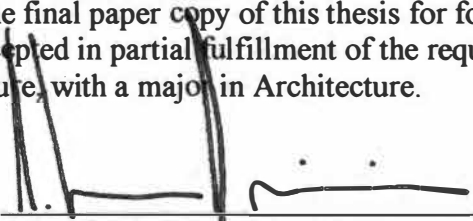
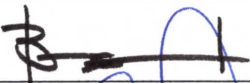


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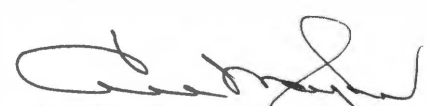
I am submitting herewith a thesis written by Barbara B. Laurent entitled "The Revealing Cut: Horizontal and Vertical Orthogonal Section in the Architectural Design Process." I have examined the final paper copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Architecture, with a major in Architecture.


Adam M. Drisin, Major Professor

We have read this thesis
and recommend its acceptance:


Brian Ambroziak
Charles Debelius

Accepted for the Council:


Vice Provost and Dean of Graduate Studies

**The Revealing Cut:
Horizontal and Vertical Orthogonal Section
in the Architectural Design Process**

A Thesis
Presented for the
Master of Architecture
Degree
The University of Tennessee, Knoxville

Barbara B. Laurent
May, 2003

Thesis
2003
L38

Dedication Page

I dedicate this thesis to my husband,
Louis Laurent,
for his support, belief in my ability and above all, his enduring love.

I dedicate it to my son, Alexander, whose dedication to
the pursuit of art reminded me of who I am.

I dedicate it, as well, to my family and friends
whose encouragement, and patience, during this long process
have been a great source of strength for me.

In my dream,
The angel shrugged
and said if we fail this
time it will be a
failure of imagination

and then she
placed the world
gently in the
palm of my hand

Brian Andreas
Imagining World, 1994

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Abstract Page

This thesis explored the role of orthogonal section in the architectural design process, contending that, in particular, multiple orthogonal sections, both horizontal and vertical, are the primary tools in the design process. It examined spatial layering as the primary architectural language of section, and developed a taxonomy of section as a means for both exploration and design. The thesis examined the historical origins of orthogonal section drawings, how architects used sectional drawings over the centuries, and the role of section in twentieth century architectural production. It also examined several case studies of significant buildings, the analysis of which were pertinent to the thesis exploration.

The vehicle for this thesis exploration was the Villa Giulia, a sixteenth century country retreat built for Pope Julius III just outside the north gate of Rome, Italy. Early in the twentieth century, the Italian government converted the Villa into the National Etruscan Museum, and added museum buildings to the complex. With its own intricate longitudinal section, the Villa and its museum buildings provided an ideal site at which to explore the role of section in the architectural design process. The architectural proposal for this thesis provided expansion and additional functions for the museum. The proposal added new gallery space, both an indoor and an outdoor auditorium, access to the grottos, a library, and facilities for visiting scholars as well as expanded the bookstore and café.

While “proof” of an architectural proposal’s success can only come with the actual construction of the building, this proposal, none-the-less, used section and layering as the vehicle for the new museum design. Program was layered in vertical section, as well as distributed via the traditional plan. The new proposal gave emphasis to the transverse section as well as the traditional longitudinal section of the Villa, and paid particular attention to the different ideas of section developed in the sectional taxonomy.

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I. Statement of Thesis

Architects convey the essence of their ideas about the buildings they envision through various forms of representation. In the area of visual representation, architects employ a wide range of tools to explore and articulate an architectural proposal, from conceptual three-dimensional physical models to three-dimensional digital models to two-dimensional drawings or paintings. While three-dimensional digital models overcome some of the limitations of the time-honored techniques of two-dimensional drawings, in practice, they form yet another way to examine the spatial conditions of an architectural proposal through plan, vertical section, elevation, perspective and axonometric views.

This thesis contends that, in particular, multiple orthogonal sections, both horizontal and vertical, are the primary tools in the design process. Through section, the architect can confront simultaneous issues of space, form, light, program, structure, construction, materiality, and theory and thus produce buildings with sophisticated spatial qualities. These design tools allow the architect to organize and explore issues of connection, organization and composition in an abstract and poetic way. While we never actually see buildings in plan and section, when we experience great architecture, we experience their creatively integrated presence.

II. Thesis Description

The Revealing Cut: Horizontal and Vertical Orthogonal Section in the Architectural Design Process, will explore architectural production through the mechanisms of horizontal and vertical orthogonal sections. Sections in either direction are revelatory by their very nature and at many levels. Sections reveal the inside of a building at a particular location. They reveal methods of construction. They reveal the relationship between the structure and the ground, the structure and the sky. They reveal the relationship between the interior and the exterior of a building as well as the relationship of a wall to the spaces on either side of it. They reveal the relationship of the building to other buildings. As abstract representations of architectural conditions, sections reveal order and hierarchy. They also elicit another type of revelation: the poetic relationship between structure and space. We cannot actually see any of these conditions. Nonetheless, the integration of design qualities engendered by sectional exploration resonates through great architecture.

Architects always design plans (horizontal sections), and sometimes design vertical sections during the design process. While we have an historical abundance of rich plans, the number of memorable vertical sections is far fewer. In fact, finding examples of vertical sections in architecture books is often quite difficult. Guarini's Cappella della SS. Sindone and Mansart's Saint-Louis-des-Invalides (Figure 1, Wodehouse and Moffett,

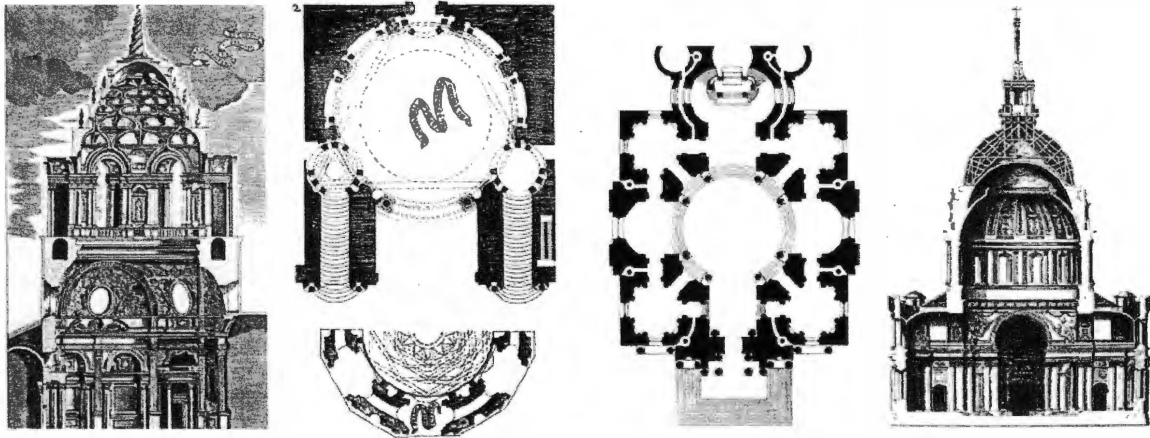


Figure 1 – Cappella della SS. Sindone and Saint-Louis-des-Invalides

p. 303, p. 326) are two early examples, which demonstrate the relationship between the horizontal and the vertical sections.

Louis Sullivan's Auditorium Building, Le Corbusier's Unité d'Habitation, Jørn Utzon's Bagsvaerd Church, and Lou Kahn's Library at Philips Exeter Academy are exemplary examples of modern vertical section drawings. (Figure 2, Curtis, p. 44, p. 440, p. 612, Lobell, p. 105).

What makes these vertical sections so special? Each reveals a building of unexpected complexity. In these buildings, the exterior does not reveal the spaces of the interior. The visitor must experience them. These buildings demonstrate variety in both interior and exterior space. They reveal interwoven spaces. They ask us to think about the meaning of a wall. They reveal both asymmetrical and symmetrical relationships. Their

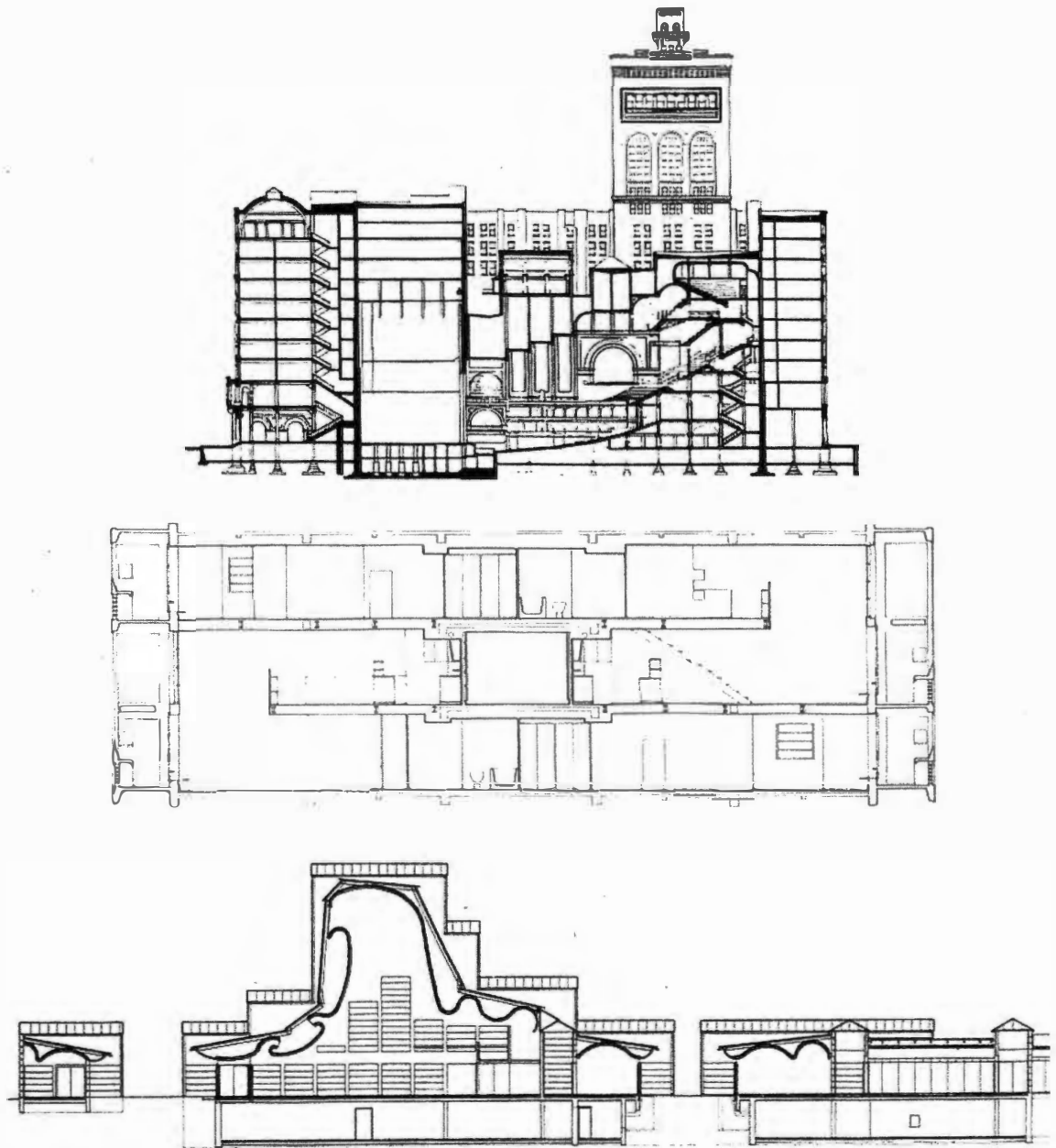


Figure 2 – Auditorium Building, Unité d'Habitation, Bagsvaerd Church, Library at Philips Exeter Academy

