to take the drawing's scale into consideration. We can already notice the space between the framing columns at the front of the colonnade (14 palms) is divided by two at the end of the gallery (7 palms). These measurements can be found on both drawings, hinting at the nature of the *pseudo-perspective* which is in fact an elevation. The accelerated perspective introduces vanishing lines in both plan and facade drawings. The representation allows us to go back to the geometric lines, towards a supposed vanishing point, we will start by drawing the elevation as it allows us to analyze the project as a whole.

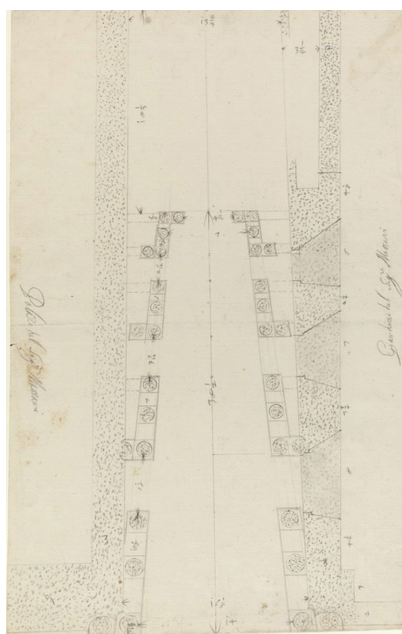
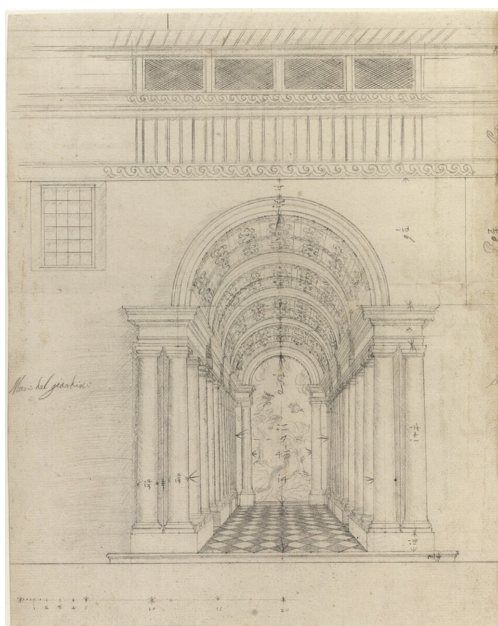


Fig. 02. Pseudo-perspective elevation of Galleria del Palazzo Spada, Francesco Borromini, Francesco Righi, 1652/1653. Fig. 03. Pseudo-perspective plan of Galleria del Palazzo Spada, Francesco Borromini, Francesco Righi, 1652/1653.

Source: Collection of the Albertina Museum, Vienna .

#### ***1. The Pseudo-Perspective Elevation, Towards a Vanishing Point?***

When starting the re-presentation, the bar scale is the first mark reproduced. It serves as a ruler, as our first guide for reporting all proportions and measurements using a compass. At first glance, the drawings suggest the accelerated perspective was designed according to classical conical projections, meaning all lines in the depth should converge towards a singular vanishing point which would serve as our second guide in the re-presentation. This point should be situated on a horizon line, at the

height of the ideal observer. However, in the elevation this vanishing point cannot be found precisely. Indeed, when drafting 6 lines of flight (in red) we can see they converge towards a vanishing zone but not a singular point (Fig.04). The discrepancy is most noticeable when comparing the lines from the floor and those at the top of the pedestal. This divergence could, however, be explained by drawing imprecision, which is why we attempt to verify our observation by looking for the horizon line.

