Fenestration Practice and Theory in Early Modern Europe

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For Estelle

Contents

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Introduction

The creation of a window is the point where architectural imagination and technical ingenuity often find their most fruitful union in a building project. It is the most comprehensively 'layered' of all architectural components, and therefore the most revealing of a building's character in all its manifestations, technological as well as cultural. As such its place at the centre of building culture seems secure. However, despite this prominent position, the topic has rarely received the attention it deserves in academic research, its literature being mainly of a technical kind and, if historical, aimed at the conservation market. Recently, under the influence of the ecological humanities and material culture studies, the window has acquired a new status as a cultural object, thus opening up a rich new vein for future scholars to explore. This is a welcome and timely development.

The subject however remains an elusive one and its pursuit carries risks. In the first place, the inherent multi-valency of the window as a building component means that no single approach is likely to cover all its multiple roles; secondly, due to the selective perspectives of previous research into historical architectural development our understanding of the fenestration of buildings from the past is often skewed and lacking in important aspects. For example, we know a lot about the formal characteristics of Renaissance windows, their cultural references; rather less about the functional determinants which underpinned their creation. And, as the classical revival of the early modern-period in Europe continues to serve as the main reference point for so much of current theoretical speculation, it is essential that this foundation is solid. What follows is an attempt to consolidate that knowledge-base by constructing an over-arching narrative charting the development of 'classical' window types in Europe over a period of three centuries, comparing and contrasting the responses of different building cultures to the challenges posed by a new stylistic convention.

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The window lies at the heart of most architectural styles and, consequently, it figures prominently in stylistic revolutions. It was so with the triumph of modernism early in the twentieth century and a similar transformation had occurred four centuries earlier when novel window forms, inspired by the classical revival emanating from Italy began to penetrate the medieval fenestration practices of northern European countries. It is that revolution which is the focus of this study. It seemed fitting to call what happened during this period of European architectural history, c.1420 to c.1780 (from the Renaissance to neoclassicism), the 'reinvention of the window', because this is exactly what the movement had to achieve: firstly, to establish the stylistic norms for a modern language of the 'classical' window and, secondly, to find the appropriate constructional means to adapt this idiom so as to suit different cultural and climatic conditions across Europe, without losing its integrity as a 'universal' expression of a classical idea.

In order to trace the genealogy of the modern classical window to its roots – as we propose to do – an exploration of all the relevant

typological themes, both formal and functional, is required, since a true understanding of this development cannot be achieved by prioritising the aesthetic and social aspects of classical revival architecture as has hitherto tended to be the case. Many factors conditioned the search for suitable window forms at the time. Those concerning the origin and development of stylistic features are relatively straightforward and have been well researched, even though rarely placed in a wider context. The functional determinants of contemporary window design and their impact on architectural progress, on the other hand, have not yet been properly addressed. I believe that this (still prevailing) emphasis on aesthetics and high culture in studies of historic architecture[1] comes at the expense of socio-technological issues and, as a consequence, impoverishes the field of study – as the in-depth study of the sash window's creation and assimilation into the English architectural idiom (Part Three) seeks to demonstrate.

By revealing the different cultural approaches and outcomes over time a clearer picture emerges of the various cross-currents at work shaping even the smallest of building components; the context that conditioned the formation of each and every window type helped to determine its specific character. The story of the rise of the classical window in early modern Europe is, therefore, constructed as a continuous narrative following a central theme. Overlapping chapters – in the manner of a kaleidoscope – explore various aspects of historic window design to different degrees of specificity, allowing for cultural diversity. The coverage is most comprehensive for England, which serves as a control for comparing and contrasting parallel European developments.

During the early modern period there was a conflict between the ideal compositional and expressive criteria which were invented in order to determine the location and iconic form of the window in a classical design schema, and the ways and means at the disposal of different societies to deal effectively with the inescapable need for controlled access to light, air and views – the raison d'être for all windows. This too adds depth to the argument and enhances the relevance of this project. It is the perennial dialogue between the intellectual and artistic demands of 'window architecture' as a stylistic project, and the practical requirements of construction and environmental design which intrigues as well as informs – and *that* remained a constant.

The aim is to show that, when treated with comprehensive specificity (as a separate entity, but one that forms an inextricable part of a bigger whole), the true character and scope of the window as an essential component representative of the very act of building is revealed; that it, therefore, can become an effective instrument for historical enquiry which demonstrates – as Le Corbusier observed nearly a century ago[2] – that the history of the window becomes, in effect, a history of architecture as well.

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From the very beginning, the window posed a special challenge to the Renaissance architects. Apart from Vitruvius's obscure comments on the subject, the odd reference found in classical authors and some surviving classical monuments, there was nothing to give them an understanding of what windows in classical antiquity looked like, and how these functioned. This was particularly a problem in civil architecture where the window fulfils a conspicuous and necessary role in everyday life. Italian designers and craftsmen, therefore, quite literally, had to 'invent' new window forms which not only suited their clients' daily needs, but also conformed to an evolving notion of what a classical idiom demanded, mostly by reference to their own medieval past.[3] Thus began a slow process of continuous innovation – what Leonardo Benevolo called, 'a cycle of experiments' Subsequently, the creation of a 'new' classical repertoire would continue to draw heavily on existing traditions in fenestration as local builders throughout Europe struggled

with the constraints of varying climatic conditions, customs and physical resources in a pursuit of a broader vision of an international classical revival: a 'universal' aesthetic ideal, best articulated by Vincenzo Scamozzi (1548-1616) in his *L'Idea della architettura universale* (1615). (The term, 'universal' is used here in a general sense, suggesting that the shared aspiration of progressive designers and craftsmen Europe-wide, adopting the classical style in architecture – at least until the mid-eighteenth century – amounted to a genuine striving for a universally applicable system emulating ancient practice, even though it only ever achieved clear programmatic identity in very specific circumstances such as, for example, with the socially inclusive architectural vision of Sebastiano Serlio; the scenographic works of Hans Vredeman de Vries, the theories of Nicolaus Goldmann and Leonhard Christoph Sturm in the Low Countries and in the German-speaking states,[4] and the early Palladian Movement in England).

The reality was, of course, often very different, with vernacular variety stimulated rather than curtailed by the proliferation of textbooks, but this does not refute the basic argument that, intentionally, the revivalist movement that swept across Europe constituted a de facto campaign towards the attainment of such objectives. During the fifteenth and the sixteenth centuries the Italians were the unquestioned leaders of this movement, setting the theoretical parameters for development and the interpretation of the archaeological finds, but as classical revivalist ideas began to spread throughout northern Europe in the course of the sixteenth and seventeenth centuries the practicalities of designing for a colder climate brought different criteria for window design into play for civil architecture. Led by France and the Netherlands, advances in window technology rapidly improved standards of interior comfort, inaugurating the modern lifestyle – a process which had run its course by the mid-eighteenth century.

During the medieval period in Europe the emphasis in window design fell on the church window; light symbolism was the objective and the greatest feats of engineering and artistic creativity were achieved in the stained-glass windows of the great Gothic cathedrals of northern Europe. Windows in civil architecture in the region were of less significance and rarely received the same attention. Window glass was the prerogative of the very rich and as a climate modifier the domestic window remained a primitive instrument. The Renaissance saw a change of emphasis with secular design rising to prominence and, as the classical revival gained momentum, a quest for a cultured lifestyle more compatible with the new architectural style brought an increased demand for sophisticated fenestration systems in civil architecture as well.

This movement coincided with the onset of the so-called Little Ice Age – a period of dramatic climate change which began in the sixteenth century and continued for several centuries. Although the impact of this event on architectural development is hard to quantify with any degree of precision, there can be little doubt that it would have brought an added urgency to the campaign for transforming fenestration practises. It is, therefore, not surprising that in Italy it was Venice – climatically closer to northern Europe than the other Italian states – which took the lead in developing the appropriate technology to sustain this revolution. In the colder north, France and the Low Countries led the way.

