



Architectural Perspective Between Image and Building

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Abstract Perspective is an important example of “cultural heritage” in Western figurative culture. This issue provides an overview of the applications of perspective to architecture and their current validity in design. The sequence of topics underlines the relationships between historical literature and coeval realisations, and the connection with other applications, such as cartography. The affirmation of a shared rule of perspective was the result of a long process of practical experimentation. The starting point was the classical principles of optics in the applications to the wall paintings of Pompeii, where the fascinating story of architectural perspective began. Thus, in this context, the term ‘architectural perspective’, also refers to the set of perspective constructions realised on the surfaces of a wall or room to simulate a different space than those actually built. Several “real scale” examples document the broad experimentation of projective devices in which the image interacts with the space and representation becomes architecture, offering suggestions are still valid today for its possible applications in design.

Keywords Architectural perspective · Interior decoration · Anamorphosis

Introduction

The culture of perspective constitutes a scientific patrimony of indisputable technical value. Because of its profound roots in the visual arts and the numerous practical applications it has enjoyed over the course of centuries, it permeates Western figurative culture, for which it serves as an important point of reference and on which it bestows a character that is unifying and distinctive. It aptly expresses the

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capacity to conceive knowledge as the fruit of speculation based on the observation of physical reality and not as divine revelation, a conception that developed from the thinking of the philosophers of the Greek world, who sought in mathematics the possibility of explaining the laws of physical reality made of space and time, in order to re-elaborate them in practical applications for the benefit of technical progress (Penrose 2004).

Perspective is certainly not a new topic. A rich bibliography includes research on its mathematical essence, the role it has played in the representation and history of architecture, its use in theatres and the various projective applications to measurement and representation of surfaces. We might ask why we need a collection of studies devoted to architectural perspective, culminating in the phenomenon of *quadratura*, a technique that appears to be unique to Italy and was very widespread there between the sixteenth and eighteenth centuries (Farneti and Lenzi 2004, 2006).

As a scientific topic in general, perspective traditionally involves various disciplines that are easily distinguished by the specific nature of their approaches. Art history, mathematics, descriptive geometry, drawing, architecture, stage design and other more technical fields of knowledge have applied geometric principles to the solution of practical problems such as architectural photogrammetry and cartographic representations. Since its theorisation at the dawn of the Renaissance, thousands of pages have speculated about and then proven the mathematical bases, forming a valuable body of technical-scientific literature, and then described and explained the applications to drawing and architecture, studying the works and treatises in a historical-critical body of literature that is so ramified that it might lead us to think that there can be nothing new to say (Andersen 2007).

This is not the case: the topic continues to attract scholars for various disciplines, constantly revealing new aspects with respect to both traditional approaches and possible applications to design. Digital representation, which appeared set to render the methods of descriptive geometry obsolete, and to replace the hand-drawn perspective representations of mathematically measurable space with virtual simulations of reality, has resulted in a leap forward in the quality of studies on perspective. In fact, digital tools have made it possible to verify, thanks to rigorous examinations of works, how in the past the geometric knowledge of artists paved the way for technological innovations by means of experimentation in architecture (Field 1997). This justifies our decision to devote an entire issue of the *Nexus Network Journal* to architectural perspective, even though numerous articles have dealt with similar arguments and, 13 years ago, in April 2003, another issue was dedicated more generically to perspective ('Perspective and Optics', *Nexus Network Journal* 5(1), 2003, guest edited by David A. Vila Domini).

A Brief Description of Perspective in General

Based on the application of elementary geometric constructions (*perspectiva artificialis*) that reconstruct the process of the formation of the visual image (*perspectiva naturalis*), perspective was born for the pictorial (two-dimensional)

representation of (three-dimensional) space (Damisch 1994). A felicitous marriage of art and science, it produced technical applications in other contexts as well, from architecture to theatre, not to mention cartography. The delicate balance between theoretical knowledge seeking an absolute truth and the empirical know-how of craftsmen produced an inestimable artistic patrimony in terms of both quality and quantity, flanking the practical applications that fostered technical development, guaranteeing the old continent's technological supremacy for centuries.

The codification of a univocal rule for representing spatial depth in a way that conformed to the visual image of three-dimensional reality is attributed to Filippo Brunelleschi and associated with the beginning of that profound cultural renovation that in the space of a few decades would have determined the advent of a new era. In reality, the discovery of perspective was not a sudden discovery, but an achievement gained after a slow development, the result of the search for expressive means from the fourteenth-century Tuscan painters who, following in Giotto's footsteps, had looked at the representation of depth in pictorial images in a more naturalistic way, up to the sensational empirical proof provided by Brunelleschi's two tables, now unfortunately lost but described by his friend and biographer, Antonio di Duccio Manetti (Kemp 1992).