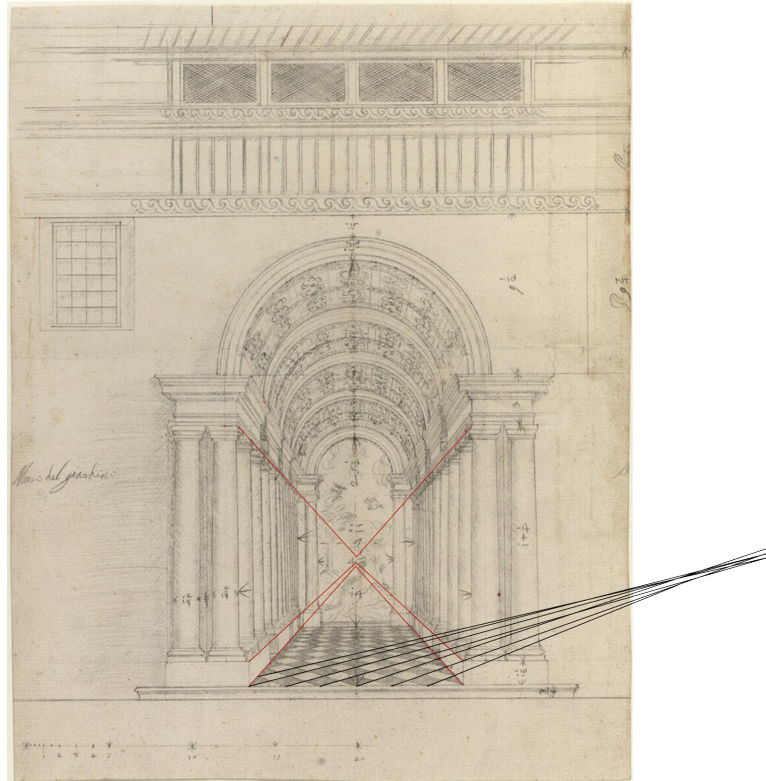


Fig. 04. Galleria del Palazzo Spada, Francesco Borromini, Francesco Righi, multiple vanishing points and no singular horizon line.

Source: *The Authors*

We search for it by following the floor grid, in accordance with the rules of quadrature (Fig.04). When doing so we notice the lines (in black) not only do not converge precisely towards two symmetrical points but are also situated approximately 1,5 palms above the vanishing zone, confirming the elevation was not drawn according to conical perspective rules. If all the lines of flight vanished towards a singular point in space, the elevation, as a canonical projection should indeed conserve this singular vanishing point on a horizon line. (Fig.05) As a precise vanishing point cannot be found in this drawing, our only drafting guides are the bar scale and the annotated measurements.

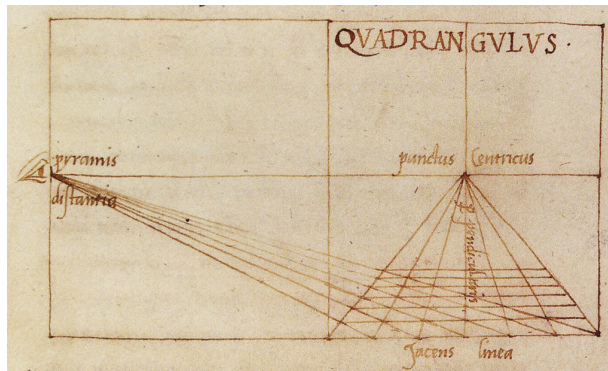


Fig. 05. Leon Battista Alberti, on quadratura, 1448.

Source: Biblioteca Statale Lucca

## 2. The Pseudo-Perspective Elevation, Proportionate Shrinking in Roman Palm.

As we concluded the vanishing point is only approximated in this first drawing, our hypothesis that emerged from the re-presentation drawing (Fig.06) is the following. Borromini and Righi's elevation was designed according to a proportionate shrinkage stemming from the plan's dimensions, from heights related to Doric composition and potentially by reporting heights from a missing section.

