

Giotto and the Construction of Space. The *Stories of Saint Francis* in the Upper Basilica of Assisi

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Abstract

*Interest in the pictorial representation of architectural space has deep roots in classical and Roman antiquity and has developed as a form of decoration or as an integration of built architecture with virtual special constructions, continuing into the modern age. In the first half of the fourteenth century, a substantial evolution took place: painted architecture was emancipated from its traditional role as a mere backdrop, typical of the Byzantine tradition, to acquire volumetric and perspectival consistency, capable of actively interacting with the symbolic and narrative construction of the scene. This transformation can largely be attributed to Giotto, who reinterpreted the Roman figurative heritage in an original way, drawing from a vast repertoire of classical sources and integrating his pictorial compositions with architectural models of contemporary buildings. The cycle of the *Stories of Saint Francis*, attributed to Giotto and his workshop and executed between the late thirteenth and early fourteenth centuries in the Upper Basilica of Assisi, represents the first fully realized example of this new approach. This study constitutes an initial reflection within a broader research project based on a high-accuracy digital survey of the decorated interior surfaces of the basilica. The pictorial cycle is thus examined not only as an ordering principle of real space but also as an opportunity to explore drawing as a tool for knowledge, analysis, and mediation between architectural conception and figurative narration.*

Keywords: integrated digital survey, Basilica of San Francesco in Assisi, documentation and interpretation of medieval frescoes, perspectiva naturalis.

Introduction

In the first half of the fourteenth century, a significant evolution occurred in the representation of space, with painting acquiring greater volumetric consistency. This renewal is primarily associated with Giotto, who redefined the pictorial language with a heightened sense of realism, adapting it to the sensibilities of his time. The cycle of the *Stories of Saint Francis* in the Upper Basilica of Assisi, executed between the late thirteenth and early fourteenth centuries, represents the most accomplished example of this innovative phase, revealing a conscious interaction between figures and space, founded on principles of structural coherence and verisimilitude. The construction of the Basilica of San Francesco in Assisi, articulated on two levels, was a complex process that unfolded over several decades.

The Upper Basilica (fig. 1) introduced a radical innovation within the architectural panorama of central Italy, assimilating the significant stylistic and structural developments then emerging in the transalpine regions. Gothic forms, reinterpreted through the lens of local building traditions, gave rise to an unprecedented architectural organism in which architecture, painting, and decoration—including the stained-glass windows executed by northern European workshops—were harmoniously integrated into a coherent, unified whole.

Giotto played a decisive role in this turning point, reworking the Tuscan and Roman figurative traditions with remarkable originality. Drawing from a vast repertoire of classical sources—such as bas-reliefs, wall paintings, coins, and mosaics—he

integrated these references with elements derived from contemporary medieval architecture, creating a new synthesis between ancient models and the visual culture of his own time [Benelli, 2016]. Since antiquity, the pictorial representation of architectural space has been a recurring theme; however, it is between the late thirteenth and early fourteenth centuries that architecture definitively emancipated itself from its traditional role as a scenography, Byzantine-inspired backdrop, acquiring its own volumetric and perspectival autonomy [Benelli 2016].

It is by no means a novelty to approach great works of art with a critical eye, seeking new elements or original insights, and considering them not only from a historical-artistic or aesthetic perspective, but also as valuable sources for reconstructing the cultural dynamics of their time. The cycle of the *Stories of Saint Francis*, executed by Giotto and his workshop in the Upper Basilica of Assisi, stands as the most accomplished example of the ideas outlined above. The decorative scheme of the central nave –featuring the parallel narratives of the *Life of Saint Francis*, the *New Testament*, and the *Old Testament* [Romano 2017]– reflects a well-established pictorial tradition in central Italy. This tradition finds its most illustrious precedents in the mosaic decoration of the dome of the Baptistery of San Giovanni in Florence, in the Roman mosaics of Pietro Cavallini, and in the wall paintings of the Hermitage of San Benedetto at Subiaco.

In the fresco cycle executed by Giotto and his workshop, a new clarity emerges in the articulation of the painted

architectural framework, which not only organizes and visually supports the scenes but also enhances the structural coherence with the Basilica's real spatial context. The analysis of the frescoes, conducted by our research group together with the architectural survey of the Basilica's interiors, reveals a marked integration between real and depicted structures. These painted elements emulate loggias, projections, and architectural members of considerable visual impact, thereby influencing the overall perception of the nave's lower wall zones.

Furthermore, the painted architectures –depicted as landscape or architectural settings within the twenty-eight scenes of the cycle– do not perform a passive role. Instead, they function as active narrative devices, contributing significantly to the construction and interpretation of the visual narrative.