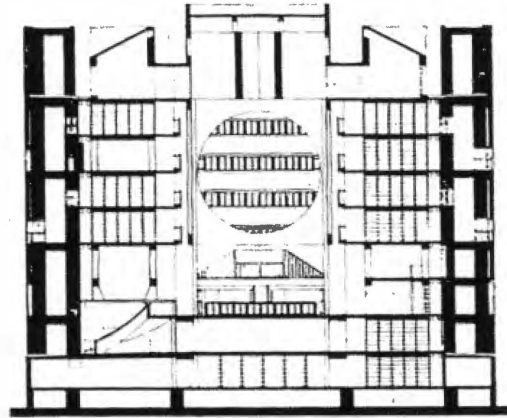


Figure 2, continued – Auditorium Building, Unité d'Habitation, Bagsvaerd Church, Library at Philips Exeter Academy

complexities cause us to pause – we must study them at length. We cannot take them in at one glance.

The great architect, Lou Kahn, in particular, understood the value of vertical section to the design process. For Kahn, a building was the means to capture light, for him the embodiment of the eternal spirit:

Structure is the giver of light. When I choose an order of structure that calls for column alongside of column, it presents a rhythm of no light, light, no light, light, no light, light. A vault, a dome, is also a choice of a character of light. (Lobell, p. 34)

and

I think that a plan is a society of rooms. A real plan is one in which rooms have spoken to each other. When you see a plan, you can say that it is the structure of the spaces in their light. (Lobell, p. 36)

Kahn's many section sketches attest to his concern for the meaning of the wall: thin, thick, or expanded, as means to modulate light and shadow in his buildings.

The history of the development of orthogonal sections helps clarify their significance.

Wolfgang Lotz traces architectural representation of the interior from the invention of perspectival drawing by Brunelleschi in the early 1400s, to Alberti's treatise on painting in 1435 in which he ranked the painter and the painting above the architect. Any extant drawings of that time attributable to architects reflect the emphasis on perspective as the manner in which to depict architecture in a perceptually accurate way. In 1450, however, Alberti changed his ideas about architectural representation when he published his *Ten Books on Architecture*. He wrote:

Between the mode of depiction of painters and architects there is this difference, that the painter achieves an appearance of relief on his panel by shadows and the foreshortening of lines and angles, while the architect, avoiding shadows, gets his relief from the drawing of the plan, and indicates in other drawings the form and measurement of the façade and sides by lines of invariable length and real angles, since he does not want his work judged by illusionary appearance but precisely on the grounds of determinate quantities. (Lotz, p.4)

Architects did not accept for some time Alberti's realization of the shortcomings of perspective as a tool for representation. Until the death of Bramante, architects rendered interiors using perspective. The major architectural event that engendered the change to orthogonal representation occurred in the workshop of St. Peter's as architects confronted a building project of unprecedented magnitude and spatial complexity. Upon Bramante's

death, Raphael succeeded him as chief architect for the project. In 1519, he wrote a letter to Pope Leo X where he discussed the nature of architectural drawings.

And because the method of drawing that belongs more to the architect differs from that of the painter, I shall state what seems to me appropriate to understand all the measurements and to know how to find all the parts of a building without error. The drawing of buildings, so far as the architect is concerned, therefore should be divided into three parts, of which the first is the plan, or rather the ground plan, the second deals with the exterior...the third, with the interior. (Lotz, p. 21)

Raphael described the plan and elevation, concluding with the “interior wall:”

The third part of this drawing, which we have defined as the interior wall,...is not less important than the other two, and is made in the same way from the plan with parallel lines, like the wall of the exterior; and it shows one half of the building from the interior, as though it were divided in half. (Lotz, p. 21)

Lotz concludes that the change from perspectival drawings to orthogonal drawings accompanied a more significant change in the architect’s perception of space.

The Bramante circle, which conceived of enclosed space as something imbued with volume-as an independent entity, as it were-and not like Alberti as ‘compartments based on reason,’ could only represent this spatial volume according to Alberti’s rules of perspective. The orthogonal section, as postulated by Raphael, would have led to untrue reproduction, because Bramante’s interiors must be seen as an image in perspective. (Lotz, p. 21)

For Raphael, the interior was more complex, not a single, “independent entity.” In describing Raphael’s Chigi Chapel in Santa Maria del Popolo, Lotz explains that the

visitor needs “the cumulative effect of many impressions in order to take in and truly comprehend the chapel interior.” The interior now encloses the visitor, and the “picture qualities of the space-limiting surfaces,” he continues, “recede before this impact of space.” (Lotz, p. 22)

As the architects for St. Peter’s worked out the spatial problems of the highly complex design, orthogonal vertical section drawings became more essential. Plans, elevations, and even three-dimensional models were not enough to provide the information they needed. Antonio da Sangallo the Younger, who worked as Raphael’s chief assistant at St. Peter’s and took the position as head of the workshop upon Raphael’s death, was the first architect, Lotz concludes, to use orthogonal sectional drawings consistently. Lotz even postulates that Sangallo won the position based more on his knowledge of architectural drawing than on his building experience. His appointment

coincides with the separation of the two professions (painting and architecture) which became increasingly evident in the first half of the sixteenth century. Sangallo was not only the first chief architect of St. Peter’s to come from the building craft, he was also the first to work exclusively as an architect. (Lotz, pp. 31, 32)

Orthogonal sections, therefore, provide architects with a measured and precise way to explore spatial conditions, both vertically and horizontally. In their “flattened” condition, orthogonal sections also present an abstraction of the relationships between building and space. This type of building “x-ray” can generate other explorations such as foreground, middle and background, and figure/ground relationships. Indeed, sections may be used to

explore not only the building and its interior space, but the relationship of these to the immediate exterior, and to the entire site as well.

Architects have neglected – or avoided – vertical section, in particular, since the turn of the twentieth century. In her article, “Small Craft Warnings: Thickening Horizons, Hollowing Walls,” Mary McAuliffe laments the loss of sectional drawings as a tool among the architects of the International Style. She attributes this loss to both the “coherence of surface” with its ambiguity between two-dimensional and three-dimensional effects, as well as the “near automatic coupling of ‘wall’ and ‘plane’ in many accounts of modern architecture” (McAuliffe, p. 96). In its modern ambiguous state, the wall both fascinates and threatens architects. Sectional exploration runs too much risk of exposing the wall’s potential indication of mass, a concept that does not fit with the modernist agenda of dematerialization.

If neglect of section is due, as McAuliffe states, to a “deliberate marginalization of the question of mass” (McAuliffe, p. 96), then section as a tool for spatial exploration has been marginalized as well. In his analysis of St. Peter’s in Rome, Spence Kass uses multiple horizontal sections to describe not only the intricacies of the *poché*, or interstitial spaces in the walls, but also the complexity of the spatial conditions in the cathedral (Figure 3, Kass, p. 47). Compared to the traditional vertical sections of the church, which describe the vertical size of the interior spaces and the thickness of walls (Figure 4, Kass,