The civil or domestic window thus became a laboratory in the search for optimal technical solutions. The Italian Renaissance drew no clear typological distinction between windows in sacred and profane buildings – all were deemed to submit equally to the classical rules of proportion and decorum. In northern countries, as we shall see, this became more of an issue. The search for suitable functional formats for windows ranged over the full operational spectrum, covering the three basic mechanical principles governing opening actions in windows, namely, hinging, sliding and rotation. All three systems have their roots in unrecorded

history, and they continued to form the basis for experimentation, with new developments more-often-than-not being simply variations on traditional themes. The capacity for environmental control in windows depended on a limited range of materials: wood and metal (iron and lead) for the structural frame, with window glass generally accepted as the superior closing membrane. On the availability of this set of basic materials, and the skill with which they were utilised in building practice, rested the success of any particular society's fenestration systems. Access to good quality window glass remained a determining factor throughout the period. With the exception of England all European countries had adopted the wooden window frame in civil architecture, either on its own or combined with a structural stone frame, and this was one of the main reasons why the English lagged behind their continental neighbours in developing effective fenestration systems until the end of the seventeenth century.

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The most efficacious functional arrangement to emerge from this campaign towards developing appropriate classical window forms across Europe is the so-called cross-window, based on the mullion-and-transom structural frame system. In its simplest and most popular free-standing format – the vertical rectangle with single 'Latin' cross dividing the window into four lights, one or more of which had opening casements – the Renaissance window reached iconic status in the sixteenth century. It was often one of the first visible signs of Renaissance cultural ideas reaching a northern European country. The basic concept for this format was not new. Cross-windows were recorded in regular use in residences in France and the Netherlands as early as the thirteenth century, and they were already an established part of these countries' architectural practice when the Renaissance arrived. In Italy a square format cross-window, different from the French variety, first appeared in the Papal States in the mid-fifteenth century and by the early- sixteenth century a Roman -Tuscan version of this window type had developed which merged with Venetian fenestration practice to become an independent Italian tradition. There seems to be no conclusive evidence of a linear relationship between the French and Italian traditions thus formed and they continued to follow separate trajectories, albeit with periodic cross-fertilisation. Italian influence initially spread north via the German-speaking states on its borders.

Although flexible and economical the Italian/ Venetian fenestration system – due to its having been engineered essentially for a Mediterranean climate – however, required significant re-adjustment for northern European weather conditions. Consequently, it was the sturdier French cross-window frame technology – developed over a long period of time and well suited to colder climatic conditions – which became the benchmark for quality in those parts of Europe that are the object of our survey. France, therefore, offers the clearest and most consistent picture of the evolution of the modern classical window type, culminating in the creation of the tall window/ door, the folding casement (commonly referred to as the 'French window' outside France).

However, other regions also made significant contributions. The Netherlands – historically linked to the Francophone world through the Burgundian connection – played an important role in disseminating the new technology through their Europe-wide trade links; in the sixteenth century it was the Southern provinces that took the lead, in the seventeenth century that mediating role passed to the Northern Netherlands. The southern German states, drawing on their Italian heritage, saw significant progress in the development of an efficient local fenestration system for environmental control in secular buildings, i.e., until the catastrophic political events of the mid-seventeenth century disrupted architectural development. Northern Germany benefitted more from its trading links

with the Netherlands. England largely stood apart from this European enterprise until the seventeenth century, its civic fenestration technology rooted in medieval building traditions, with little conscious reference to continental practice. But, when it eventually did join the campaign, in the aftermath of the civil wars and restoration of the monarchy, it introduced a revolutionary new window concept: the counter-balanced or mechanical sliding window, which became known as the 'sash window'. Along with the 'French window' the sash window would come to represent the highest achievement of a northern European classical fenestration system.

In order to understand what this accomplishment signified we must return to the notion of the classical window as reconfigured in the Italian Renaissance. By seeking to reconcile two contrasting structural traditions – the Ancient Roman with its emphasis on solid wall mass construction, and the medieval frame system – an ontological contradiction was created between the functional and the symbolic, the structural and the decorative modes of expression. This had consequences for window design, in particular for the cross-window when it was adopted as the staple 'classical' window in civil architecture. The ideal Renaissance window aspires to a condition identified, conceptually, as 'a hole in the wall', i.e., an opening formed without any internal structural support, in which the secondary glazing frame remains a neutral, non-loadbearing infill, with whatever structural symbolism deemed necessary for the building design being reserved for the sculptural surround. The distinction drawn between the design and constructional aspects of the window reflected the general theoretical position of Italian Renaissance architects. Since this approach corresponded with local building traditions essentially based on walled constructional systems and, because lightweight glazing systems suited the warm Mediterranean climate best, the transition from medieval to modern window forms in Renaissance and Baroque Italy was unproblematic. Not so for northern Europe.

In northern countries, ever since medieval times the window had been regarded as an integral part of the structural system of the wall, its frame, in masonry, brick as well as timber-framed construction, had a loadbearing function and, consequently, shared fully in the structural symbolism of the building. The move away from this expressive, 'Gothic' approach to window design towards the free equilibrium sought by classicism was complicated and, for its success, largely dependent on the slow trial-and-error development process of vernacular building. A resolution was eventually reached through a combination of factors: the introduction of new structural techniques (e.g., the relieving arch borrowed from ancient Roman technology), that permitted large unsupported openings in solid walls, and the advance of window technology (e.g., new and/or improved materials, framing techniques and operational systems). By the mid-seventeenth century, the efforts by northern European builders to develop appropriate indigenous 'classical' window forms for their respective societies, began to deliver products sophisticated enough to form the basis of new architectural styles – northern classical traditions that could rival those created in Italy.

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The two window types that proved to be the most influential catalysts in determining the character of the new architectural styles that emerged towards the end of the seventeenth century in northern Europe, were the above-mentioned *Franco-Italian* folding casement ('French window') and the English counterbalanced sliding window. Although they shared common roots the development patterns of these two window types were different. The French window grew out of generations of incremental development of the late-medieval mullion-and-transom or cross-window type, and in the process drew on French as well as Italian traditions. The sash window's arrival on the scene, on the other hand, was sudden enough to merit being considered a new

'invention' (or at least an original creation), but it too had antecedents in wider European practice. More important, the latter's appearance marked the moment at which England finally emerged from the shadows of continental architectural practice in the classical style and succeeded in developing its own classical fenestration system based on the sash window – a design programme that could match the standards previously set by the Italians, the French, the Netherlanders and the Germans. Henceforth England would challenge French stylistic hegemony in the north.

The eighteenth century saw the advances made in window design in the course the seventeenth century being consolidated throughout Europe, with a systematic refinement of framing technology and further advances in the window glass industry. This technical progress went hand in hand with a broadening of the geographical spread of classical window forms. Outlying countries like Sweden – which drew inspiration from developments in their southern neighbours, in theory as well as practice – become important to our study for the critique they offered on the relative merit of the competing typologies. Apart from the British Isles, where the sash window had become virtually synonymous with civil architecture in the new classical style by the 1720s, sliding windows of this kind were enthusiastically adopted only by the Dutch, but the type did also gain a degree of popularity in some northern German states with Dutch and English links, like Prussia and Lower Saxony (and Portugal, during the latter half of the eighteenth century). Elsewhere in Europe it was the French folding casement – perfected during the latter part of Louis XIV's reign – which came to dominate as the embodiment of high culture and taste in civil architecture in the new style.

The whole repertory of new window forms employed in Northern European vernaculars had, however, expanded dramatically ever since Italian Renaissance ideas first gained a foothold north of the Alps in the sixteenth century. In the German-speaking states, for example, an individualised and flourishing window glass industry continued to sustain the simple, flexible cross-window variety of Italian origin as the staple for medium-sized urban architecture; other regions saw similar developments inspired by different models.

We can do no more than give a broad outline of such developments. What seems to be incontrovertible is that by the mid-eighteenth century the 'craft' of window design in the classical idiom had reached the levels of sophistication achieved in other aspects of contemporary European classical architecture. As is demonstrated most comprehensively in the two flagships of the movement: the Franco- Italian folding casement, and the English mechanical sliding window, the contradictions still apparent in the early concepts of the classical window (between the ornamental and the constructional), had been resolved. The stylistic norms for classical design established in the Italian Renaissance had also been successfully integrated with the subsequent innovations in environmental design and the technology underpinning these. This was, ultimately, the achievement of the Northern Renaissance and Baroque, but the status quo would not last as the rise of neoclassicism and the Gothic revival posed new questions to window design and its technologies, which led to new solutions. Both these window types had, by then, already attained true international status and, in the course of the nineteenth century, they would become potent international architectural symbols as competing European colonial powers sought cultural hegemony on a global scale. That, however, constitutes a new chapter in the history of the window.