The research project presented here proposes an innovative reading of the fresco cycle, focusing on the analysis of the depicted spaces and settings, and offering a new interpretation of the representations of interiors, architecture, and urban environments in light of the technical and scientific knowledge developed during the Middle Ages, grounded in classical tradition. These representations serve as a visual summary of the architectural innovations of their time and can be interpreted today as a true treatise on medieval architecture in images. In addition to explicit references to the constructive aspects of the depicted architectures, allusions to major building sites then active in central Italy can also be found, such as the façades of Orvieto Cathedral and

Fig. 1. Interior of the Upper Basilica of St. Francis, Assisi (fotos by Stefano Bertocci).



that of the Baptistery of Siena Cathedral. Within this context, drawing—understood both as the graphic operation of the fresco painter and as an analytical tool enabled by digital surveying—plays a central role in the critical understanding and interpretation of the work.

The study presented here thus constitutes an initial reflection within a broader research project based on the acquisition of a high-accuracy digital survey of the interior surfaces of the Upper Basilica of Assisi. The project aims to analyze the fresco cycle of the *Stories of Saint Francis* not only as an ordering principle of architectural space, but also as a key to understanding the epistemic and communicative value of drawing itself, as a mediator between design thinking and figurative narration.

The work under examination lends itself to a stratified interpretation articulated across multiple levels of architectural representation. The first level concerns the painted architectural framework that encloses the pictorial cycle, characterized by twisted columns and painted architraves that serve both as an organizing structure for the scenes and as a mediating element between the real architectural framework and the narrative fiction. The second level consists of the architectures and landscapes depicted within the individual scenes, which shape the figurative space by defining visual hierarchies and symbolic meanings.

Particularly significant in this regard is the fourth episode of the cycle, *The Prayer in San Damiano*, where, through the expedient of architectural ruin, the represented building is opened in an almost axonometric section that reveals its internal structure and constructive principles. This visual language anticipates the use of architectural section as both a technical and narrative instrument. From this perspective, the *Stories of saint Francis* cycle not only highlights the expressive potential of architectural structures as ordering principles of both real and pictorial space but also enables a deeper reflection on drawing as a vehicle of knowledge, a tool for critical analysis, and a bridge between design imagination and iconographic representation.

Methodology

The study of the fresco cycle of the *Stories of Saint Francis* in the Upper Basilica of Assisi was conducted using a consolidated, integrated research methodology that combined digital survey tools with graphic analysis techniques. The objective was to provide a comprehensive critical reading of the

frescoed surfaces, the architectural context in which they are set, and the relationships between the two.

The data acquisition phase employed a combination of laser scanning and photogrammetric surveying to collect both metric and morphological data, as well as chromatic and material information. This synergy enabled the creation of a high-resolution three-dimensional model of the basilica's nave, serving not only as precise geometric documentation but also as a reference framework for calibrating the photogrammetric models of the painted surfaces. The high-definition photographic mapping produced highly accurate models of the frescoed surfaces, correctly oriented and scaled with respect to the architectural survey, thus ensuring the metric and spatial coherence of the entire system.

Following the digital survey campaign, to develop a reliable digital reconstruction of the decorative apparatus, the vectorization of both the pictorial decoration and its architectural context was undertaken [Parrinello, La Placa 2019], which was fundamental for the subsequent analytical phase (fig. 2).

Fig. 2. Example of the digital survey of the Upper Basilica of Assisi, obtained through laser scanning and integrated with photogrammetric data, focusing on one of the bays (graphic elaboration by Roberta Ferretti).



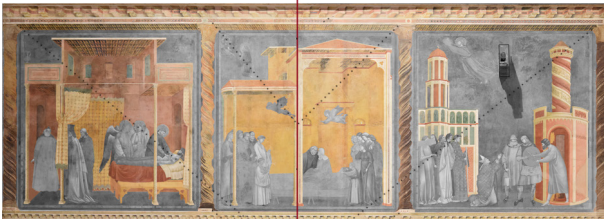


Fig. 3. Perspective with vanishing axis: at the top, an example from the excavations of Oplontis, Villa di Poppaea; at the bottom, a bay of the Upper Basilica of Assisi with the three panels of the false loggia with perspective interpretation (graphic elaboration by Roberta Ferretti).

Through the medium of drawing, it was possible to analyze the compositional criteria adopted by the artists, the geometric matrices underlying the spatial organization of the scenes, and the optical and perceptual devices employed to confer three-dimensionality and depth to the painted architecture. The entire frescoed surface was then examined according to a stratified logic, organizing the information into different interpretative layers that reveal the internal coherence and complexity of the figurative project. A first level concerns the definition of the decorative framework, a painted architectural setting that frames individual scenes. A second level includes the narrative

scenes themselves, along with the landscape and figurative elements, articulated within the established frames and engaging in a dialogue with the real space of the basilica.