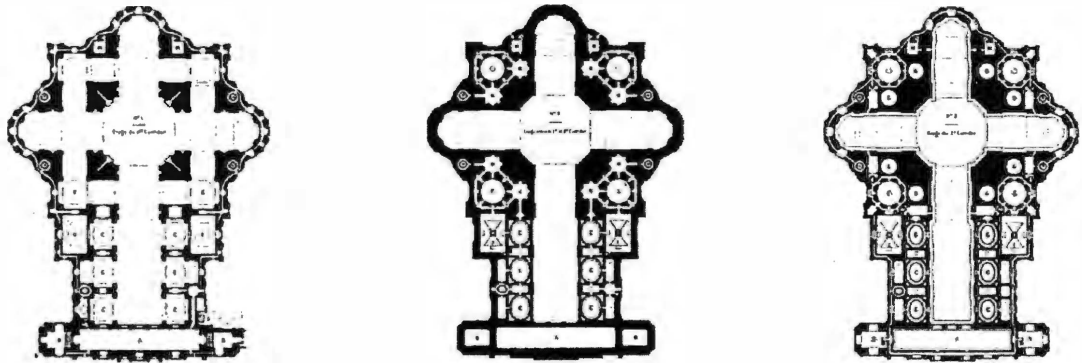


Figure 3 – Horizontal Sections through St. Peter's, Rome

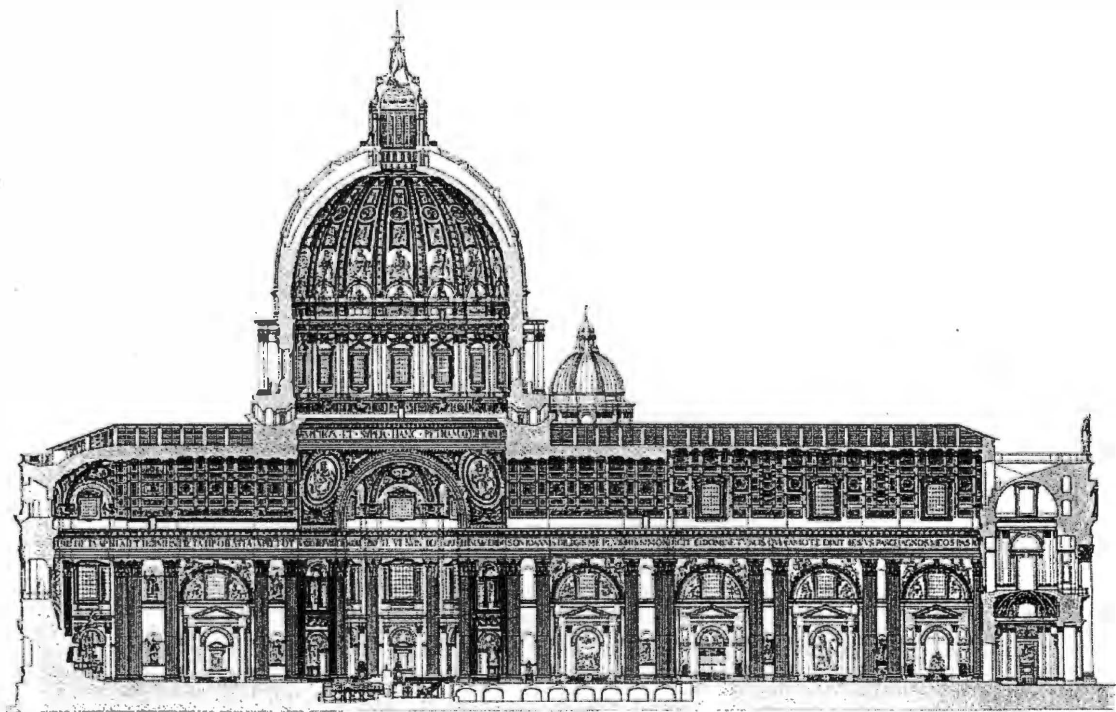


Figure 4 – Longitudinal Section through St. Peter's, Rome

p. 47), the horizontal sections expose a different aspect of the spatial condition. They reveal conditions of expansion and contraction of volume. It is, in fact, necessary to section the church at many levels both horizontally and vertically in order to understand its complex spatial conditions. Kass's ideas and St. Peter's itself will be explored further in a case study for this thesis.

Bruno Zevi, writing in 1957 in *Architecture as Space*, describes the "large scale diffusion of poetry and literature, painting, sculpture and music" resulting from technological advances such as the printing press, photography, radio and film. (Zevi, p. 45). He continues with a lamentation about architecture:

Architecture, however, remains isolated and alone. The problem of how to represent space, far from being solved, has not yet been even stated. Since up to now there has been no clear conception or delineation of the nature and consistency of architectural space, the need for its representation and mass diffusion has been consequently not felt. This is one more reason for the inadequacy of the architectural education. (Zevi, pp. 45-46)

While issues of mass diffusion are not a part of the scope of this thesis, Zevi's concerns about representation of architectural space are. His book is subtitled "How to look at Architecture," and he describes the three ways that buildings are represented in architectural histories: plans, elevations and photographs. He does not include vertical section. This is curious. None of the methods he includes is available to the on-site visitor. Architects draw elevations from a fixed, point of view that is often physically

impossible for a viewer to attain. Elevations are also “flattened.” The photographer’s viewpoint is also often unavailable to the visitor. The ubiquitous plan, as discussed previously, is also never available to the visitor. Vertical section is also not physically available to the visitor, but why does Zevi not include vertical section among the methods of building representation? His neglect of vertical section is indicative of the age in which he wrote, as described by McAuliffe. He concedes that it takes a combination of representational methods to give someone not at the site a sense of architectural space, yet he leaves out an important method that would significantly help alleviate the problem. His attempts to describe the spaces, especially the dome and cupolas, in Michelangelo’s plan for St. Peter’s without the use of vertical sections may bolster his argument that representation of architectural space is difficult, but in neglecting vertical section, his argument is fallacious.

Rob Krier, in his primer, *Elements of Architecture*, of 1983, commits the same sin of omission as Zevi. He draws the interiors of rooms in perspective, as related to their horizontal sections, but never their vertical ones. His images are scenographic, but not architecturally spatial. Avoidance of the long-available design tool of vertical orthogonal section, in particular, has only served to increase confusion over the representation and meaning of architectural space.

This thesis proposes that the best way to explore architectural space during the design process is through an increased use of sectional cuts – in both directions. To this end, this proposal will refer to traditional building sections as *vertical sections*, and will refer to floor plans as *horizontal sections*. While architects sometimes cut several vertical sections to demonstrate significant interior spaces or site relationships, the floor plan is traditionally a single cut, at about four feet off the floor plane. *This presumes that above or below this cut line there are no significant spatial conditions to explore.* Thus, this proposal will liberate the horizontal section from its solitary position at four feet above the floor plane promote its use at multiple levels within each level in the structure.

Areas for Exploration

There are several different ways to explore how architects can use section in the design process.

Sectional Taxonomy

Architects inherently tend to gravitate to horizontal sections – plans – or elevations when they begin the design process. Vertical sections and sectional partis are less often the impetus to an architectural proposal. Perhaps the reason is that the horizontal section reads traditionally as a “map” to the structure, something that even those untrained in the discipline can follow. Vertical section remains more elusive. It is more difficult for us to comprehend. We are mentally able to remove the roof from a building. We have more clarity when we make the imaginary slice and peer inside. A taxonomy of section

types is a way to provide a vocabulary – both visual and textual – to define and analyze different sectional concepts.

Proposed are four categories of various types of sections. Figure 5 deals with the wall, demonstrating qualities of the built structure that separate interior from exterior. Figure 6 deals with space, or that which is not wall. Figure 7 looks at the relation in section between the wall and space. Finally, Figure 8 shows how section can be viewed as an abstraction, pertaining especially to composition and order. These four groups will be used as a framework for both the evaluation of the case studies, as well as for the design process for the thesis project. While diagramed as vertical sections, each may also be read as a horizontal section. Sections, both vertical and horizontal, may be hybrids of any of the types.

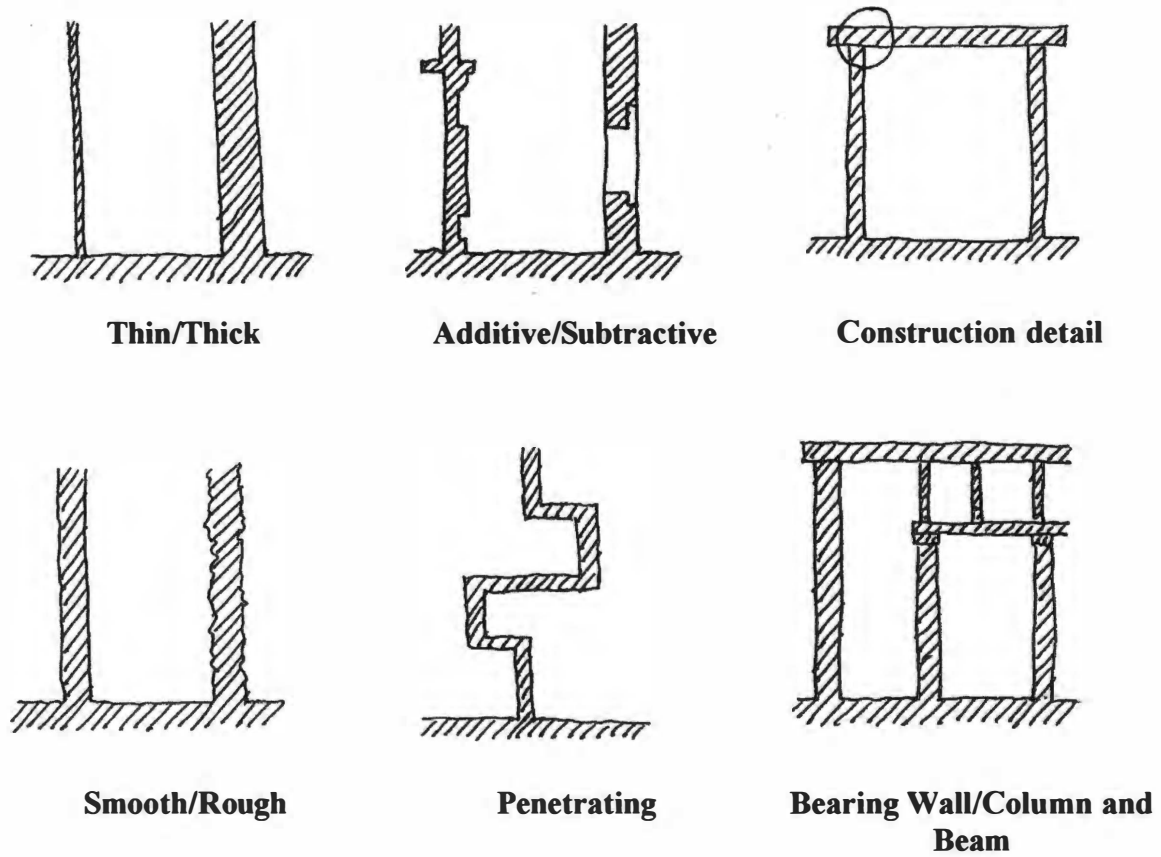
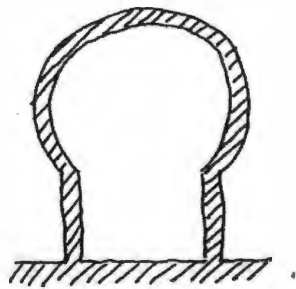
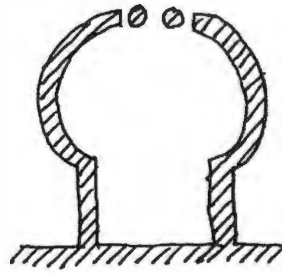


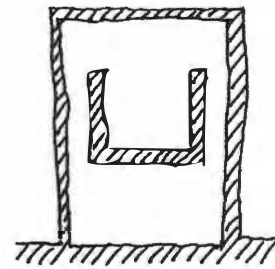
Figure 5 - Wall: Pertaining to the qualities of the built structure that separate interior from exterior.