In the course of the fifteenth century perspective spread rapidly throughout Italian courts, accompanying a new way of conceiving visual space, which had become an object that could be measured by geometry, and thus architecture. Then, the events that shook the history of the modern world—global navigation and the discovery of new continents—facilitated the spread of the knowledge of perspective into the new centres of political and economic power in the coastal countries of the Atlantic, and its application to the solution of concrete problems, such as map projections. Meanwhile, in the small Italian dominions techniques of perspective tied to architecture, such as *quadratura* and theatre scenography, flourished. Perspective thus spread through the entire Western world as the legitimate geometry of the visual image that guaranteed the rational representation of space that was real, measured and measurable, becoming the dominant trait of the visual communication that was one of the primary didactic tools of the Counter-Reformation.¹

Thanks to the mathematical proofs of its principles, perspective enjoyed noteworthy applications (Field 1997). Some of these had an influence on technological and economic development in Europe, such as the practical solution to technical problems related to the measurement of distances and the representations of double-curved surfaces on two-dimensional maps, required by modern powers to control the seas following the transfer of the centre of political interest from the Mediterranean to the Atlantic. The rise of the great colonial powers contributed to the spread of perspective, which expressed the Western approach to knowledge, characterised from the Classical age was by its capacity to ally itself with technology, fostering the technical progress that for many centuries, for better or worse, remained the distinguishing trait of the Western world.

¹ In Baroque art, architectural perspective played a leading role in the religious debated between the Reformation and the Counter-Reformation; see (Dalai Emiliani 1980).

Establishing itself as a form of knowledge that provided the arts with a cohesive and organic scientific basis, perspective is an expression of the shared patrimony of Western scientific culture, and the charged character of its visual tradition, while assuming recognisable and specific connotations in various countries.

Architectural Perspective

With the term ‘architectural perspective’, or *quadratura*, we are referring to the set of perspective constructions realised on wall and ceiling surfaces to simulate diverse spaces (generally more extensive ones) than those actually built, thanks to the possibility to measure and represent depth of space in a illusory way, playing with trickeries of perception (Valenti 2014). The ‘deceptive’ use of perspective is a consequence of the geometric control of space in the configuration of spaces that are ephemeral or false, in which physical space defined by the construction is integrated with that represented by the two- and three-dimensional decoration, extending the visual perception beyond the physical limit of the wall. The application to architecture crosses over the simple representation of space to involve the spectator by means of a procedure that is controllable and designed, destined to pave the way to theatrical stage techniques, in which, however, the perspective apparatus dilates the space without deceiving, because in the theatrical tradition the falsity is obvious: the space of the scene is one that is evoked more than simulated.

The point of departure for the realisation of these architectures painted full-scale on the surrounding surfaces, in which the pictorial-plastic decoration of the interiors creates the visual space that is integrated with the one that is constructed, lies in the research of the painters who, at the end of the 1300s, found a way to measure space in order to represent its depth. The geometric matrix is identical, but what differs are the aims and relationship with the spectator and with the architecture that contains the virtual space.

Architectural perspective was born from the creation of a relationship that is geometrically defined, and thus measurable, between the space that is perceived and the space that is real. Perspective drawing is the tool that defines the space in which the painted image melds with the surrounding surfaces thanks to a preliminary, unitary design. The decoration becomes a ‘constructive’ element of the architecture and not simply the ornamentation of the wall. In other words, the perspective representation is not a mere image, but becomes architecture.

The concrete examples document the broad experimentation of projective devices in which the image interacts with the space thanks to stratagems that are still valid today for possible applications in design. Ultimately, architectural perspective makes evident the relationship that ties architecture to mathematics, interpreting in an exemplary way the essence of the special connection between architecture and mathematics that forms the subject of the *Nexus Network Journal*.

Before the flowering of *quadratura*, the use of perspective as a ‘constructive’ element of illusory spaces fused with the architecture proper was latent in daring creations of the late 1400s—Bramante’s false choir of the church of Santa Maria presso San Satiro and Leonardo’s refectory in Santa Maria delle Grazie, both in

Milan—and had other surprising manifestations in Roman Renaissance works, such as the Gallery of Palazzo Spada. Later it would emphasise the scenographic conception of Baroque architecture, paving the way of the perspective stage designs of the modern theatre.

Throughout Italy we find a surprising concentration of such creations, some of which are of remarkable complexity and importance. In spite of the high number of publications on perspective, there is no systematic study of the architectural perspectives and the applications originating in perspective that demonstrate the inventive skill of the painters and their leading role in the technical progress of the modern world. The fragmentation of studies does not promote the comprehension of the true importance of perspective and the need to address the study as an organic and transversal manifestation. The substantial number of works and their experimental nature comprised in this pictorial-architectural patrimony in Italy, suggests the need for an investigation into the reasons why it was so specific to Italy; the fact of this specificity is confirmed by the various theoretical re-elaborations and practical applications that perspective enjoyed in the various linguistic-cultural contexts of the old continent and beyond. Extensive research into the Italian patrimony² documents the transversal nature of perspective as a problem-solving instrument for architectural problems, and effectively silences the accusations that the topic is exhausted and obsolete. The broadening of such studies to other countries facilitates the comparison between the developments of perspective in mathematics and applied sciences in the different cultural areas.