The critical analysis of the frescoes was conducted through an integrated approach that considers the multiple layers of meaning within the work. Particular attention was given to the iconography and figurative and architectural models of reference, the composition of pictorial space and the distribution of figures within the scenes, the methods of spatial representation, and the role of color in shaping form and defining volume.

This methodology –based on the integration of digital surveying, graphic restitution, and interpretative analysis– has enabled moving beyond mere documentation, achieving a deeper understanding of the technical and design structures underlying the fresco cycle. It reveals the work's nature as a narrative and spatial device fully integrated with the architecture itself.

Spatial Strategies in the Painting of the Basilica of San Francesco in Assisi

The analysis of the decorative apparatus of the Upper Basilica of Assisi requires, first and foremost, a careful examination of the architectural structure that frames the scenes of the fresco cycle, of the iconographic and formal models that guided its conception, and of the representational strategies adopted to construct a complex effect of spatial depth and coherence. The nave of the Basilica is divided into four bays covered by ribbed cross vaults, supported by clustered pillars that rhythmically articulate the vast surfaces of the lateral walls. The decoration is organized into three registers: the stories of the Old and New Testaments unfold in the two upper tiers, while in the lower one, the *Stories of saint Francis* are depicted beneath the ambulatory, on a high base projecting slightly from the wall of the nave. The lowest section is adorned with a painted curtain motif –like those found in the choir and transepts– which visually introduces the narrative sequence above. Framing the twenty-eight scenes is a sumptuous painted architecture: a monumental colonnade with twisted columns, surmounted by a richly decorated frieze, supports a coffered architrave, which in turn is topped by painted corbels that illusionistically sustain the upper frame, marking the upper boundary of the pictorial field. This refined formal invention –alternating the continuity of horizontal

lines with the solemn vertical rhythm of the columns—constitutes the key to interpreting the overall structural conception of the decorative cycle [Gioseffi 1963].

A significant point of comparison in this regard is offered by the mosaic cycle of the dome of the Baptistery of San Giovanni in Florence, executed between 1225 and 1330. In that context, the structured use of architectural frameworks is particularly evident: the scenes are organized into distinct panels, delimited by columns that divide the space according to an orderly compositional logic, thereby imparting a regular, coherent rhythm to the visual narrative. Equally relevant examples can be found in monumental painting. Among these are the cycle of San Crisogono alla Cafferella and the twisted columns and perspectival corbels in the area attributed to Consolo in the decoration of the *Sacro Spedo* at Subiaco [White 1971]. A particularly significant precedent that may have influenced Giotto's spatial organization of the nave paintings is the framing of the narrative scenes executed by Cimabue in the transept of the same Upper Basilica. From these, Giotto seems to have adopted the corbel model for his own compositional structure.

However, the illusionistic quality of Giotto's nave bays marks a decisive departure from these precedents. It is sufficient to compare the regular, oblique, and symmetrically parallel alignment of Cimabue's corbels—which converge at the midpoint in a form of reversed perspective—with the far more convincing sense of depth achieved by Giotto through the masterful use of one-point perspective. This use generates a 'spatial array' effect, articulated by the same corbels and the underlying coffered ceiling, resulting in a coherent and dynamic illusion of architectural space [Gioseffi 1963].

The use of painted architectural elements thus does not respond solely to compositional needs; it also introduces an illusionistic dimension that transforms the wall surface into a rhythmically organized space, suggesting an analogy with the real architectural articulation and creating a filter between the actual architecture and the individual scenes, which follow their own internal logic.

In this context, the division of the pictorial space and the perspectival management of the bays play a crucial role in defining the sense of depth and reorganizing the visual space within the nave. The artist does not passively accept the spatial segmentation created by the intercolumniation; this becomes evident in the analysis of the perspectival construction, which, rather than treating the nave as a