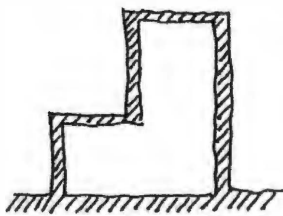
Enclosed



Open



Overlapping

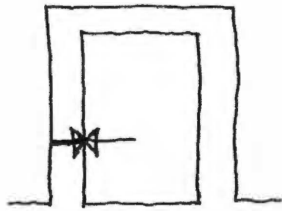
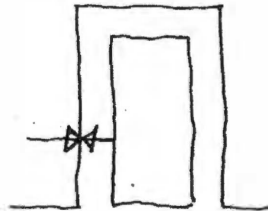
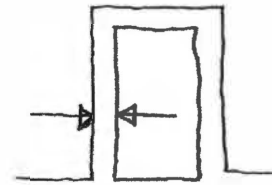
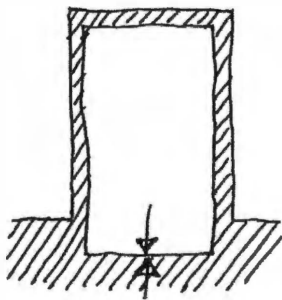
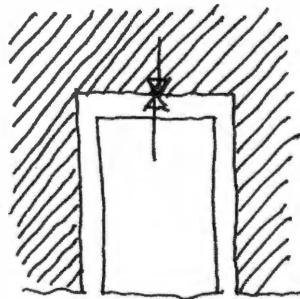


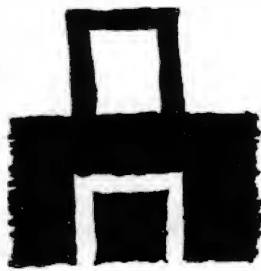
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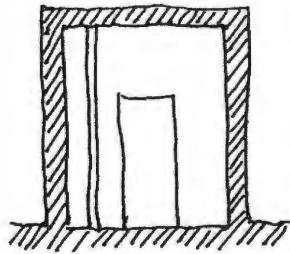
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Figure 6 - Space: Pertaining to that which is not Wall

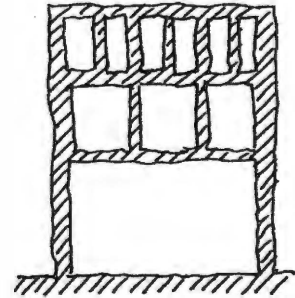
**Wall to Interior****Wall to Exterior****Interior to Exterior****Structure to Ground****Structure to Sky****Figure 7 - Relational: Pertaining to the relationship between Wall and Space**



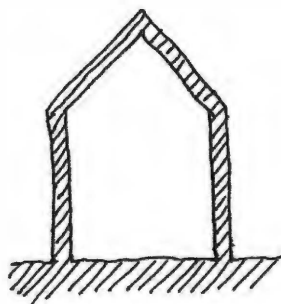
Figure/Ground



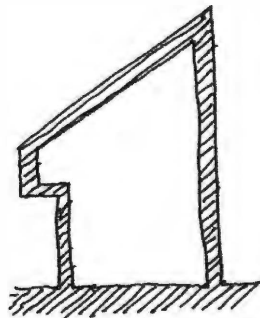
Fore/Middle/Background



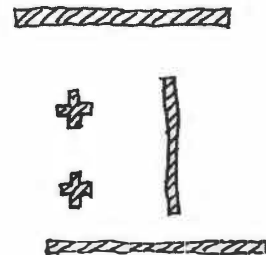
Hierarchy



Symmetry



Asymmetry



Space-defining

Figure 8 - Abstract: Pertaining to composition and order

Sequence/Circulation

Sectional drawings are essential tools when an architect considers sequence. While sequence, in one respect, is a linear path through a space or series of spaces, sectional tools such as level changes, compression and expansion, and other modulations of the envelope transform the mere notion of path into something more experiential. Again, while architects have traditionally used vertical section to design these sequential experiences, multiple horizontal sections would encourage vertical changes in sequence.

Layering/Dissection

Considerations of sequence may also include spatial layering at both the scale of the site and the scale of the building. Layering and dissection may also occur at the scale of the wall. As McAuliffe has pointed out, modern architecture's dematerialization of the wall has reduced the wall to a mere plane. In her essay, however, she reveals the way Le Corbusier actually re-invested the wall with layers by using interior layers such as *casier-murs* and exterior layers such as *brise-soleils* (McAuliffe, pp. 99-101, 106-108).

Dissection in modern architecture deals for the most part with the concept of façade as skeleton or skull, as discussed by Thomas Schumacher in his essay, "The Skull and the Mask: The Modern Movement and the Dilemma of the Façade." Structure is exposed and program is reflected on the façade.

III. Thesis Goals

The goal of this thesis exploration is to develop an architectural proposal using multiple horizontal and vertical sections as the primary design tools. Primacy will be given to vertical section and parti. The taxonomy of sectional types provides a primary method of exploration. By its very nature, the concept of section engenders secondary explorations: sequence, layering, and the opposite of layering – dissection or the peeling back of layers. The chosen site and program support and promote these explorations.

IV. Site Selection

The site for this thesis exploration is The Villa Giulia just outside the Porta del Popolo, off the Via Flaminia, at the northwest edge of Rome, Italy, as seen in Figure 9. Figure 10 displays Letarouilly's idealized drawing of the plan (Letarouilly, Plate 205). The Villa is presented first in horizontal section for ease of orientation. The labels below the plan refer to various parts of the Villa in the discussion that follows.

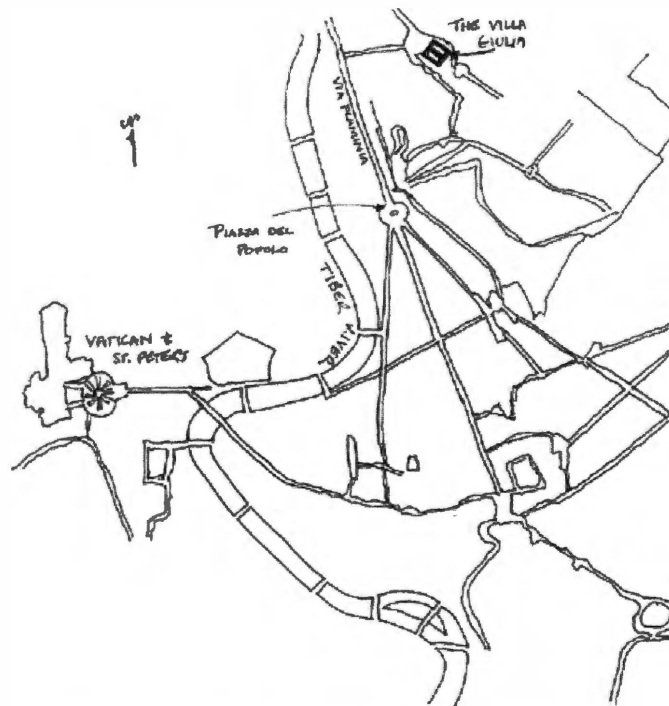


Figure 9 – Rome, Italy, and the Villa Giulia

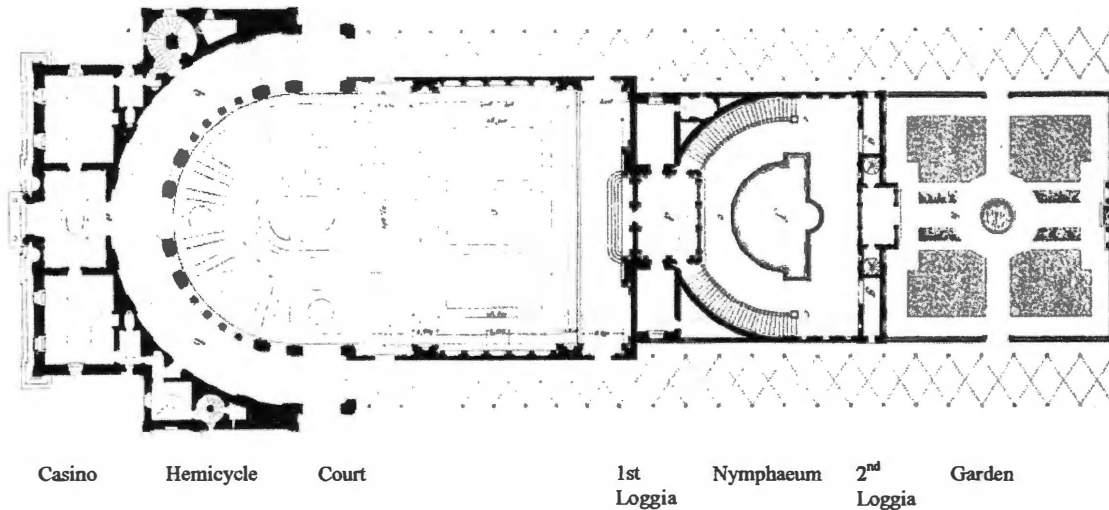


Figure 10 – The Villa Giulia, original building and gardens, 1553

The building and its gardens provide a complex venue in which to explore the concept of horizontal and vertical section as interrelated design tools. Pope Julius III commissioned the Villa in 1551 as both a retreat from the city and as a guesthouse for arriving dignitaries prior to their ceremonial entry into the city. The Pope's family owned the *vigna*, or vineyards that formed the site. The Pope suffered from the gout, and the healing waters of the Acqua Vergine aquaduct flowed out of the city in a conduit under the property. Vasari was the initial architect for the project, with input from Mannerists Ammannati, Michelangelo and Vignola. Vasari may have based the Casino design on an existing villa by Sansovino. By mid-1552, Vignola replaced Vasari as architect-in-charge. Ammannati is credited as designing the Nymphaeum, to which the waters of the Acqua Vergine were diverted, and as well as the caryatids in the lower grotto. (Coffin, pp. 152-155)

In 1889, the Italian government decided to house the National Etruscan Museum in the Villa, and, in 1893, built the North wing of the Museum to house the collection. Several events after the turn of the century prompted further development of the Villa and Museum complex. In 1901, the Italian government acquired the Villa Borghese and its surrounding park, in which the complex is located. In 1904, archeological excavations at Cerveteri and Veio unearthed significant finds of Etruscan artifacts creating the eventual need for more exhibit space. Excavation on the north side of the complex created the Viale delle Belle Arti, built for the 1911 International Exhibition held in the Park.