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PART ONE

CHAPTER 1

Establishing the Canon: Style and Rules

1.1 The Italian Model

It is beyond the scope of this study to delve deeply into Italian Renaissance aesthetics. Recent research has stressed the significance of the façade as both an architectural and social statement in the Italian cities during this period, and confirmed the importance of the window as part of its articulation, governed by an overriding sense of decorum.[5]

Of particular relevance to this study are the theories formulated regarding the geometrical configuration of the built form of secular buildings. These guidelines concerned the size and shape of openings as well as their arrangement on the facades – criteria that remained a point of reference for classical architects throughout Europe for centuries. Even though based on the authority of Vitruvius and the study of the ancient Roman remains, Italian Renaissance architectural theory would have acquired neither the potency nor the endurance it did if it had not been so securely rooted in the diversity of contemporary Italian architectural practice; it was the brilliant way in which the Italian architects drew upon the resources of their local building traditions to fulfil the demands of revolutionary artistic objectives without losing their individualism, that inspired others to follow in their footsteps.

Leon Battista Alberti's generic definition of the opening in architecture, with the space between columns, or, intercolumniation as the ultimate reference point [BK VII, Ch. XII], started a new debate in the history of architecture which would resonate until our time.[6] His open-ended approach contrasted with and broadened the formalistic Vitruvian conception of the window/ door. Instead of accepting the outward physical form as the sole determinant factor Alberti – with his notion of the column being implicitly imbedded in the wall as both its structural locus and principal ornamentation[7] – emphasised the need for decorative articulation to define the nature of the openings. Although subsequent Renaissance theorists tended to favour Vitruvius's more prosaic classification of the window/ door, it was Alberti's speculation on openings and their symbiotic relationship with the structural system in the abstract that laid the theoretical foundations for the robust synthesis achieved in High Renaissance practice, reconciling two antithetical structural systems: the frame and the wall. This situated the Renaissance midway between the solidity of the Ancient Roman approach to construction and the 'diaphanous structure' sought by medieval architects – a merger that, as will be seen later, was only feasible because the Italians could draw on such a rich mixture of vernacular building traditions.

Classical rules of composition, according to Tzonis and Lefaivre, comprise three parts: *Taxis*, i.e., the overarching framework, which in turn has two schemata: the *grid* and *tripartition*; the *Genera* or the *Elements*, based on the *Classical Orders*, and *Symmetry*, which establishes the relationship of

the chosen elements to one another and within the overall structure of the *Taxis*.[8] To the Italian Renaissance theorists the key factor determining the arrangement of openings in a classical façade was symmetry, especially as governed by the figure, 'alignment' (*lineamenta*), achieved by distributing the components according to an invisible 'architectural surface geometry' – *linee occulte*.[9] Palladio explained what the outcome of this approach meant, in practical terms, for the fenestration of a building:

> 'The windows on the right ought to correspond to those on the left, and those above directly over them that are below; and the doors likewise ought to be directly over one another, that the void may be over the void, and the solid upon the solid, and all face one another, so that standing at one end of the house one may see to the other, which affords both beauty and cool air in summer, besides other conveniences.'[10]

Alberti suggested that odd numbers should be used whenever possible so that the central axis could be emphasised more directly.[11] As far as the requirements for the actual shapes of individual openings were concerned no hard and fast rules were laid down and local vernacular traditions dictated practice in the various Italian states until well into the sixteenth century.[12] Theoretical treatises, however, show a distinct preference for rectangular openings, a tendency which can be traced back to the Renaissance belief in the superiority of the cube as the source of all number and form[13] and, although the Italian architects were generally not dogmatic about this, when it came to distinguishing the new way of building from the old it is the application of a rational doctrine of rectilinearity and reflective symmetry that made the difference – as Serlio demonstrated with his propositions for the 'Remodelling of Old Things' [Bk VII, Ch.LVI and LVII] **[Fig. 1.1]**, and Scamozzi re-emphasised a generation later with his application of 'linee occulte', 'to redeem an irregular site'.[14]

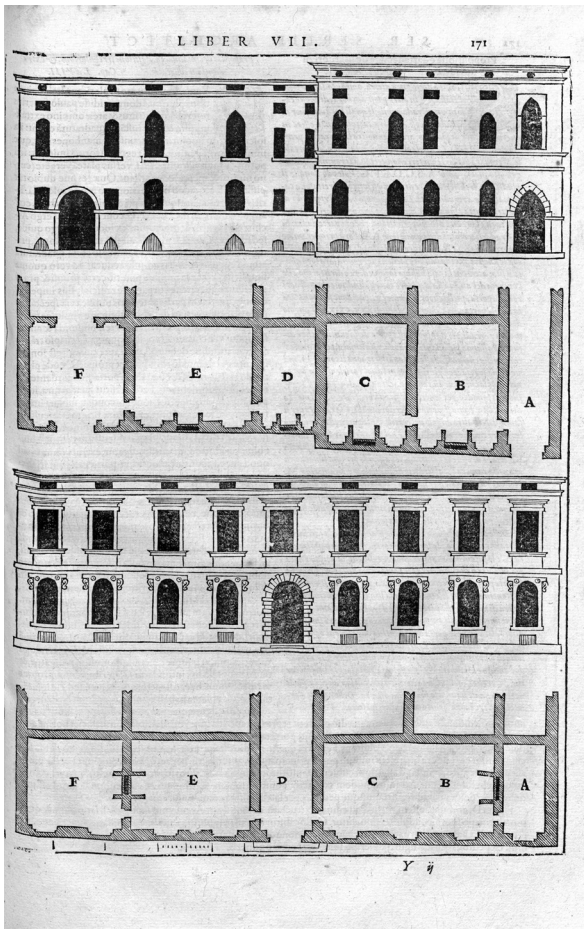
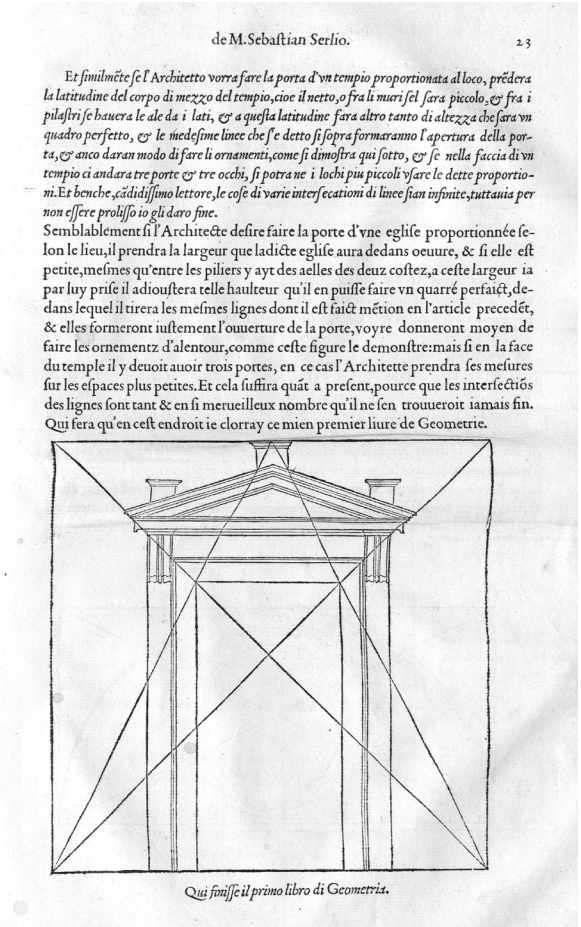


Figure 1.1. Sebastiano Serlio. 'On the Remodelling of old Things,' *Tutte l'opere d'architettura et prospetiva* (Frankfurt am Main: 1575), Bk. VII, Ch. LXVII, 171.