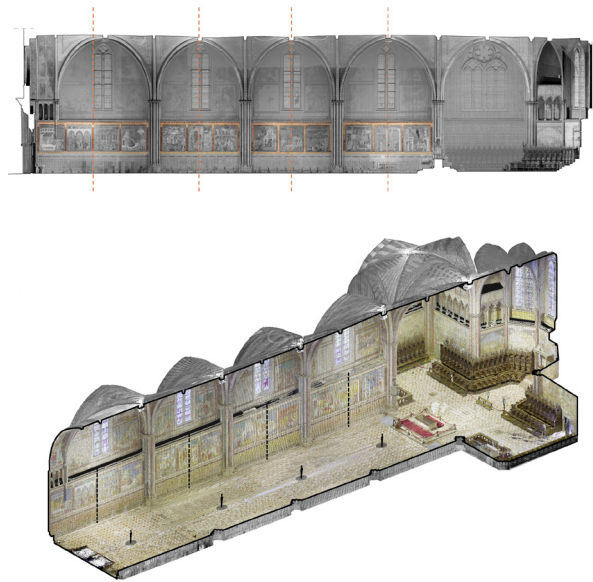


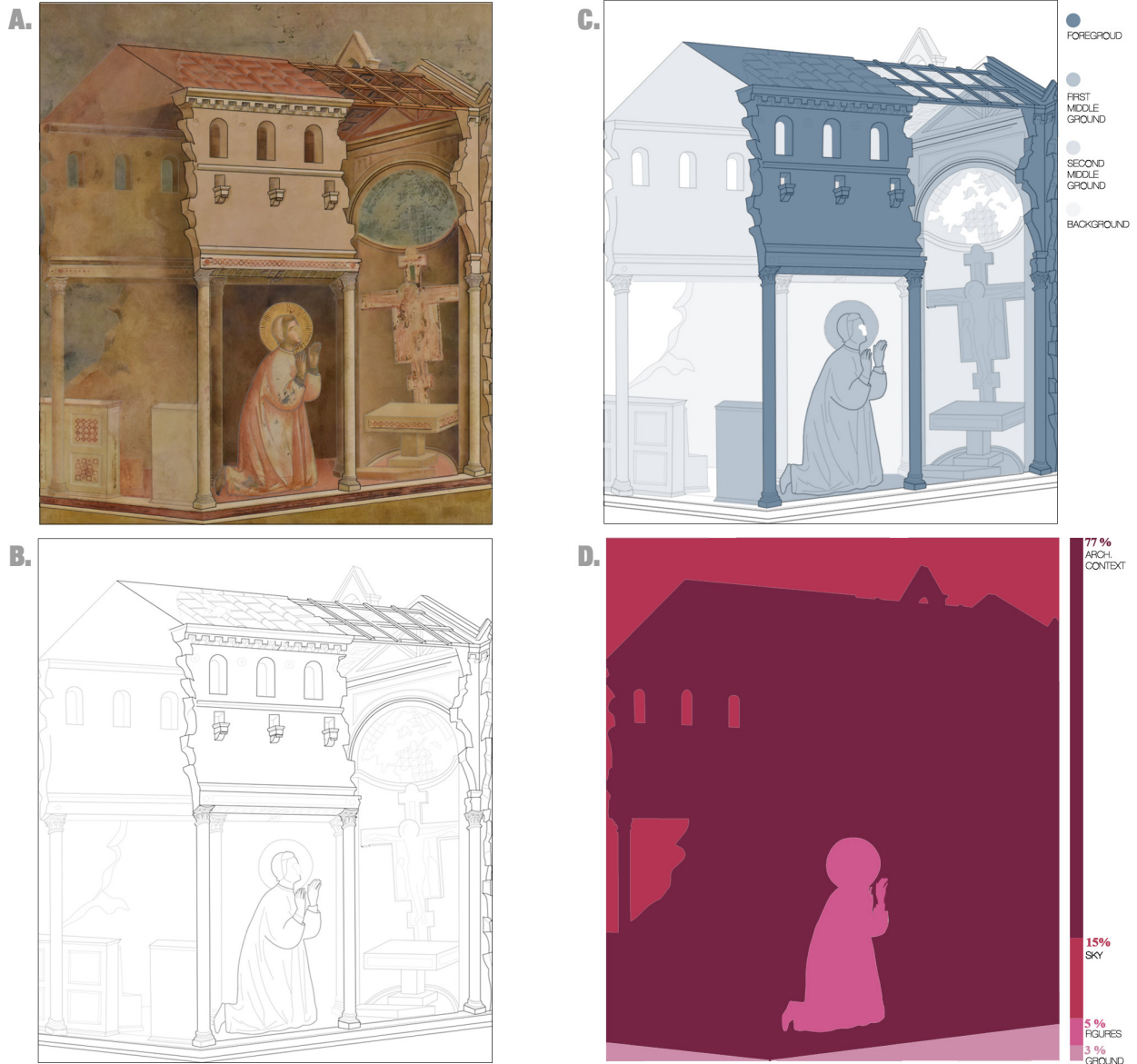
Fig. 4. At the top, processing of the longitudinal section of the Upper Basilica's interior from a point cloud, with interpretation of the organization of the Saint Francis fresco cycle; at the bottom, an axonometric section with a schematic representation of the observer's stopping points suggested by the position of the vanishing axes (graphic elaboration by Roberta Ferretti).

single unified space, assigns each bay its own distinct focal point [Gioseffi 1963].