In 1913, the Museum undertook an elaborate expansion program to house its growing collection of Etruscan artifacts. The new South wing was built as a symmetrical twin to the North wing. The 1913 proposal also included several other additions to the complex that were never built. The drawings for a new east entrance to the complex showed volume and massing similar to the Casino and Hemicycle at the west end of the original Villa. There were also plans for a serliana-based entrance into the North wing from the Viale delle Belle Arti, as well as significant landscaping both inside and outside the complex (Figures 11, 12, and 13, Sgubini, pp. 41-48). Figure 14 displays the Museum complex, as it now exists (Moretti, p. 19).

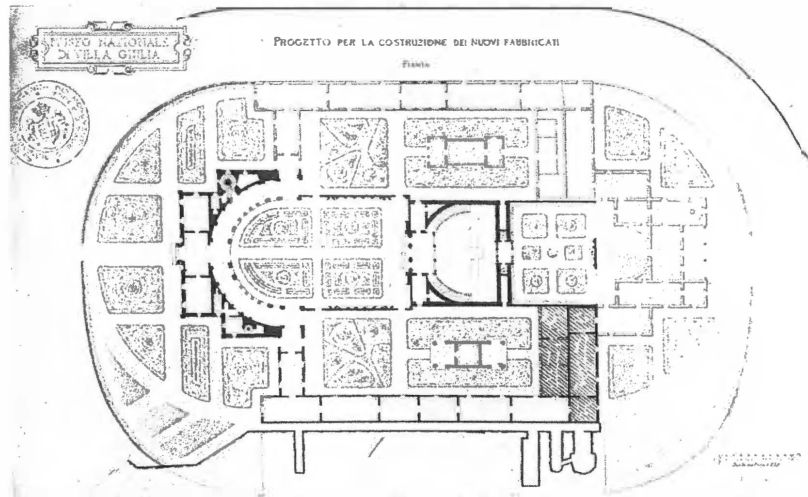


Figure 11 – 1913 Proposed Plan for the Villa Giulia and National Etruscan Museum

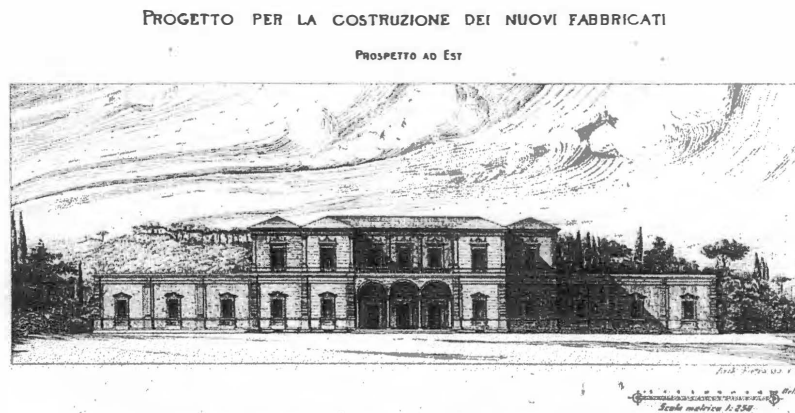


Figure 12 – 1913 Proposed East Entrance – The Villa Giulia and National Etruscan Museum



Figure 13 – 1913 Proposed North Entrance – The Villa Giulia and National Etruscan Museum

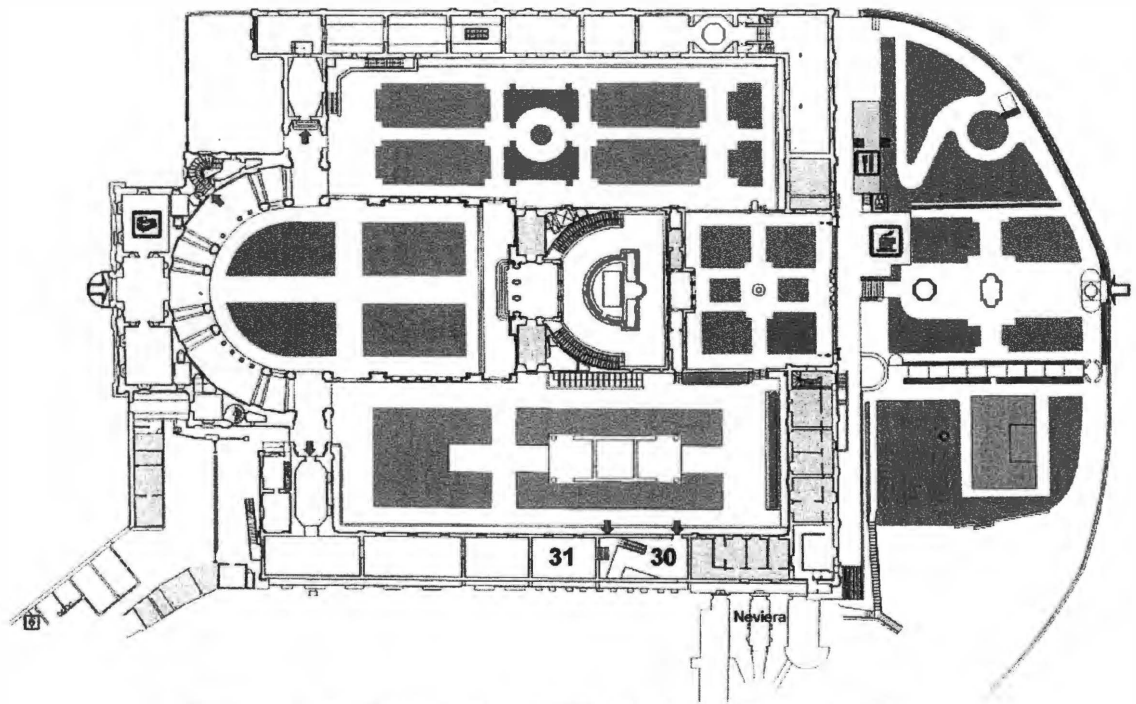


Figure 14 – The Villa Giulia and National Etruscan Museum

Appropriateness of Site

The Villa is an appropriate site for this exploration for a number of reasons.

1. The Villa appears to have a simple, axial orientation and sequence, but this simplicity belies a complex series of spatial experiences only possible in section. The visitor can see through the Casino into the Court, but it is not until he passes through the Casino that the arms of the Hemicycle appear. Once through the Court, the visitor ascends a short flight of stairs to the First Loggia. At this point he can view the corresponding Second Loggia, and its Garden beyond, to which the *visual* axis continues, but he cannot *physically* follow the axis. The space

descends, unexpectedly, into the first level of the Nymphaeum at this point. Even after the visitor follows one of the curved staircases down to this level, a second, lower level appears, but there is no visible way to descend further. Neither is there an obvious passage to the Second Loggia and the Garden beyond.

2. The drawings reveal how the architects consciously used section in several different manners in the Villa. While some drawings were created around the time the Villa was constructed, Giovanni Stern performed the first true survey for Pope Pius VI during restoration work at the end of the eighteenth century. In 1868, Paul Letarouilly created the most widely disseminated set of drawings. Recent measured drawings of the Villa indicated that both architects idealized the drawings to some extent, but for the purposes of this thesis exploration, this is not an important issue (Cocchia, p. 8)

A. The longitudinal section demonstrates the manipulation of complex spatial concepts in the Villa that include not only interior and exterior spatial relationships, but excavation as well. Figure 15 shows the Letarouilly longitudinal section (Letarouilly, Plate 206). The line of sight from the casino through to the far garden is clearly visible, as is the unexpected drop into the Nymphaeum courtyard. What is not apparent from the longitudinal section is the manner in which the physical axis shifts from the visual one. The hidden spiral staircases down from the

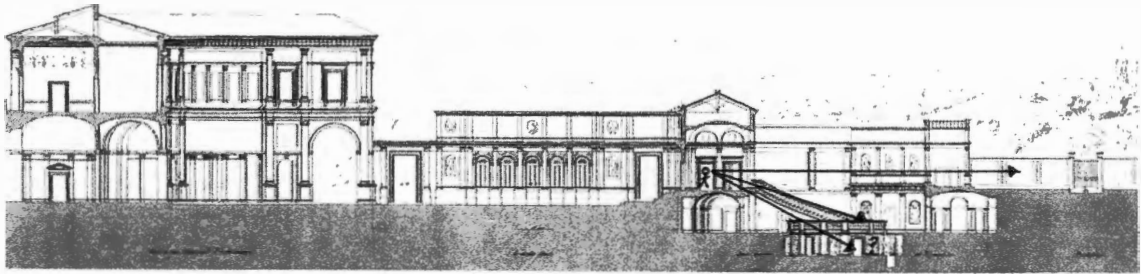


Figure 15 – Longitudinal Section of the Villa Giulia with line of sight

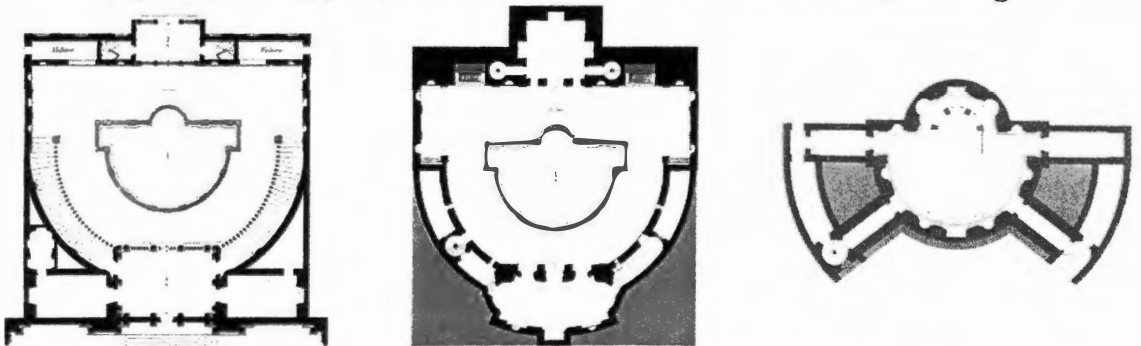


Figure 16 – Horizontal Sections through Nymphaeum Courtyard – the Villa Giulia

First Loggia to the Nymphaeum and up to the Second Loggia and Garden are not visible in this section.