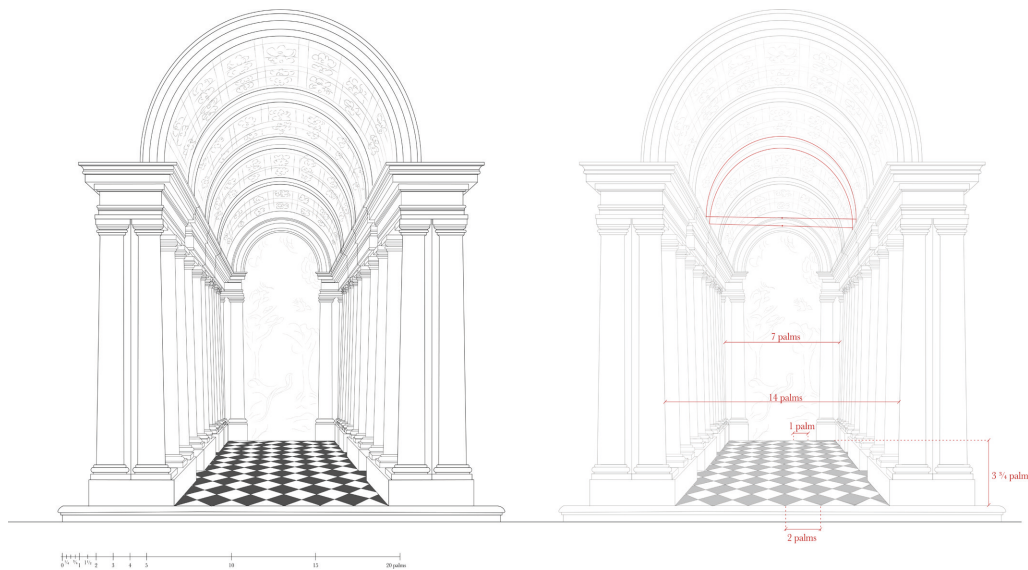


Fig. 06. Galleria del Palazzo Spada, Elevation re-presentation and annotations

Source: The Authors



Our elevation was drawn starting from the forefront colonnade. Measurements from the original drawing allowed us to draw this foreground, considering it as the accelerated perspective's projection plan, meaning it would constitute the illusion's undeformed true size. The main width measurement of 14 palms, an even number that could fit in between the existing surrounding walls, might have guided the order's heights which maintain Doric proportions. Our second main width measurement then comes into play. The background colonnade, with the external width of 7 palms is then drafted by dividing all the foreground measures by two. It was drawn at a height of 3 palms and 3/4 from the foreground columns' bottom of the pedestal. As we know, Borromini burnt number of documents before his death (Fallacara G., Parisi N., 2004) we cannot be sure of how all heights were determined. We can, non the less, surmise this placement is related to a potential lost section drawing that set an ideal observer height, resulting in the floor and vaulted ceiling's specific inclines. This supposition also stems from how the rest of our re-presentation was drawn.

### 3. The Pseudo-Perspective Elevation, Column Placement and Distorted Arches

After drawing both the foreground and background columns, vanishing lines are outlined by connecting the two parts. The vault's arches are effortlessly reproduced by drawing a series of horizontal lines following the annotated measures. We do, however, notice each series of two half-circles, which compose an arch comes from a translation of the center on the vertical axis resulting in a true half-circle and a slightly raised one. As the accelerated perspective stretches the arches in the depth, a geometrically exact vault (according to a conical perspective) in elevation would be composed of two arches, with one center each, on two parallel diameters. This distortion is noticeable when comparing the arches' thicknesses on the central vertical axis and those on the cornices. The distortion suggests two things, first it confirms the elevation wasn't drawn as a perfect perspective. Second, it questions once again the projection of heights through a lost section. As we will see later when analyzing the gallery as built, the arches' distortion was solved by implementing a succession of vaults framed by front facing arches supported by groups of three columns. The first rows of columns, supporting the arches can be sketched by following the arches trajectories. When attempting to delineate the remaining columns, we soon notice the elevation's annotations do not suffice.

### 4. The Pseudo-Perspective Elevation, Checkered Floor and Depth Perception

We turn our interest to the checkered floor and divide the foreground in six segments measuring at two palms each. The floor's end is divided in six one palm increments, allowing us to recreate the diagonal checkered pattern. In quadratura, these floor division would serve as depth guides for anamorphosis, and would thus help us in finding the remaining columns positions. In Borromini and Righi's drawing, however, the columns' bases are not placed on the squares' vertices. The floor's patten doesn't serve as a guide, it role seems to be rooted in emphasizing depth perception in the drawing. We count ten squares in depth, without even considering the accelerated perspective's role in shrinking each square, we realize the floor cannot match real measurements as the gallery's plan measures at 38,5 palms and a non-distorted checkered floor would only reach 20 palms. Our only guide in redrawing the remaining columns is the projection of vertical lines from the columns' positions in plan.

### 5. The Pseudo-Perspective Plan, Round Columns Against Anamorphosis Rules

The plan's re-presentation is a more straight forward endeavor. By following the annotated measurements, the directional strokes, the dashed lines and some bold dots marking various proportions, a plan is reproduced. Once again the vanishing lines connect the 14-palm wide opening between the front columns to its 7-palm counterpart at the end of the gallery. In opposition to the elevation, a singular vanishing point can be found 36 palms away from the end of the gallery. (Fig.07)