Source: SLUB-Dresden/ Digital Collections/Archit.217

It should be noted, however, that the contemporary notion of symmetry was ambiguous. The classical understanding of the concept, as propagated by Vitruvius, simply meant a harmonious proportional relationship in the arrangement of forms. Bilateral symmetry in the modern sense – i.e., where the left and the right-hand sides of a form are mirrored around a central vertical axis – was an Italian invention of the fifteenth century and the distinction between these two interpretations remained blurred until the eighteenth century throughout Europe. In theory, that is; in practice the Renaissance quest for visual simplicity had confirmed bilateral symmetry as the norm for new designs already by the sixteenth century in Italy.[15]


de M. Sebastian Serlio. 23

Et similmẽte se l'Architetto vorra fare la porta d'vn tempio proportionata al loco, prẽdera la latitudine del corpo di mezzo del tempio, cioe il netto, o fra li muri se l sara piccolo, & fra i pilastri se hauera le ale da i lati, & a questa latitudine fara altro tanto di altezza che sara vn quadro perfetto, & le medesime linee che se detto si sopra formaranno l'apertura della porta, & anco daran modo di fare li ornamenti, come si dimostra qui sotto, & se nella faccia di vn tempio ci andara tre porte & tre occhi, si potra ne i lochi piu piccoli vsare le dette proportioni. Et benche, cãdidissimo lettore, le cose di varie intersecationi di linee sian infinite, tuttauia per non essere prolisso io gli daro fine.

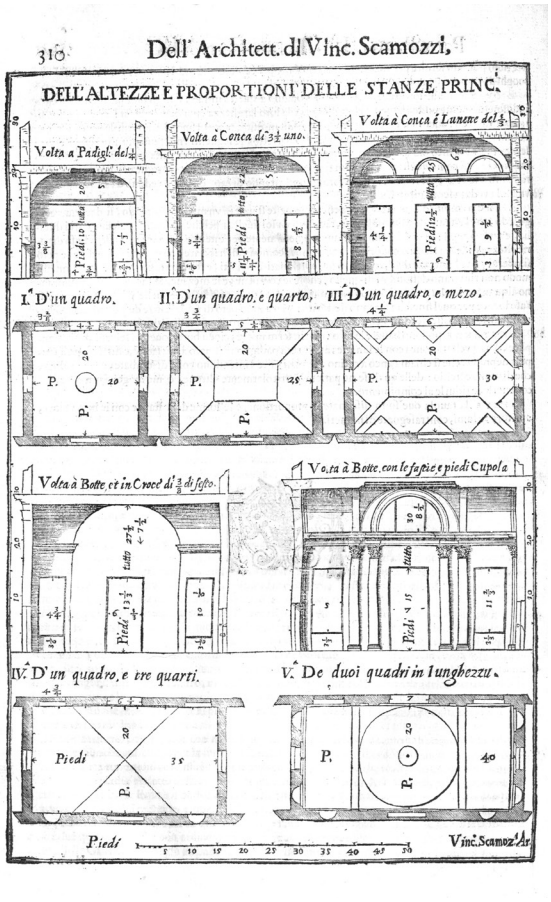
Semblablement si l'Architecte desire faire la porte d'vne eglise proportionnée selon le lieu, il prendra la largeur que ladicte eglise aura dedans oeuure, & si elle est petite, mesmes qu'entre les piliers y ayt des aelles des deuz costez, a ceste largeur ia par luy prise il adiousterа telle haulteur qu'il en puisse faire vn quarré perfaict, dedans lequel il tirera les mesmes lignes dont il est faict mẽtion en l'article precedẽt, & elles formeront iustement l'ouuerture de la porte, voyre donneront moyen de faire les ornementz d'alentour, comme ceste figure le demonstre: mais si en la face du temple il y deuoit auoir trois portes, en ce cas l'Architette prendra ses mesures sur les espaces plus petites. Et cela suffira quãt a present, pource que les intersectiõs des lignes sont tant & en si merueilleux nombre qu'il ne sen trouueroit iamais fin. Qui fera qu'en cest endroit ie clorray ce mien premier liure de Geometrie.

Qui finisse il primo libro di Geometria.

Figure 1.2. Serlio. 'Gate or a Door in a temple or a Church,' *Il primo libro d'architettura- geometrie* (Paris: 1545), Bk. I, Fol. 23.

Source: BSB München – Res/2A.civ.198-1/5

In order to establish the exact position and proportional relationship of these openings within the overall scheme of a façade, various numerical and geometric proportional systems were developed – rooted, as Gerda Soergel had shown, in a study of Pythagorean mathematics, but with reference to medieval building practice, as is demonstrated, for example, by Serlio in his First Book, on geometry (Paris, 1545).[16] **[Fig. 1.2]** Alberti, Francesco di Giorgio, Palladio, Scamozzi, all provided guidelines aimed at finding a satisfactory balance between the practical and aesthetic requirements for the fenestration of a building in the classical style. When there was a conflict between these the Italian architects tended to err towards the aesthetic. This is illustrated by Palladio's directive for determining the dimensions of doors and windows. After stressing the importance of having windows of exactly the right proportions to comply with the ventilation and illumination requirements of the various rooms within the building, he goes on to say that all the windows in the same storey, regardless of orientation and the varying sizes of the rooms that they open unto, should be of equal size, and that they should all relate proportionally to the principal rooms on the main floor, gradually diminishing in size in the upper storeys.[17] Scamozzi – who was the first to translate these formulae into a drawn format **[Fig. 1.3]** – went even further:


310 Dell' Architett. di Vinc. Scamozzi,

DELL'ALTEZZE E PROPORTIONI DELLE STANZE PRINC.

Volta a Padigl. del ½

Volta à Conca di 3 ½ uno.

Volta à Conca é Lunette del ½

I. D'un quadro. II. D'un quadro, e quarto. III. D'un quadro, e mezo.

Volta à Botte, et in Croce di ⅔ di sotto.

Volta à Botte, con le sue Lunette, e piedi Cupola

IV. D'un quadro, e tre quarti.

V. De duoi quadri in lunghezza.

Piedi

Vinc. Scamozzi Arc.

Figure 1.3. Vincenzo Scamozzi. 'Room proportions and opening dimensions,' *L'Idea della architettura* (Venice: 1615), Bk. III, Cap. XIX, Fol. 310.

Source: BSB München – MDZ -Res/2/A. civ183-1.1/2

> 'I strongly recommend the same [ceiling] height within one floor. In various Italian cities as well as in Spain, France and almost all over Germany, one finds

> the erroneous construction of rooms of different heights within one storey, a most inconvenient and ugly occurrence in a house.'[18]

As codified by Sebastiano Serlio, the whole arrangement, down to the articulation of the minutiae of decorative schemes for windows and doors was governed by reference to the classical orders. Visual confirmation of the proportional scheme came from the superimposition of the Orders on the façade, with the Doric or Tuscan on the ground floor, followed by the Ionic, then the Corinthian and Composite, but even when these were omitted an implied proportional system based on the various orders ruled the organisation of the façade elements and their ornamentation.

Proportional doctrine was but one factor that influenced Italian Renaissance concepts of fenestration. Structural stability received much attention in their writings, which reveal a strongly developed visual sense of structure: buildings not only had to be stable, they also had to look stable. And, to attain this visual equilibrium openings had to be kept as small as possible and as few as possible in relation to the wall area of a building, be not be too close to one another and, most important of all, not be too close to the corners of a building, for, as Palladio warned regarding the latter, 'that part ought not to be opened and weakened, which is to keep the whole edifice upright and together'.[19] It was a way of thinking derived from mass construction technology, masonry and brickwork, the typical building materials of the Italian vernacular traditions since Roman times. In terms of massing and void/solid relationships, the basics of architectural composition, this produced a 'modern' classical built form that even in its unadorned state – as in depictions of late-sixteenth /early seventeenth century buildings from the Veneto and Liguria stripped of their painted decoration **[Fig. 1.4]** – would set the bench mark for simple proportionate design which European architects would follow for generations to come.