B. Numerous horizontal section drawings increase understanding of the excavation for the Nymphaeum and its relationship to the surrounding courtyard. Figure 16 shows three horizontal sections through the courtyard that contains the Nymphaeum. (Letarouilly, Plates 219 and 220). These drawings demonstrate the visual axis from the First Loggia to the Second as well shifted physical axis as the curved staircases descend to the first level of the Nymphaeum. The hidden spiral staircases to the level of the Nymphaeum and up to the Garden also appear in these drawings.

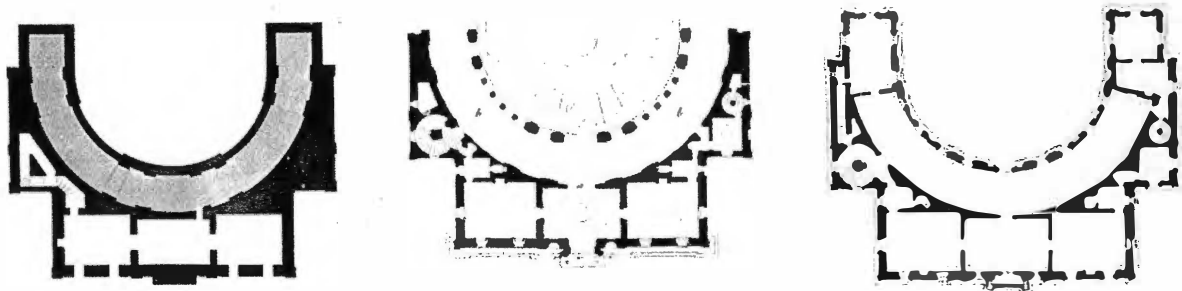


Figure 17 – Horizontal Sections through Main Building and Hemicycle – the Villa Giulia

As seen in Figure 17, horizontal sections through the Casino and Hemicycle also reveal interstitial intricacies similar to those described by Kass at St. Peter's (Letarouilly, Plate 205).

C. The Villa, in many ways, is not a building in the traditional sense where walls enclose interior spaces. Rather, the Villa is a series of walls that enclose outdoor spaces, in particular, terraces and gardens. The one room deep Casino is simply an expanded wall. In the Villa Giulia, then, one must confront walls, in McAuliffe's sense. This is not a construct based on dematerialization.

3. While the longitudinal section always receives attention in analyses of the Villa, it is significant that the transverse section does not receive the same consideration. What are substituted are various elevations of not only the front façade, but also more importantly, of the interior façades of the various courtyards and gardens. This use of elevation, which is actually a form of section with the cut at the vertical surface, demonstrates the idea of section as stage set. The Letarouilly drawing of the inside of the Hemicycle in Figure 18 illustrates this

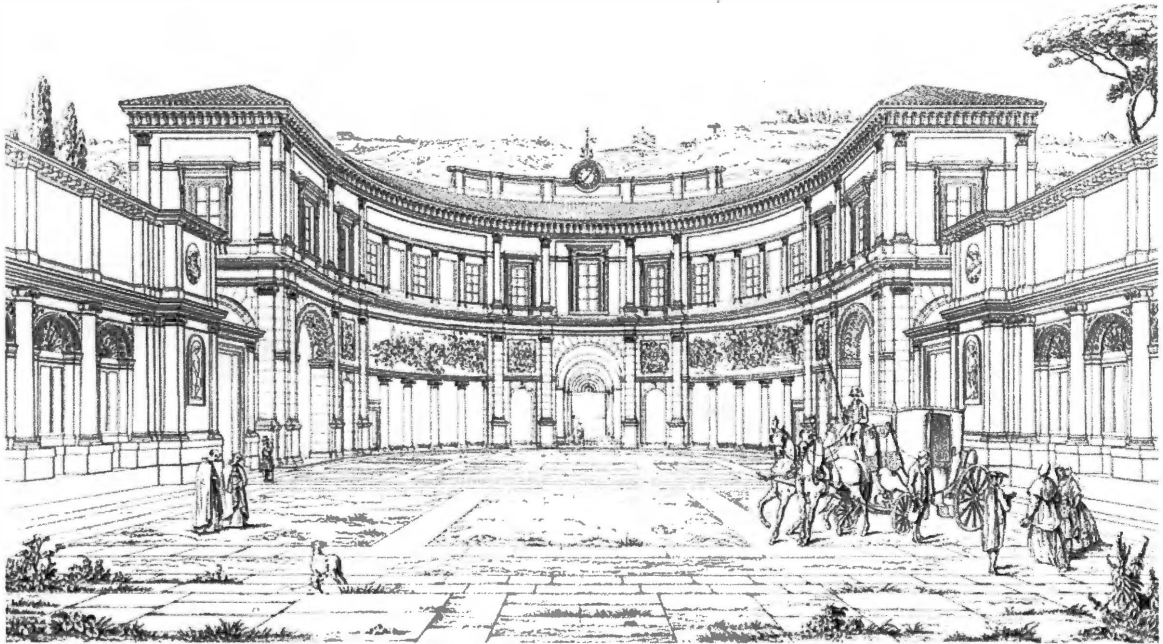


Figure 18 – Interior of First Garden and Hemicycle – the Villa Giulia

(Letarouilly, Plate 214). It is clearly a one-point perspective. The truncated arms of the Hemicycle could easily represent a vertical section through the ensemble that results in a dramatic stage set. The walled courtyard of the Court then becomes the space for an audience. The allusion is not accidental. Ammannati left a detailed description of the Villa and its construction. He refers to the Hemicycle and the Court in theatrical terms, “the semicircle of the palace then makes the theater [or auditorium] and this other, which I shall describe [the three walls of the court] make the scene” (Coffin, p. 162). Originally highly decorated with colored marbles, gilded stuccos, and a red porphyry fountain, Coffin concludes that the Court must have “evoked the image of an ancient Roman theater” (Coffin, p. 163).

4. The Villa Giulia contains its own internal sequence, but it is important to understand its role in a larger sequence. The Villa was both a destination – a country retreat for the ailing Pope Julius III – and a stopping point for important visitors coming to the city. The gated Porta del Popolo was the northern entrance to Rome. Dignitaries arriving from the North would stop at the Villa overnight before making a ceremonial entrance into the city the next day. This “ceremony of entry” was a long-standing tradition in Rome, dating back to the arrival of Charlemagne in 774, and for many years after Pope Julius’s death in 1555 this was the primary function for the Villa. Cosimo de’ Medici of Florence prepared for his 1560 visit to Pope Pius IV with a stay at the Villa. (Coffin, pp. 149-150) The Villa, then, is part of a ceremonial sequence, much like the Acropolis or the Le Corbusier’s Villa Savoye. Its ceremonial section stretches from Northern Europe to the Vatican.

5. The concept of layering – and its opposite concept, dissection, are both present in the sectional qualities of the Villa Giulia in two different ways. First, sequence through the Villa is clearly through a series of vertical, then horizontal, layers. The visitor traverses the Casino, the Hemicycle, the Court, and the First Loggia, each with a different spatial quality. The Casino is the expanded wall, the traditional space. The loggia within the Hemicycle begins the transition from interior to exterior. The Court is first embraced by the Hemicycle loggia, then firmly delineated by the walls. Finally, there is the short ascent to the First

Loggia and through its constricted archway to the surprising space that follows. At this point both the axis and the layering shift. As has been described, the visual axis appears to continue across open space to the corresponding Second Loggia. This only happens when the visitor is still on the platform of the First Loggia. Once the descent down the curved staircases begins, the visual axis is distorted as the visitor passes down through the space. In a sense, the visitor passes through layers, or strata, of space as he descends into the excavation. Patterns on the walls demark these strata and form an invisible grid, or web, across the space. Figures 19 and 20 show the inside of this space (Coffin, pp. 156, 159). The Form-Z model in Figure 21 shows the strata.