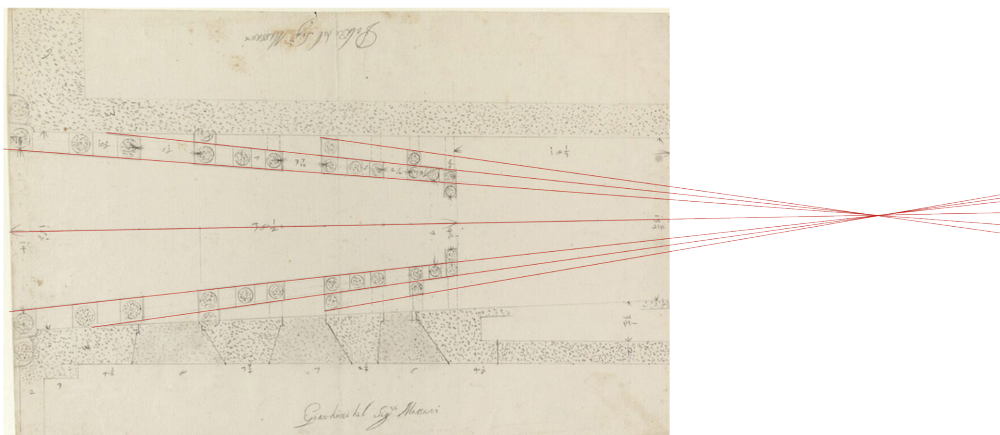


Fig. 07. Galleria del Palazzo Spada, Francesco Borromini, Francesco Righi, singular vanishing point in plan  
Source: The Authors

The columns become of interest in this drawing too, they reveal the gap between anamorphosis's geometric implications and the realities of projects meant to be built. In order to truly follow the anamorphosis's perspectival deformations, the columns' section would be elliptical. These ellipses' major axes would conserve the current columns diminishing diameters. The ellipses' minor axes would shrink more drastically, flattening the columns towards the end of the gallery. As the columns support the arches and vaults, we can argue the elliptical columns' absence is due to constructive realities.

The re-presentation brings geometrical inaccuracies to light. Annotated measurements serve as clues in understanding how the accelerated perspective original drawings were constructed. We will now compare our findings stemming from the gallery's drawings to the gallery as built in order to appreciate the coherence between the project and its materialization. This will then lead us to an analysis of the building's composition as perceived.

#### ***A Re-Reading of the Gallery Through the Survey***

Considering the architectural project through its drawing and its copy allows us to apprehend with more subtlety some of its compositional dimensions, but also to bring out a non-visible part of the genealogy of design. While this approach enriches our view of the drawn object, it does not fully take into account its material dimension. Between the drawn object and the constructed architectural object, there remains a

gap that needs to be qualified.

Whether for reasons of execution on site or simply for reasons inherent to the project itself, the confrontation of the study by the copy of the survey is essential to measure the richness and the coherence of the project. In the continuation, our interest in an observation of the object as built is to show the possible compositional ambiguities that the drawing reveals. These ambiguities do not disqualify the project, but rather reveal certain subtleties that the history of art fails to grasp.

In this particular case, the challenge is to provide a more complete view of the Galleria del Palazzo Spada. In addition to the singularity of its integration between two courtyards of the Palace, it presents an anamorphic feature that increases the perceived length of the gallery. While the dimensional and executional coherence between the drawing and the built object has been highlighted in Adriana Capriotti and Augusto Roca De Amicis' study, *La Prospettiva di Palazzo Spada* (Capriotti, Roca De Amicis, 2022) the perspective projection as such remains rarely discussed.

The accelerated perspective of the constructed building is often represented by a limited number of vanishing points. It is interesting to note that the design drawings and the re-drawing work show more, indicating the absence of a constructed conical projection. This perspective approximation, present from the beginning of the project, seems to manifest itself also in the built object. In total, the survey reveals almost ten perspectival lines, which makes it possible to exclude the existence of a geometric design using the "Perspectiva artificialis", even if it was already used by numerous artists and architects since the 15th century.

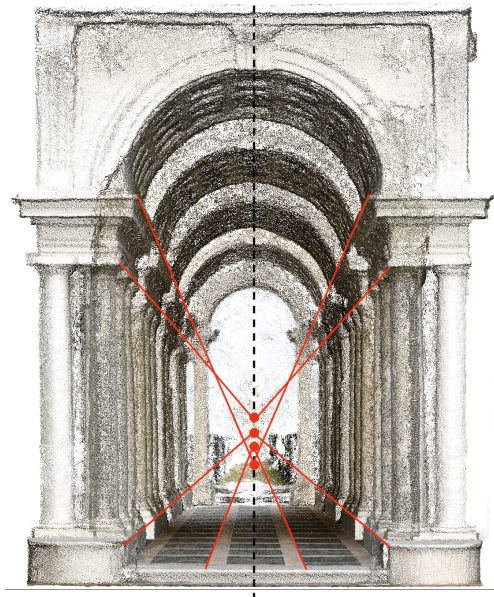


Fig. 08. Galleria del Palazzo Spada elevation from a photogrammetric survey, multiple vanishing points.