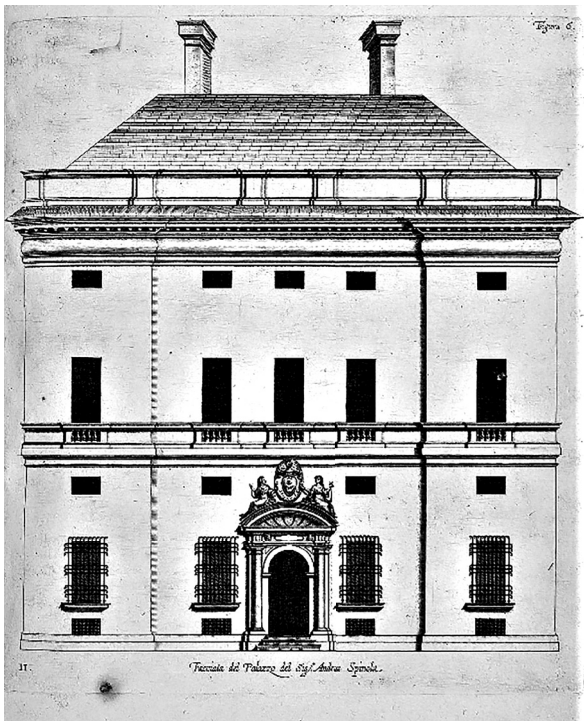


Figure 1.4. Peter Paul Rubens: *Palazzi di Genova* (Antwerp: 1622), Vol. II. Fig, 06: Palazzo Andrea Spinola.

Source: Ruprecht-Karls-Universität Heidelberg – Wikimedia Commons – Public Domain

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In this architectural schema, which originated from an approach to structural design that differed from that of the Gothic builders in northern Europe, apertures were deemed to be of lesser import than the wall surface in between them. The Mediterranean climate favoured this arrangement, and it suited the compositional aims of the classicists. What, to the classical mind-set would appear to be a potentially negative impact of large apertures on the monumentality as well as the stability of the façade design, could thus be neutralised by keeping opening sizes down, their outlines and spacing as simple and regular as possible, and by visually suppressing or negating the window's internal framework This allowed the emphasis to fall on the solid form of the building and the structural idea embodied in the decorative system. It is from the articulation of external features like the classical orders, the pediments, the window

and door surrounds that the fully developed Italian Renaissance building would derive its expressive language. Decoration was not, however, allowed to undermine the monumentality that came essentially from the clarity of the articulation of the massing. Once consensus was reached in the Roman High Renaissance on the basic conventions for façade treatment in the new idiom Italian architects rarely deviated much from it in principle. **[Fig. 1.5]**

Figure 1.5. Baldessare Peruzzi, Villa Farnesina, Rome, 1509-11, south façade.

Source: Wikimedia Commons – Peter1936F – CC BY-SA 3.0 – 20/11/2013

Even radical baroque architects like Guarino Guarini (1624-83), would adhere to the basic tenets of this configurational schema insisting, for example, on the inviolability of the Palladian dictum: 'solid over solid; void over void'. Within this framework of interrelationships between the parts and the whole – what Emil Kaufmann has identified as the 'Renaissance- Baroque system' of design – architects would operate according to a set of fundamental principles: the concatenation of the parts; their integration into the whole, and gradation, that is, the differentiation of the parts into subordinate and dominant categories.[20] This was not a static but a progressive continuum, held together by a common compositional ideal that was perpetually challenged by a clash of irreconcilable objectives: horizontal v. vertical/ frame v. solid plane. A different emphasis brought a different outcome: High Renaissance compositional schemes strove for a serene, non-directional balance amongst the constituent parts, whereas the Baroque revelled in rhetorical 'movement' in support of an overriding central theme. The rationalist, 'scientific' theories of Carlo Lodoli (1690-1761), and Francesco Milizia (1728 – 98), during the eighteenth century sought to strip this language down to its structural essence, but did not challenge the fundamentals upon which its compositional premise rested.

As Kaufmann explains, the pattern of development was conditioned by the inequality of the base units in terms of their expressive potential: 'Only the framework, not the massive wall, is apt to convey the ideas of concatenation and gradation. Therefore, the piercing of the façades necessarily increased with the progress of the Baroque.'[21] This could be achieved either through the physical enlargement of the apertures, or, illusionist surface painting. When Francesco Milizia denounced the latter practice in his *Principi di Architettura Civile* (1785)[22], it was because during the Baroque phase false perspectives had in his view begun to undermine the structural integrity of the wall (Serlio had raised similar objections against modern Roman fashions of the 1520s.[23]) When Milizia cautioned against the indiscriminate use of irregular and composite window forms like the Serliana[24] it was because these blurred the concept of the window as a 'hole-in-the wall'. In fact, Milizia's comments signal that the Renaissance-Baroque compositional 'system' was still operative in Italy at that point in time and throughout Europe. Despite periodic challenges – as with Abbey Laugier in the 1750s and Viollet-le-Duc a century later – it survived in essence until the twentieth century, when the steel and concrete framed structures allowed a new breed of modernists to pursue the ideal of transparency to its extreme conclusion.

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To see how these theoretical concepts manifested themselves in practice one must start with Leon Battista Alberti's treatise. In his chapter on ornamentation (Bk VI: Ch. XII), Alberti wrote as follows:

> Openings are an ornament that gives great delight and dignity to the work; but they present many grave difficulties too, which may be overcome only with the most careful workmanship and considerable expense. Openings require blocks of stone of huge size, sound structure, equal dimensions, elegant appearance, and uncommon material – characteristics rarely found together; [….] any of these openings would be more beautiful for having its bones [structural members] made entirely from one stone. Next best would be to compose all the parts so that there do not appear to be any joints.'[25]

Figure 1.6. Detail of an anonymous oil painting: 'Ideal City with a fountain and statues of the virtues' end Fifteenth century. Florentine, after design by Giuliano da Sangallo, c.1480-4.

Source: Baltimore, Walters Art Gallery, Cat. No. 178b – Creative Commons

Fifteenth century window openings in Italy were, for the most part, subdivided with structural members made of stone (this applied not only to the modern Roman cross-window, but also to the characteristic *bifore* – biforate round-arched windows of the Tuscan Renaissance, and other local arched varieties. As the movement towards classicism gained ground this complex structural window frame – which was a leftover of medieval building traditions –would be progressively simplified (as Alberti recommended), into a rectangular ashlar surround, with an internal closing framework of wood that could be treated visually as well as structurally independent from, and subordinate to the outer ornamental frame. This arrangement was necessary to achieve the 'hole-in–the-wall' effect idealised in contemporary visionary architectural imagery as the perfect classical window form **[Fig. 1.6]**, but this had significant practical implications, both in terms of the buildings' structure and the window's operational role as a source of light, ventilation and views.

The first definite step towards creating this idealised classical configuration was taken by Filippo Brunelleschi (1377-1446) with the pedimented architrave windows introduced on the first floor of the Piazza Santissima Annunziate façade of the Ospedale degli Innocenti, Florence (1419-24). **[Fig. 1.7]** These openings – probably inspired by those on the Florentine Baptistery façades – were small and should not have posed any structural difficulties. More importantly, by putting the emphasis on the framing of openings with classical motifs, and by opting for the rectangular rather than the arcuated format typical of the Florentine fenestration tradition Brunelleschi, the 'pathfinder' of the early Renaissance, set the pattern for future development and started the dialogue between the rectangular and arched window forms that has remained an inherent feature of classical façade design ever since. The square Roman cross-window narrative theme (see below, page 19ff) linked up with this, resulting in several hybrid solutions during the second half of the fifteenth century, notably by L.B. Alberti at the Palazzo Rucellai, Florence, 1446-51, and his former assistant, the Florentine architect, Bernardo Rosselini, at Palazzo Piccolomini, Pienza, 1459-64. **[Fig. 1.8]** In the Palazzo Strozzi, Florence, begun 1489**,** by Giuliano Sangallo and Il Cronaca, it is known that aedicule windows were considered for the upper floors during the 1490s before the round-arch version was finally adopted.[26] At that point, the trend was for the purer classical format, but, as Josef Durm (*Die Baukunst der Renaissance*

in Italien, 1914) demonstrated, there were many examples of windows in Tuscan secular architecture from the period showing the experiments that underpinned this transitional stylistic process. **[Fig. 1.9]**

Figure 1.7. Filippo Brunelleschi, Ospedale di Santa Maria degli Innocenti. Detail of façade on Piazza Santissima Annunziata,1419-24. From: A. Haupt, *Renaissance Palaces of Northern Italy,* Vol. I (1931).