Introduction to Papers in this Issue

The contributions collected in the issue provide an overview of the interest in the applications of perspective to architecture and their current validity in architectural and stage design.

The sequence of topics underlines the relationships between historical literature and coeval realisations, showing the connection with other applications of a more technical interest, such as cartography. The readings and surveys of the works document the co-existence of different procedures. At the same time we can understand how the affirmation of a shared rule was the result of a long and difficult process that took as its starting point the classical principles of optics in the applications to the wall paintings of Pompeii that so animated the debate on perspective (Panofsky 1927).

Between the lines we can read the existence of a guiding thread that goes through the centuries with the awareness that many of the tools for surveying and representing that we use today are the fruit of the development of studies based on perspective, giving rise to new and interesting research projects.

² This special issue flanks and extends to the international scientific community the investigations carried out in recent years in the context of university research funded by the Italian Ministry for the University and Scientific Research (MIUR), coordinated by Prof. Riccardo Migliari of the University of Rome 'La Sapienza', with the participation of other universities that also included non-Italian scholars. See (Valenti 2014).

In the paper entitled “Real and Illusory Architectures in the Pompeian Frescoes” Barbara Messina and Maria Ines Pascariello examine the importance of painted architecture in the wall paintings of Pompeii, in which recurring elements imply the use of a geometric rule for the representation of depth. This finds a possible explanation in an interesting Spanish manuscript of 1688 by an unknown author cited in the article by José María Gentil Baldrich and Andrés Martín-Pastor, “Singularities of Perspective in Spain: The ‘Other Treatises’ on Perspective and Their Importance within the European Context”. This paper compares some of the practical rules contained in little-known documents, including the anonymous manuscript, documenting the knowledge in Spain of a geometric rule for perspective and its applications as late as the sixteenth century.

Fabrizio Agnello examines the theme of perspective decoration on the curved surfaces of vaults, a central problem of the decorative experiments of *quadratura*. His “Perspective on Curved Surfaces in the Age of Pozzo: The *Nuova Pratica di Prospettiva* of Paolo Amato” offer an interesting proof of Amato’s theories, based on an accurate survey that documents the painters’ high level of technical expertise.

João Pedro Xavier and Joao Pedro Cabaleira also address the relationship between rule and practice, this time in Portugal, analysing the procedure used by painter Gonçalves in his *quadratura* composition on the ceiling of the church of the Jesuit College in Santarém, which appear to reprise principles found in the 1693 treatise by Pozzo entitled *Perspectivae pictorum et architectorum*. Their paper, “Projecting an Architectural Perspective: Euclidean Propositions and Common Practices at Gonçalves Sena’s Workshop”, places the accent on the technical knowledge necessary for the design and execution of such a work, illustrating the geometric procedures and their practical application.

In “Perspective, Cartography and Dynamic Notions: From the Plane *Bozzetto* to Solid Perspective in Two Examples in Tuscany”, Nevena Radojević re-examines the subject of the projection drawings onto curved surfaces, analysing two examples that document the mastery of projective procedures and the close relationship between the decoration of vaults and apses and cartographic projections.

Two articles in this issue offer insights into the works of the Galli Bibiena family, which represent the acme of perspective research in Italy between *quadratura* and scenography. In “Architecture and Perspective in the Illusory Spaces of Ferdinando Galli Bibiena” Alessandra Pagliano shows the effectiveness of the devices introduced by the most famous member of the family, analysing in particular some of the perspectives present in his treatise of 1711, *L’architettura civile preparata su la geometria e ridotta alle prospettive*. Stefano Chiarenza, in “Architecture and Perspective in the Set Drawings of the Galli Bibiena” looks more in general at the role of various members of the family, concluding with the reverse perspective analysis of a drawing by Giuseppe Galli Bibiena today conserved in the Metropolitan Museum in New York.

Aleksandar Čučaković and Marijana Paunović bring us up to contemporary times with their paper ‘Perspective in Stage Design: An Application of Principles of Anamorphosis in Spatial Visualisation’, which documents what is happening today in applications of perspective in theatre practices.

‘Anamorphic Experiences in 3D Space: Shadows, 3 Projections and Other Optical Illusions’ by Ioanna Symeonidou addresses the topic of anamorphosis in the design of urban installations, while Vesna Stojakovic and Bojan Tepavcevic, in ‘Distortion Minimization: A Framework for the Design of Plane Geometric Anamorphosis’ quantify the perceptive tolerance as the spectator moves from the privileged viewing point, essential for the correct enjoyment of the perspective work and thus fundamental for its design.

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