*Source: The Authors, November 2022*

The comparison of the drawing with the survey (Fig.08) not only confirms the coherence of the project (designed and built) but also suggests that Borromini would have favored the principle of perceptual shrinking to the detriment of a geometrical construction of accelerated perspective. This can be explained by the need to integrate the gallery project into an existing building, one of the wings of the Palazzo. This constraint could have led Borromini to favor an adaptation of the pre-existing composition of the building to the mathematical accuracy of a constructed perspective.

***The Gallery as Perceived***

The survey allows us to draw a plan and a section of the gallery and its direct surroundings as built. The accelerated perspective is inherently linked to human perception as it plays on our depth perception through conical vision. In order to analyse the buildings' proportions we must project the perceived space. To do so, we would need to situate an ideal observer. Re-representation revealed the multiple vanishing points contained in the gallery which were confirmed by the survey. As the vanishing points do not align on a singular horizon line, there exists multiple possible view points. We need to take all those factors into account in order to project the space as perceived. This allows the illusion to be operative not from a single point of view but from a viewing area, or even from multiple locations.

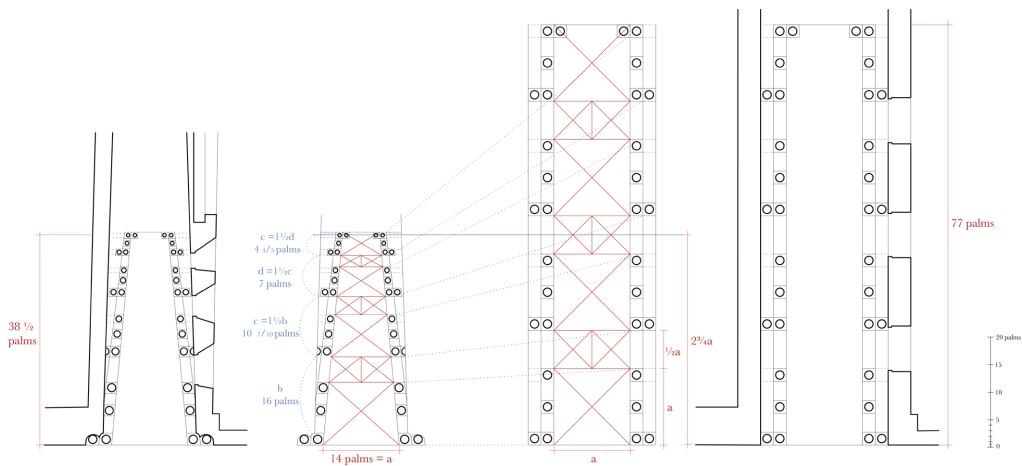


Fig. 09. Galleria del Palazzo Spada re-representation plan, annotated plan and the gallery as perceived.

Source: The Authors

To reconstruct its undistorted version from conical perspective implies identifying a single point of observation and a single vanishing point. If this approach seems relevant, it would require us to correct the project towards a conical projection contradicting the building's design. We thus consider the gallery's arithmetical shrinkage rule as our basis for the projected space. By reversing this rule and by extrapolating measurements from the undeformed true width of 14 palms, we project a hypothesis of the perceived object (Fig.09). We observe a gallery of 77 palms in length, twice as long as the 38,5 palm deep accelerated perspective Galleria del Palazzo Spada.

## Conclusion

The initial intuition pushed us to approach the analysis of the gallery through the palm and its anthropic relationship to measurement. This singular unit finally proved to be essential in understanding the arithmetic rules which guided the accelerated perspective's design. Even in the epistemic context of Baroque design, where conical perspective projection is known and mastered, this project's design seems to voluntarily not resort to it. This surprising approach suggests the use of arithmetical reduction principles which echo the anamorphoses of theater sets.

Analyzing the gallery on the basis of the Roman palm's dimensional system thus attests to the need to consider the unit of measurement of design as a key to its understanding. This was only made possible by a detailed analysis of the period drawings through their re-presentation. In this abductive research approach, a series of iterative observations were made through re-presentation. They allowed us to question the influence of geometrical projective devices through drawing and their influences on the project and its material embodiment.

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