In each bay, all orthogonals relative to the bases and capitals of the columns, the coffered ceiling, and the projecting elements of the upper and lower frames converge in parallel perspective toward the central axis of that specific bay. The representational technique employed here is known as 'vanishing axis perspective' [White 1971] or 'herringbone perspective' [Panofsky 2013], typical of Roman painting (fig. 3), particularly the Second Pompeian Style, in which all orthogonal lines to the picture plane converge toward points placed along a single central axis within the composition.

This construction signals a profound shift from Cimabue's model, in which, as noted, the orthogonal lines were directed outward. The sense of realism is further reinforced by the artist's conception of the entire composition as if viewed from below, in accordance with the actual position of the observer.

Fig. 5. Analysis of the Prayer at San Damiano episode: a. orthographic image of the scene; b. wireframe reconstruction; c. interpretation of the depth planes of the perspective box; d. quantitative assessment of the figurative and architectural components of the scene (graphic elaboration by Roberta Ferretti).



To fully grasp the significance of treating each bay as an autonomous spatial unit, the viewer must not limit themselves to following the narrative or appreciating the formal play of an individual fresco; instead, they must perceive each bay both as an independent unit and as an integral part of a larger decorative system, interacting with adjacent and opposite bays across the open space [White 1971]. This mode of representation encourages the observer to pause at the center of each bay, thereby structuring the work's experience into distinct moments that simultaneously highlight the compositional autonomy of individual scenes and the narrative coherence of the entire decorative cycle (fig. 4). A detailed examination of individual scenes reveals diverse strategies for spatial representation. Traditionally, art-historical scholarship [1] has focused primarily on the figurative component, while paying comparatively less attention to the landscape, urban, or architectural contexts that frame the action. For this reason, our investigation has specifically concentrated on the analysis of the background settings, understood as the scenography context in which the narrative unfolds, to explore their function and impact within the overall composition. From this perspective, the innovative significance of the so-called "Gothic realism" becomes particularly evident, especially in the careful contextualization of certain highly impactful scenes: among these are *The Expulsion of the Devils from Arezzo*, *The Homage to the Simple Man*, in which the Temple of Minerva in Assisi's Piazza del Comune is depicted, *The Prayer at San Damiano*, *The Stigmata* episode set at La Verna, *The Verification of the Stigmata* within the Porziuncola, and *The Dream of Innocent III*, featuring the Lateran Basilica supported by the saint. In all these cases, the precise and objective rendering of the environments enhances the narrative's verisimilitude. It appears intended to encourage pilgrims to visit Franciscan sites, thereby offering an opportunity to symbolically relive those specific spiritual experiences [Bertocci 2024a]. The episode of *The Prayer at San Damiano* [2] is rendered by Giotto as a pictorial scene of extraordinary narrative intensity and formal innovation. The setting depicts a church in a state of ruin, with partially collapsed walls and roof, within which the saint is shown kneeling in prayer before a crucifix placed on a small altar, situated within a semicircular apse. This scene assumes particular significance because, as Francesco Benelli [Benelli 2012] has emphasized, it marks the first instance –likely within the broader context of Italian painting– of representing a sacred building in a state of ruin.