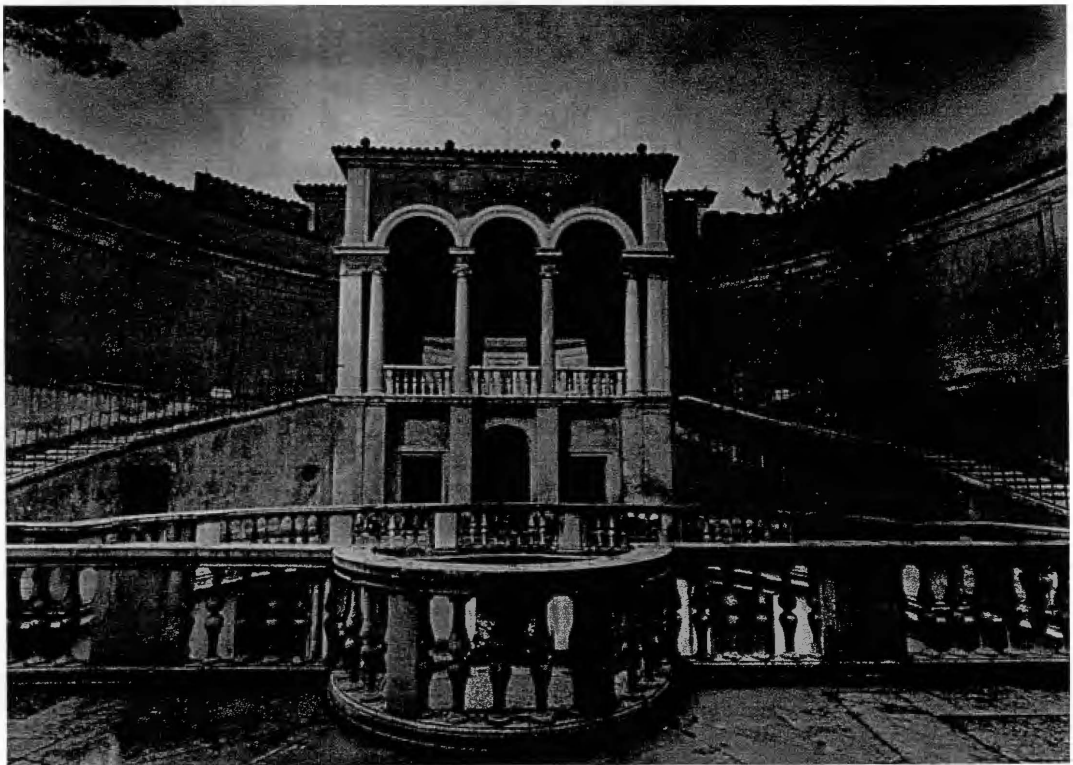


**Figure 19 – The Nymphaeum Space facing the First Loggia –
The Villa Giulia**



Figure 20 – The Nymphaeum Space facing the Second Loggia – The Villa Giulia

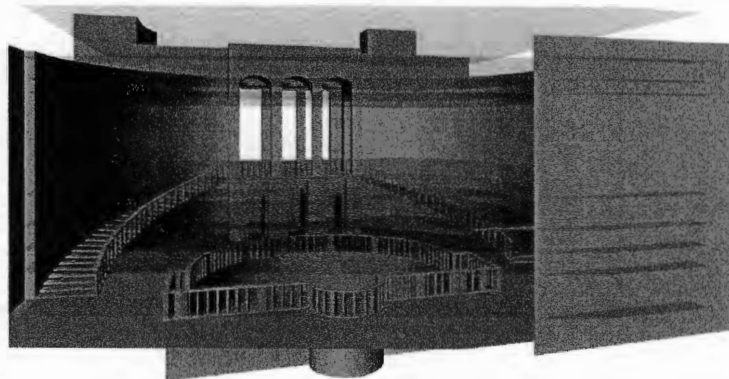


Figure 21– Form-Z Model of Villa Giulia showing Strata

The façades also reveal another type of layering: the use of pilasters, shallow window frames, and shallow niches. This is what Colin Rowe calls the flattened, minimalist grid of the sixteenth century. He likens this “cardboard cut-out” type of façade to the work of Vesalius in his *De Humani Corporis Fabrica* of 1543 where

his plates on the process of dissection, stripping the human figure down from the skin, through muscles to bone, might be a commentary upon so many sixteenth century buildings. Specifically it might be a commentary on Vignola, Ammanati (sic), and what is going on at the Palazzetto Spada where the usual appearance of multiple relief layers makes an early appearance (Rowe, 1996, p. 131).

Current Use of the Villa Giulia

The Villa Giulia currently houses the National Etruscan Museum. The exhibits are located primarily in the two wing buildings added at the end of the nineteenth century. These wings surround the original walled gardens, forming new, secondary gardens. The exhibit halls in the wing buildings are arranged enfilade. (See Figure 14) Glass cases containing Etruscan objects of archaeological interest line their walls. In some rooms, freestanding glass cases march in sequence through the rooms themselves.

The architects attempted, in the new wings, to maintain the proportions of the Casino building of the Villa. The wings are one room wide and the height of the structures

match the height of the Court walls. Niches in the walls facing the new gardens recall the elaborate layering of the Villa's façades. The additions, however, compromise the Villa and its contemporary function as a museum in several ways.

1. The additions change the scale of the complex from a villa to a palazzo. The front façade is now much wider, and the walled gardens of the original Villa have been subsumed. The complex is no longer the delicate series of walls and stage sets that Vignola and Ammannati designed.
2. The sequence along the physical and visual axis of the Villa is no longer primary. The sequence through the museum directs the visitor to the side wings rather than along the axis of the Villa. The view along the axis happens in the reverse direction to the originally intended sequence from the main entrance through the Casino, through the Hemicycle and Court, to the First Loggia, and down to the Nymphaeum. If the visitor wants to experience the Villa as intended, he or she must cycle back at the end of the museum visit.
3. The rooms in the wings are arranged enfilade, which is not an unusual configuration for a museum. The exhibits, however, are housed in statically arranged glass cases. The glass cases that line the walls in all the rooms present their three-dimensional contents to the viewer as two-dimensional. The visitor views the objects frontally. While there are some glass cases located away from the walls which allow for three-dimensional viewing, their positions in the rooms is less than interesting. The exhibits become a series of endless glass cases of

things. There is no hierarchy in the exhibit arrangements, no attempt at creating interest in any way.

V. Program Selection

As previously described, the current situation of the Villa Giulia as the National Etruscan Museum compromises the Villa as an important example of an early Mannerist villa, and also does not provide the most ideal conditions for the Museum itself. As the vehicle for this exploration, this thesis will address these conditions in the following manner:

1. Removal of the southern (right side facing Villa) add-on wing and its garden space. (There is a reconstruction of an Etruscan temple in the south garden – fate to be determined.)
2. Construction of a new museum building containing exhibit space, a small library, research facilities (non-laboratory) for visiting scholars, a café and bookstore. The new museum will be a combination of above and below grade structures.
3. The northern (left side facing Villa) add-on wing and its garden to remain as both storage space and a buffer to Viale delle Belle Arti.

These changes and the new museum facility will return the sequence through the complex to its original focus: through the Villa Giulia and out to the landscape beyond. This will also return the initial view of the Villa along the Via di Villa Giulia to that of the original Villa, not the wing addition.

In keeping with both the sectional nature of the Villa and the fact that the museum contains archeological artifacts, the new facility will emphasize a sequence and

experience that is spatially engaging in both vertical and horizontal section. The three-dimensional artifacts deserve three-dimensional display. As the Villa Giulia was designed, in part, to access the waters of the Acqua Vergine, the proposed museum may incorporate a water feature, as well.

Because the axis of the Villa Giulia involves a complex series of level changes, it will be difficult to retrofit the Villa itself with handicapped access. Mobility-impaired visitors will be able to pass through the Casino, Hemicycle and Terrace, but because the First Loggia is elevated, access will not be possible from this point forward in the sequence. Provision will be made for handicap access to the new museum building. As some of this museum will be below grade, it may be possible to provide access, or at minimum, views into the lower levels of the Villa at the Nymphaeum from the new museum.

VI. Site/Program Fit

The site is part of the Villa Borghese Park, in an area of museums and academies. It is bounded by the Viale delle Belle Arti to the North and East, and the Via Omero to the South and West. (Figure 22, Vreeland, inside cover) The buildings and piazzas which bound the site are: A: Schola Sup. di Architettura, B: The Accademia Britannica, C: Piazza Winston Churchill, D: Galleria Nazionale d'Arte Moderna, E: Piazza Thornwaldsen, and F: the Accademia di Romania. Figure 23 is a topographical map of the property just adjacent to the Villa Giulia and National Etruscan Museum complex.

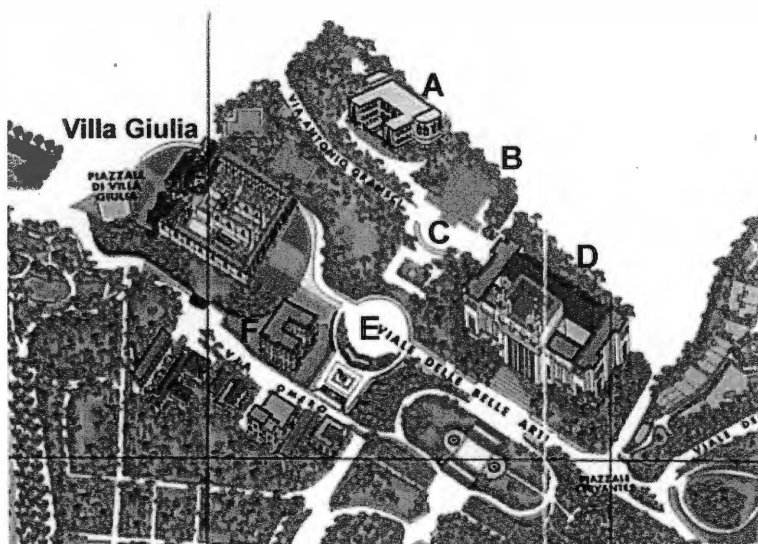


Figure 22 – Project Site

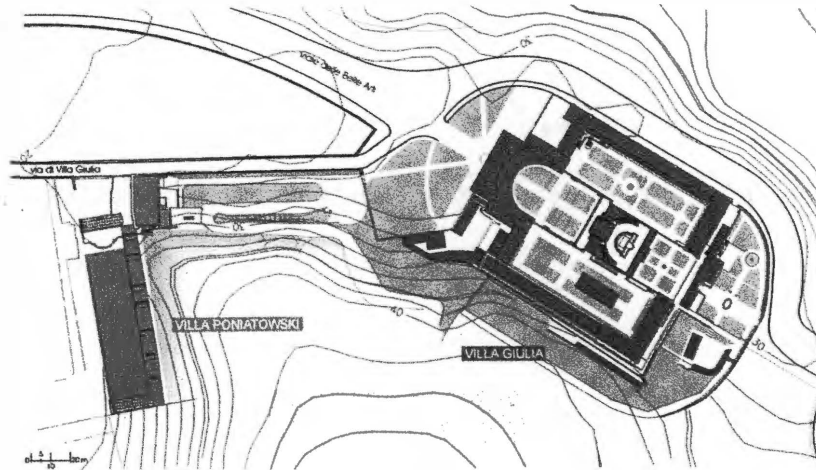


Figure 23 – Topographical Map of Villa Giulia and National Etruscan Museum complex

Form-Z Model of the Site

A Form-Z three-dimensional model (Figure 24) demonstrates the relationship of the existing buildings to the site.