Italian window frames remained demonstratively structural throughout the fifteenth century. However, as the movement towards classicism gained ground this structural emphasis – which was a leftover of medieval building traditions – would be progressively toned down, the framework made lighter and set further back within the outer frame to create the 'hole-in-the-wall' effect idealised in contemporary architectural illustrations. As shall be shown later, Venice probably provided the glazing technology for this development, but it seems likely that a decisive step in this direction was taken with the architrave windows that are such a prominent feature of the Ducal Palace at Urbino (1465 – 1482) – a project in which several leading Renaissance artists participated.

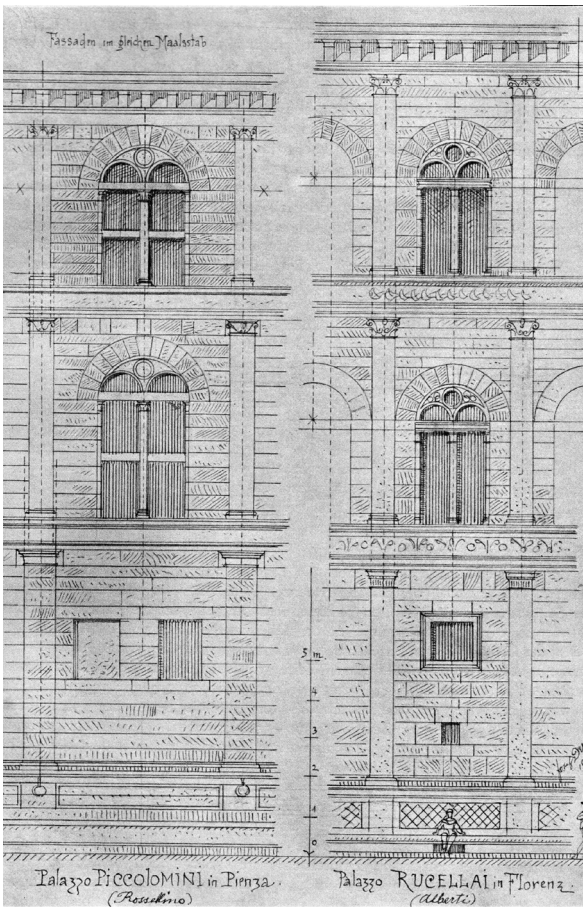

Figure 1.8. A detailed comparison of the façade designs of Palazzo Piccolomini, Pienza and Palazzo Rucellai, Florence. From: Josef Durm, *Baukunst der Renaissance in Italien* (1914), 302.

As the earliest unfortified princely residence of the Italian Renaissance, the Ducal Palace offered a unique opportunity for experimenting with different fenestration types – they even adopted a version of the enclosed balcony, or *Erker*, normally associated with northern European, more specifically, German architecture.[27] The result was an unusual range of window solutions that mark a turning point in the development of the Renaissance vocabulary – effectively a merger of the Tuscan-Roman traditions.**[Fig. 1.10]** Although the current arrangement of glazed wooden cross-window frames in the windows of the Ducal Palace is probably of a later date,

judging from the heavy structure of the lintels there was nothing preventing a simpler, non-load-bearing wooden closing system to have been used from the start.

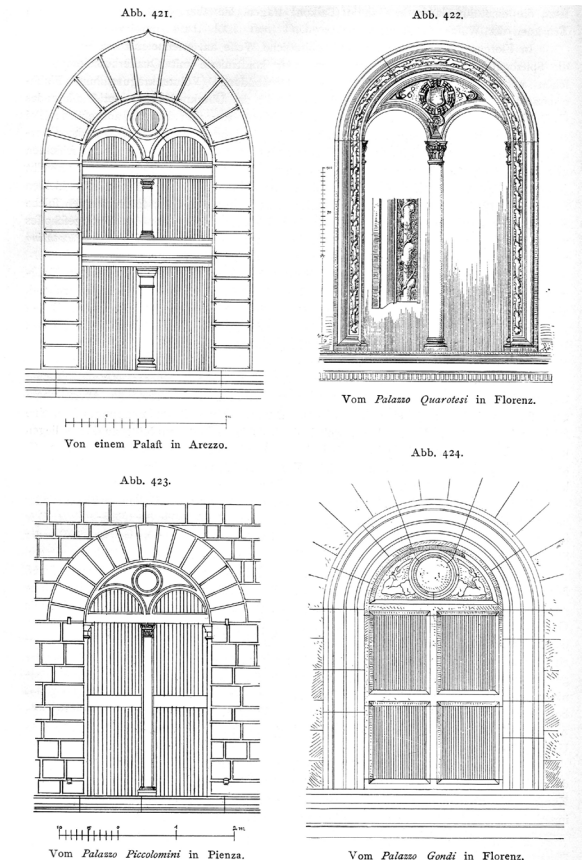

Figure 1.9. Examples of window designs from early-Renaissance Tuscany, showing the transition from the late-Medieval bifora to the Renaissance Roman cross-window type. From: Josef Durm, *Baukunst der Renaissance in Italien* (1914), 492.

Figure 1.10. Ducal Palace, Urbino. Inner courtyard, 1465- .

Source: Wikimedia Commons – Raffaele Pagani – CC BY-SA 4.0 – 30/06/2018

Elizabeth Heil in her book on the role of the window in Italian Renaissance palace façades, *Fenster als Gestaltungsmittel an Palastfassaden der Italienischen Früh- und Hochrenaissance,* (1995), identifies this building project as the point of origin of what she calls, a *Travéefenster,* that is, a window bay formed by a pilaster order containing a rectangular window – an arrangement that would subsequently become a fundamental building block of Renaissance façade composition.[28] While not denying the importance of the Ducal palace as such a reference point, the critical steps in this direction were taken earlier, notably by Giuliano da Sangallo (c.1445 – 1516), who, in his designs for Palazzo Cocchi and Palazzo Scala, Florence (both dating from the 1470s) – as David Hemsoll has shown[29] – was probably following ancient precedent.

Some qualification of the term is also necessary. Heil seems to equate the whole pilaster bay with a window. This, in my view, is an unhelpful definition because, while it clearly *can* be such, that is, where the window opening takes up the full area of such a bay, more often than not pilaster bays in classical buildings contain separate window openings, individually framed with architraves, and so on. Other than in cases where the pilaster bay constitutes the window itself it would, therefore, seem sensible to employ a more specific category, such as is listed below. Moreover, this distinction is useful for Renaissance and Baroque architecture outside Italy, where often architrave surrounds or a simple pediment sufficed for identifying a window as being 'classical'. It further preserves the meaning of the French word, *travée,* for what it, actually, is: a bay, a section or span of a wall or a vault, and avoids confusion with the English term, 'bay window'.

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The new classical architectural language which emerged from the melting pot of Renaissance Italy thus drew its formal structure essentially from the dominant Tuscan – Roman movement of between c.1430 and c.1530, which, in practice, was based on traditional solid load-bearing wall construction in buildings of extraordinary

large scale. Stylistic progress in other Italian states like Venice and Genoa contributed to the mix and added to its international appeal. Developments in the Venetian Republic are of special importance to this study since the role that fenestration plays in architectural formation there corresponded most closely with northern European practice. In Venice, the combined influence of atypical climatic conditions and the marshy terrain, led to the evolution of a compact plan form without internal courtyard and a structural system (uniquely for Italy) based on framed rather than massed constructional principles. This combination fostered a more integrative approach to the spatial organisation in buildings in relation to façade development.