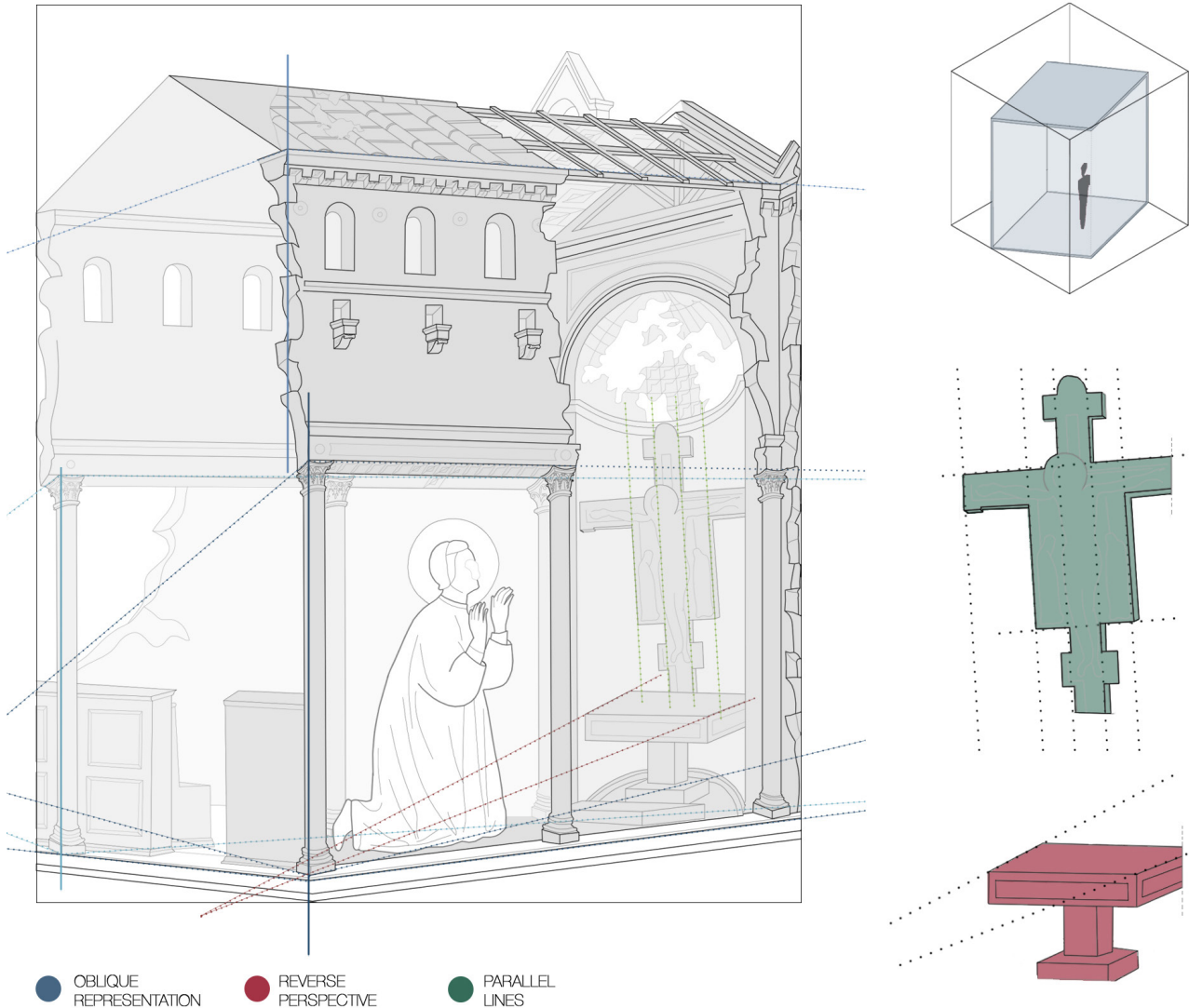
This iconographic device was subsequently adopted both by Giotto himself and by other artists, becoming a recurring expressive element.

Regarding the painted architecture, the depicted building does not constitute a faithful reproduction of the Church of San Damiano. In particular, the representation clearly shows a three-nave configuration, as indicated by the openings for roof beams in the lateral aisles. This iconographic choice diverges from the actual structure of the church, which at the time consisted of a single nave covered by a pointed barrel vault, with lateral chapels added only later, in accordance with standard practice in Franciscan architecture [Bertocci 2024b].

From a typological point of view, the building depicted in the fresco *The Prayer at San Damiano* accurately represents the ecclesiastical typology characteristic of the twelfth and thirteenth centuries. The artist demonstrates a precise understanding of the architectural features of the period, faithfully rendering formal and constructive elements that reflect real models of the Romanesque and early Gothic contexts. In particular, the structural solution, based on columns surmounted by an architrave –here enriched with Cosmatesque decoration– is consistent with the architectural practices of the time, reflecting a structural conception still rooted in the Romanesque tradition. This is further confirmed by the presence of three single-light windows providing illumination to the central nave. Such a configuration is found in several reference buildings, including the Roman Basilicas of Santa Maria Maggiore, San Lorenzo Fuori le Mura, and Santa Maria in Trastevere, which served as typological models for many churches constructed between the twelfth and thirteenth centuries, especially in central Italy.

Benelli further observes that, in this instance, the church is not depicted solely as a ruin but rather as a building arbitrarily disassembled for narrative purposes. The ruined elements are strategically selected to make the other subjects in the scene, in particular the human figure and the crucifix, visible. The intact portions of the building nonetheless contribute to maintaining the verisimilitude of its structural stability. Particularly significant is the treatment of the roof, generally the first architectural element to collapse and thus the quintessential symbol of ruin, which here is represented as partially intact. At the same time, the other half reveals the wooden truss structure. This iconographic solution, rather than documenting an actual state of decay, anticipates the modern principle of axonometric cutaway

Fig. 6. Analysis of the methods used to represent pictorial space. Highlighted: the overall spatial scheme, a detail of the cross depicted with parallel lines, and the altar represented using reverse perspective (graphic elaboration by Roberta Ferretti).



representation with detailed exposure of the roof structure and provides essential information about contemporary construction practices. Continuing the analysis, four distinct planes of depth can be identified within the pictorial scene (fig. 5c): the first, third, and fourth planes comprise the walls delimiting the three naves of the church, while the figure of the saint in prayer, the altar, and the crucifix occupy the second plane. Another particularly significant analytical approach explored in this context involves the quantitative assessment of the frescoed surfaces (fig. 5d), subdivided into figures, background, ground, and architectural context. This numerical data allows for a reevaluation of the artist's investment in the overall rendering of the figuration and underscores the scenic context's increased prominence within the pictorial composition.

For the building that occupies nearly the entire surface of the scene, the artist adopts a composition corresponding to the typology of the 'oblique representation' [3]. The structure is arranged diagonally relative to the picture plane, with an angle facing the viewer frontally, simultaneously revealing two principal sides in rapid perspective recession [White 1971].

This configuration accentuates spatial depth and endows the scene with greater plasticity, marking a significant departure from the frontality characteristic of the Byzantine tradition. The structure, depicted in a state of ruin through calibrated compositional cuts and perspectival glimpses, does not merely facilitate the legibility of the scene but reflects an advanced level of reflection on the construction of pictorial space. John White [White 1971] interprets this choice as the onset of a new phase in the history of empirical perspective, indicative of a growing interest in direct observation and a more naturalistic rendering of visual experience.

The predominant structural element in this representation is the building's corner vertical, which functions as the organizing axis of the composition and as a spatial reference point. As Decio Gioseffi [Gioseffi 1963] observes, the scene constitutes a unique instance in Assisi, being the only 'spatial box' represented in oblique perspective; a solution that, although common in depictions of objects or structural masses conceived as blocks, is unusual when applied to an exterior-interior architectural environment designed



Fig. 7. Photograph of the half-column interested by the painted false architectural frame: at the top, seen from outside the privileged viewpoint; at the bottom, seen from the privileged viewpoint (fotos by Stefano Bertocci).



as a spatial container. This visual approach seems to reflect, albeit intuitively, the principles of the ancient optic-geometric tradition as formulated by Vitruvius in the context of architectural representation [4].

Supporting the coexistence of elements from previous traditions with formal innovations in representation, the scene employs 'reverse perspective' [Florenskij 1990] to depict the altar. In this instance, parallel lines that lie outside the picture plane and would typically converge toward the horizon instead diverge. This technique, typical of Byzantine and medieval traditions, does not respond to mimetic concerns but reflects a symbolic conception of space, reserved for the depiction of elements connected to a transcendent dimension, thereby emphasizing their intangibility and sacredness. In contrast, the crucifix is rendered through a system of parallel lines, a form of axonometry employed throughout the cycle for inclined objects. The coexistence within the scene of an empirically oriented representation for the building and a symbolic representation for the altar reveals the complexity of Giotto's pictorial language, suspended between the observation of the sensible world and the aspiration toward the transcendent (fig. 6).

Conclusions

It has been observed that Giotto, particularly during his stay in Rome, may have assimilated optical theories derived from both philosophical and scientific thought, inaugurating a new conception of represented space [De Rosa et al. 2000]. In the Middle Ages, optics –still primarily based on the theories of Euclid and Ptolemy– was reworked by Islamic and Latin scholars according to a geometric model of vision grounded in the rectilinear propagation of light. For Euclid, the eye represents the apex of a visual pyramid, whose rays extend toward the object being observed; the apparent size of objects depends on the angle of vision and is inversely proportional to the distance from the observer. With Robert Grosseteste and Roger Bacon, light acquired a universal and mathematical significance: it propagates according to lines and geometric figures, and its effects are measurable. Bacon formulated the principle that the intensity of visual perception is realized along a straight line,

Fig. 8. Detail view of the decoration on the sub-arch extending over the circular buttress. Chapel of the Magdalene, Lower Basilica (fotos by Stefano Bertocci).

consolidating the idea of a space governed by proportional laws [Carlevaris 2024]. The treatises of John Peckham and Witelo, available in various Franciscan libraries in central Italy, solidified the concept of *perspectiva naturalis*, which interprets vision as a measurable physical phenomenon [5]. The analysis of the Assisi fresco cycle demonstrates that, beyond the narrative scenes themselves, even minor details contribute to integrating the decorative apparatus with the basilica's architectural structure. These observations appear to corroborate the hypothesis that the fundamental geometric principles underlying Giotto's compositions –the rectilinearity of light propagation, the concept of the visual pyramid, the proportionality of object sizes relative to the observer's distance, and the practical geometry of abacus schools– are essential elements of the new pictorial culture. These principles enabled the construction of a coherent space that serves the narrative of saint Francis's life. Giotto thus developed a novel approach to representing reality, grounded in optical and geometric relationships that actively engage the medieval viewer –pilgrim or devotee– in the dialogue between the Gothic environment and religious content.