The 'transparent' façades that distinguish Venetian architecture from that of the rest of Italy originated, as Manfred Schuler has shown, in the palace architecture of the late-thirteenth/early-fourteenth century. Schuler's careful analysis of the constructional development of this façade architecture, as it matured over a period of two hundred years, reveals the delicate balance that was achieved in creating the desired expanses of open arcading in brick fronts several stories high, on insecure foundations. Structural stability was ensured – much like in the Dutch canal architecture centuries later – by tying the façade back to a heavy supporting timber framework.[30] (Serlio illustrates a section of a Venetian palace with its timber reinforcement system in place in his unpublished Book VI.[31]) In due course – as will be shown later – these open arcades, needed to admit light deep into the building, were closed off with an elaborately contrived glazing system. From the start attempts to introduce classical forms to Venice recognised the prominent place of fenestration within the façade. In his celebrated Fourth Book (Venice, 1537), Sebastiano Serlio, for example wrote: 'In the famous Towne of Venice, because houses stand near together, they are forced to make their lights as they may, so that their Building differed much from that Building of Italy.'[32] And Venetian architects continued to follow their own tradition, blending arcuated and rectilinear forms to achieve a balanced architectural language of intellectual rigour, tempered by poetry that was unique and remained the hallmark of the Venetian classical style throughout the period under consideration.

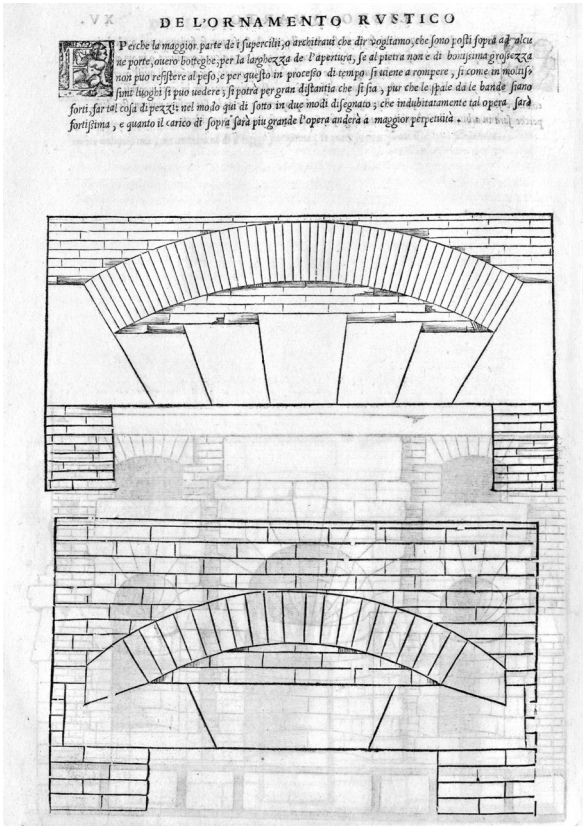

Figure 1.11. Sebastiano Serlio, Relieving arches – lintel construction. From: *Regole generali di architettura sopra le cinque manière degli edifice* (Venice: 1544), Bk. IV, Fol. XV, verso.

Source: BSB München – Res/2A.civ.307k-1/5

Elsewhere in Italy a more solid, cellular walled architecture prevailed where smaller rectangular openings could relatively easily be spanned in traditional ways by moderate lintels or relieving arches, without the need of support from the internal window frame. Italian Renaissance buildings of social importance nevertheless tended to be big in scale, requiring physically large openings. Architects like Peruzzi studied the classical ruins for structural as well as stylistic precedents, and the resultant reinforcement techniques for spanning wider square apertures in brick or masonry construction illustrated by Serlio in his Fourth

Book, published in Venice in 1537[33], shows that by the mid-sixteenth century the technology existed generally in the Italian building industry to support this important advance towards a true 'classical' fenestration. **[Fig. 1.11]** In his *Quattro libri dell'architettura,* published in 1570, Palladio would simply acknowledge that it was 'usual to incorporate some arches so that the lintels or heads of doors and windows are not overburdened by the weight'.[34] With structural stability secured the Italian Renaissance architects were free to explore the full expressive potential of the newly invented façade language and that legacy would eventually sustain the characteristic Baroque freedom: It was Borromini's mastery of this constructional method that underpinned his adventurous approach to façade design. **[Fig. 1.12]**

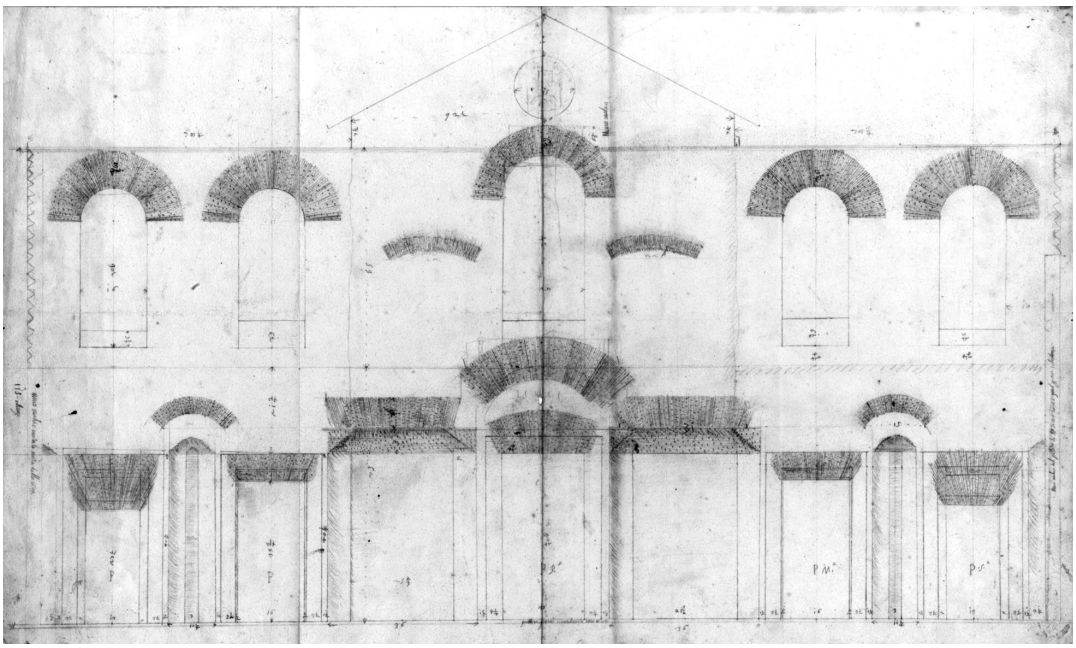

Figure 1.12. Francesco Borromini, S, Giovanni Laterano, Rome, 1646-9. Elevation drawing of façade showing structural arch and lintel reinforcements for brickwork over the openings.

Source: Cumulus-Kollektion 'Albertina Repro, Inv. AZRom 385

Figure 1.13. Villa Madama, Rome, 1516- , northeast façade before 1913.

Source: [Inv. bh587654] Foto: Biblioteca Hertziana – Max-Planck – Institut für Kunstgeschichte, Rom

Apart from contributing to the formation of the classic Renaissance façade, Venice appears to have been one of the main sources of an alternative, 'picturesque', Italian façade design tradition which periodically found followers in northern Europe as well. This stylistic trend was rooted in the typology of Venetian domestic plan forms, expressed through the use of openings of varying size and shape to form non-linear, 'syncopated' patterns on the façade, and came to appeal especially to sixteenth century Italian mannerists and early Baroque architects. Although partly a response to internal planning constraints this method could equally have resulted from attempts by Venetian architects of the early Renaissance to synthesise the

decorative Veneto-Byzantine facade tradition with the more rigorous and regular formal language of the Romano-Tuscan classical idiom (e.g., S. Maria dei Miracoli, c.1481-9, and the Clock Tower complex, St Mark's Square, c.1496-1506). The theme was adopted by the Raphael/Giulio Romano circle (e.g., Villa Madama, Rome, c.1518 onwards, **[Fig. 1.13]**) – who also drew on their own studies of the interior of the Pantheon in Rome[35] – and thereafter became popular with mannerists like Sebastiano Serlio (1475-1554), Bartolomeo Ammanati (1511-92) **[Fig. 1.14]**, and Giacomo della Porta (c.1533-1602). Even the normally restrained Palladio occasionally reverted to this expressive façade language, as in the Villa Poiana at Poiana Maggiore (1545/50) and the rear elevation of the Villa Foscari (La Malcontenta, c.1560). **[Fig. 1.15]** And so did his followers in Venice and elsewhere. **[Fig. 1.16]** At the Monastery of San Carlo alle Quattro Fontane in Rome (1634-), Francesco Borromini (1599-1667) produced an elaborately patterned façade which was in effect a false front with painted windows **[Fig. 1.17]**, following a trend for the use of this perspective device that remained popular throughout the Baroque period.