Particular attention is warranted for the first bay adjacent to the entrance, where the artist does not adhere to the actual architectural partition between the narrow barrel-vaulted pseudo-narthex and the first groin-vaulted bay, instead unifying the two spaces pictorially into a single environment perceived by the visitor as central and intimate. In this space, scenes are arranged four per side, unlike the tripartite groups in the other bays. The colonnade's perspective reflects this organization, with a central twisted column occupying the middle of the fictive portico rather than leaving the central bay empty, as in the others. Giotto's perspectival performance engages not only flat surfaces

but also three-dimensional architectural elements, such as the semi-column separating the two bays: here, the painted architectural frame extends across the semicylindrical surface emerging from the wall, executed to appear straight to an observer standing at the center of the bay (fig. 7), while its lower portion seems to be rendered as the sky of the scene below. This anticipates anamorphic effects that would be widely developed from the Late Renaissance to the Baroque [Aterini 2012]. In the Lower Basilica, restructured and redecorated in the early fourteenth century, further examples of such techniques can be observed, aimed at 'correcting' spatial perception – for instance, in the intrados decorations of the passageways connecting to the Maddalena Chapel (fig. 8). Specifically, the passage leading to the right arm of the transept features a complex decorative band on the intrados, which continues anaphorically deformed over the base of the large cylindrical buttress, offering the observer positioned on the altar side a continuous visual alignment of the arch. Giotto's attention to the overall effect of the work, as well as its relationship with the enclosing architecture, is also evident in the impressive decoration of the transept vaults, where the theme of the apotheosis of saint Francis unfolds, as well as in minute details such as the painted bench on the southern transept wall, which appears to emerge from the surface of the wall surface, covered with soft fabric, thereby invading the real space in an illusionistic manner. Such effects confirm what Giovanni Boccaccio, in a *novella* from the Decameron, attributes to one of his characters: "Giotto was so excellent with that [...] he, with his style and pen and pencil, would depict its like on such wise that it shewed not as its like, but did often err in regard thereof, mistaking for real that which was painted" [Boccaccio 1930, p. 74].

Credits

Stefano Bertocci authored paragraphs *Introduction* and *Conclusions*; Roberta Ferretti authored paragraphs *Methodology* and *Spatial Strategies in the Painting*

of the Basilica of San Francesco in Assisi. We wish to thank the friars and the technical office of the Sacro Convento of Assisi for their kind assistance.

Notes

[1] Vasari, in his *Vite*, reports that Giotto was summoned by Giovanni di Minio da Morrovalle, who served as general of the order from 1296 to 1304; however, the traditional attribution of the fresco cycle to Giotto had already been questioned at the beginning of the twentieth century. More

recent studies, conducted following the 1997 restoration of the Basilica of Assisi, have reopened the issue of attribution [Fry 2008]. For this study, the individual hand responsible for executing the frescoes is not considered a significant factor; accordingly, throughout the discussion, reference will

be made to the author or authors of the work as “Giotto and his workshop”.

[2] Taken from the second chapter of the *Legenda Maior* of Saint Francis, this episode marks a pivotal moment in the saint's biography: his spiritual conversion. According to tradition, the miraculous encounter with the crucifix occurred in the small church of San Damiano in Assisi.

[3] This type of representation has also been termed a ‘corner view’ (*visione d'angolo*) by Erwin Panofsky [Panofsky 2013].

[4] As Migliari and Fasolo [Migliari, Fasolo 2022] observe, Vitruvius' distinction between *ichnographia*, *orthographia*, and *scaenographia* reflects an articulation of architectural drawing based on different

perceptual modes. Specifically, *ichnographia* describes the plan layout of a work, *orthographia* conveys its frontal elevation. At the same time, *scaenographia* appears to allude to a three-dimensional representation without a vanishing point, akin to what is today referred to as axonometry.

[5] In the Renaissance, one witnesses a shift from *perspectiva naturalis* –an inheritance from the medieval tradition, grounded in the study of direct and reflected vision– to *perspectiva artificialis*. While *perspectiva naturalis* investigates the mechanisms governing the formation of diminished images of objects, *perspectiva artificialis* emerges as the discipline concerned with their representation. For a detailed discussion of this distinction, see Luigi Vagnetti *De naturali et artificiali perspectiva* [Vagnetti 1979].

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