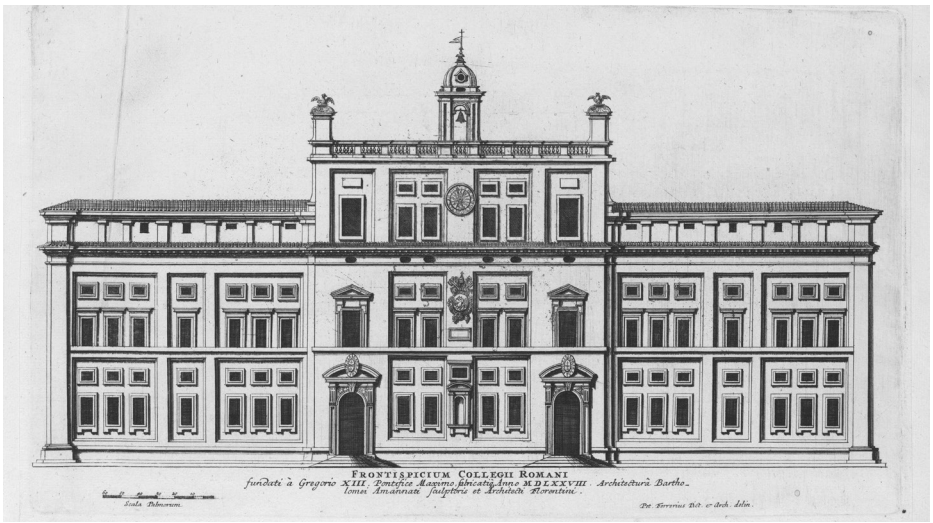

Figure 1.14. Bartholomeo Ammanati: Front elevation of the Collegio Romano, Rome, 1582-4. From: Pietro Ferrerio & Giovanni Battista Falda, *Palazzi di Roma de piu celebri architetti*, 1655-70.

Source: Rijksmuseum Amsterdam – RP-P-1957-653-11-2

Figure 1.15. Rear elevation, Villa Foscari (la Malcontenta), 1560.

Source: Wikimedia Commons – Hans A Rosbach – CC BY-SA 3.0 – 10/07/2007

Figure 1.16. Front elevation, Palazzzo Trevisan, Murano, 1550.

Source: Wikimedia Commons – Sailko – CC BY-SA 3.0 – 09/08/2018

Figure 1.17. San Carlo alle Quattro Fontane, Rome. Monastery façade on Via Pia (Borromini's design for this façade is in the Albertina, Vienna (Azr194)).

Source: Photo: Hentie Louw

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The Italian Renaissance architects not only established the basic grammar for the new classical language based on Vitruvian orthodoxy, they were also responsible for creating much of its vocabulary. Many of the most popular window motifs that we shall encounter again and again throughout this book have Italian prototypes – either a refinement of a classical theme or a novel creation by a modern master – which were codified in treatises and disseminated throughout Europe; adopted and adapted locally according to need or taste. Two centuries of art historical research has made this formal typology a familiar topic, so, we need at this point only identify those basic Italian Renaissance prototypes which might have served as a reference base for the ensuing Europe-wide classical revival. This is not meant as a categorical statement that the types selected were necessarily copied from Italian sources by northern countries (which may already have had similar window types in their traditional architectures when the Renaissance came), but to show the range of the Italian classical vocabulary as a potential source for others wishing to adopt the language. **[Plate 1. A Typology of Italian Renaissance Windows]**[36]:

a The architrave window (i.e., a rectangular opening surrounded by an architrave, with or without a crowning entablature or pediment supported by scrolled brackets or consoles).

b The arched or compass-headed window (i.e., rectangular opening with a semi-circular arched head, usually crowned with an entablature or pediment).

c The three-light, or, 'Jesi', cross-window (a mullion and transom window with the lower half of the mullion omitted to accommodate folding casements; the oldest survivals of the type are found at the Palazzo della Signoria, Jesi,1486-98).

d The classical cross-window (a rectangular or square window divided by a mullion and transom into four lights).

e The *bifora* or biforate window (of Byzantine origin and commonly used in Tuscany, Lombardy, and Venice during the late medieval and early Renaissance period).

f The Diocletian or thermal window (a semi-circular window subdivided into three by mullions).

g The mezzanine or half window (either rectangular or round, and often combined with one of the regular window types – referred to by both Serlio and Scamozzi as a 'bastard-window').

h The coupled or two-light window, comprising either two separate windows placed close together to read as a single unit, or, two lights separated by a column or mullion. Alberti prescribed such a window: 'twice as broad as high with two little columns in the middle', for his Priests' Court (Bk X). The inherent duality of this window form made it an uncomfortable fit with the High Renaissance canon. It was not used much in Italy, but, became popular in the north, especially in Germany.

i The Venetian or Palladian window (a tripartite window with a central arched opening, flanked by two lower, rectangular sidelights. Also called, a serliana.

j The aedicule or tabernacle window (i.e., framed by columns or pilasters, set on a base, and crowned with a pediment).

k The square Venetian window (a composite tripartite arrangement of smaller lights set over larger ones in a square format, sometimes incorporating a central compass head – popularised by Serlio).

l The inset-arch window (a recessed arched bay with smaller inset window forms).

m The rusticated window (astylar openings set in rustic masonry, usually in basements or lower storeys).

n The geniculated window (with a canted 'arch' – after Michelangelo at the Porta Pia).

A prolific 'fenestrator' like Sebastiano Serlio might use a large number of the types listed above in one building, in a variety of combinations, but the more orthodox Italian designers tended to restrict themselves to only a few window motifs at a time. In this context Michelangelo was a unique exception. He came to architecture late in his career, and was responsible for very few architectural projects, but these reveal the significant role that the window played in his architectural thinking, which was intrinsically sculptural. For Michelangelo the elements of architecture were 'like the parts of man'. As Guilio Argan has pointed out, in contrast with the classicist doctrine of the contemporary Rome school, grounded in the typological morphology of modular and proportional composition, what interested Michelangelo about the window or other such recurring forms in architecture was not typology, but iconology: 'It was not a scheme liable to reasoned variations, but an icon which was transformed by rhythm.'[37]

In his very first architectural project, a chapel dedicated to Saints Cosmas and Damian at Castel Sant'Angelo, Rome, c.1514-16, a sculptured square cross-window set within a pedimented aedicule, was made to serve simultaneously as a light source for the chapel and a shrine in its own right. **[Fig. 1. 18]** Michelangelo's use of the cross-window motif for such an overtly votary purpose had a precedent in the four blind cross-windows, set in relief and separated by double pilasters, that formed an over-sized frieze on the entrance loggia of the Pazzi Chapel, Florence. This was designed a generation earlier by either Michelozzo or Giuliano da Maiano. **[Fig. 1.19].** Michelangelo, in turn, probably inspired the equally sculptural cross-windows that Baggio d'Agnolo created for the Palazzo Bartolini Salimbeni, Florence (1517-20), and dedicated to the 'sleepless' (*per non dormire)* **[Figs. 1.20 and 1.21]**

Figure 1.18. Michelangelo Buonarotti: Chapel of Leo X, or, Saints Cosmas & Damian, Castel Sant'Angelo, Rome, 1513-16.

Source: Wikimedia Commons – Sailko – CC BY-SA 3.0 – 01/09/2015

For Michelangelo, however, this was only the beginning of an audacious series of experiments in using the window as a vehicle for exploring spatial and formal themes in architecture, which constantly challenged the emergent Vitruvian orthodoxies of his contemporaries. While remaining sceptical of antique authority Michelangelo, nevertheless, revelled in the complexities of classical detailing, seeking to exploit the expressive potential of standard units like bases, cornices, scrolls