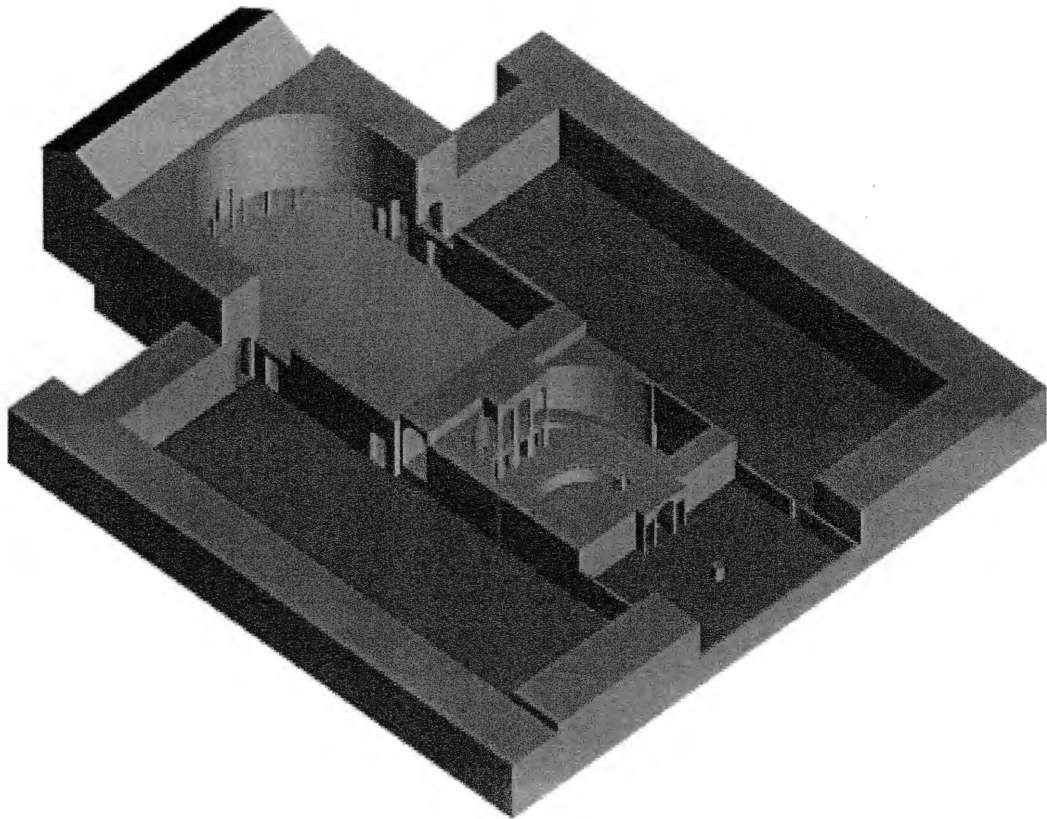


Figure 24 – Form-Z Model of the Villa Giulia

VII. Program Description

Program Concept

The site shown in Figure 22 reveals a complex of museums and schools, of which the Villa Giulia is a part. In fact, this small area is actually a subset of the larger Borghese Gardens, itself a complex of buildings and gardens. What, then, will be the relationship between the new museum, the Villa Giulia, and the complex in which it is located?

As with Robert Venturi's addition to the Allen Museum at Oberlin College, this museum adds to a "distinguished building" (Cohen, p. 50); a task that is always daunting. Cohen states, "the problem of building addition may be approached by imagining the existing building as an incomplete fragment of a larger whole." He continues, quoting Michael Graves who wrote, "the addition can be seen as the completion of the fragment, as its extension, or as a new fragment itself" (Cohen, p. 50). The concept of a "new fragment" works well here. As with the Allen Museum, the existing Villa Giulia is complete. The new museum, then, will not be an addition in the sense of a physical attachment to the existing building (as was the late nineteenth century addition). Instead, it will be an addition to the complex of museums and schools, of which the Villa Giulia is a part. It will have the closest relationship to the Villa Giulia, but it will also relate to the other buildings around the site.

To complicate the program concept further, museums, by their very nature, present a highly-charged agenda: what is the relationship of the museum building to the art that it contains? In his essay, “The Architecture of Art: The Museums of the 1990s,” Vittorio Lampugnani addresses this issue. His comparison of the Louisiana Museum near Copenhagen by Jørgen Bo and Vilhelm Wohlert with Frank Lloyd Wright’s Guggenheim Museum in New York City is telling. Where the Louisiana is quite and reserved, the Guggenheim demands attention. Where the Louisiana was designed for contemplation of the art it contains, the Guggenheim is antithetical to its art. “This building likes being center stage....The wall surfaces on the interior do not favor the paintings mounted there...Here architecture is the real attraction, the incontestable protagonist. This architecture does not serve the artwork it surrounds” (Lampugnani, 1999, p. 11). Lampugnani cautions that “all too often the original goal seemed forgotten: to present works of art in an environment where space, light, and atmospheric conditions would be ideal (Lampugnani, 1999, p. 13). For the proposed museum at the Villa Giulia, the best approach is one of restraint. This building should not compete with either the art it contains or the Villa to which it is near.

What, then, of the museum’s form? Stanislaus von Moos addresses museum typologies in his essay, “A Museum Explosion: Fragments of an Overview.” Currently, the Etruscan Museum is both a “converted monument” and a “museum with traditional enfilades,” but neither suits the purpose of this thesis exploration. Von Moos describes

the complexity of modern museum programs in which approximately two-thirds of the program is not used for exhibition purposes. These areas he calls “catchments” (cafeteria, reception, lobby, etc.) and the office, workshop, administration, storage, and conservation areas. This change in museum program from the nineteenth century ratio of 9:1 (art to other) to modern-day 1:2 (art to other), he claims, frees museum design as “There exists no catalog of architectural forms to satisfy all three functions” (von Moos, 1999, p. 22). Here the Villa Giulia itself will provide the precedent with its complex sequence in both horizontal and vertical section.

While the current collection at the Villa Giulia is primarily archeological artifacts and therefore three-dimensional in nature, the new museum will accommodate future changes in the types of collections displayed. Landscaping will be fully integrated into the design, especially given the nature of the Villa Giulia and its location in the Villa Borghese Park.

General Organization

The program for the new museum at minimum must provide replacement exhibit space for the south wing that is to be removed. This space currently occupies approximately 890 m² per floor, or 1780 m². There is currently a small refreshment area just outside the original garden wall of the Villa. It is still unclear what use the current north wing serves. If it is currently exhibit space, its program will need to be accommodated in the new museum, otherwise the intent is to use this space for storage.

The program for the new museum is divided into four distinct zones¹. Each zone may include both interior and programmed exterior spaces.

Zones

Public Non-Art Zone (Table 1)

All areas of the museum open to the public except gallery/exhibit space. Includes lobby and welcoming functions, ticketing functions, auditorium, classrooms, café, gift and bookshop, meeting room, first aid, and public restrooms.

Public Art Zone (Table 2)

All gallery/exhibit space open to the public.

Non-Public Art Zone (Table 3)

All art storage, exhibit staging, curatorial workshops, visiting scholar workshops, and shipping and receiving for art only.

Non-Public Non-Art Zone (Table 4)

Museum administration offices and meeting rooms, curatorial offices, gift shop management offices, visiting scholar offices, library, mailroom/photocopy/office supply storage, docent offices, staff lounge and kitchen, computer services,

¹ The program for this thesis is based on the functional program for the Frist Center for the Visual Arts, Nashville, TN, developed for Tuck-Hinton Architects, Nashville, TN, by LORD Cultural Resources Planning Management, Inc. I am grateful to principals Seab Tuck and Kem Hinton for allowing me to use this program as a resource.

auditorium projection booth, staff restrooms, café kitchen and food storage, exhibit construction, gift shop stockroom, chair and equipment storage, mechanical room, janitorial supply room and washrooms, non-art shipping and receiving, and garbage area. Table 5 is a summary of the four zones.

Space Allocation

While there will be at least two floors to accommodate the program, the design will determine the actual number of floors. All space allocation is in square meters (m²).

Table 1 – Zone A – Public Non-Art

No.	Space Name	Description	Allocation (m ²)
A1	Vestibule	At disabled entrance	10
A2-A	Main Lobby	Main entrance to museum, both from the Villa Giulia and independent of the Villa.	300
A2-B	Ticketing/Reception	Included in Main Lobby area. Controls access to museum.	10
A3	Coatroom	Manned coat check	14
A4	First aid	Public first aid station - near restrooms	10
A5	Men's Restrooms	ADA accessible with baby-changing station One off Main lobby, second elsewhere (30 ea)	60
A6	Women's Restrooms	ADA accessible with baby-changing station One off Main lobby, second elsewhere (50 ea)	100
A7	Auditorium	For 100 people	140
A8	Multipurpose Meeting Room	Near Café for functions. Contains folding doors to allow separation into 2 smaller rooms	60
A9	Gift/book shop	Office for shop manager adjacent	140
A10	Café	Seats 50 people. Adjacent to Multipurpose Meeting Room for functions. Includes outdoor dining/activity space	80
Zone A Total:			924

Table 2 – Zone B – Public Art

This allocation only considers the space for collections from the south wing.

No.	Space Name	Description	Allocation (m2)
B1	Temporary Exhibition Gallery	For traveling exhibitions. Climate controlled.	1500
B2	Permanent Exhibition Gallery	Permanent collections. Climate controlled.	3000
Zone B Total:			4500

Table 3 – Zone C – Non-Public Art

The existing north wing will be used for Collection Storage.

No.	Space Name	Description	Allocation (m2)
C1	Isolation Room	Separate room for art requiring fumigation	20
C2	Temporary Exhibit Storage	Storage for art in traveling exhibits prior to and following exhibition	500
C3	Documentation Center	Workroom for documentation staff, database entry	25
C4	Curatorial Workrooms	Workrooms (2 at 30 ea) for scholarly research on art	60
C5	Clean workshop/lab	Preservation and conservation work, framing	100
C6	Exhibit Staging Area	Lobby area for exhibit and art movement at Art Freight elevator	90
C7	Art Loading Dock	Must be separate from Service Loading Dock	100
C8	Crating/Uncrating Area	Adjacent to Exhibit Staging Area	100
C9	Crate Storage	Adjacent to Crating/Uncrating and access to Art Freight elevator	140
Zone C Total:			1135

Table 4 – Zone D – Non-Public Non-Art

No.	Space Name	Description	Allocation (m2)
D1	Director's Office	Includes office with conference table, restroom	30
D2	Director's Admin Assist	Also functions as reception area for Director	12
D3	Programs Administrator	Private office	20
D4	Development Office	Private office	20
D5	Volunteer Coordinator	Private office	20
D6	Accounting	Private office	20
D7	Gift Shop Manager	Adjacent to Gift Shop	20
D8	Clerical area	Landscape office near Mail/Copy Room, supplies	20
D9	Staff Meeting Room	In general admin area	25
D10	Office Supply room	In general admin area	15
D11	Mail/Photocopy room	In general admin area	30
D12	File room	In general admin area	30
D13	Staff Kitchen	Adjacent to Staff Lounge	12
D14	Staff lounge	Adjacent to Staff Kitchen	50
D15	Computer Room	Contains server, telecom equipment, raised floor	30
D16	Computer Staff	Office for Network Admin and Services	20
D17	Curator of Art Office	Includes office with conference table	25
D18	Curator's Admin Assist	Also functions as reception area for Curator	12
D19	Library	Research Library, library storage	150
D20	Librarian's Office	Private office	20
D21	Offices for Visiting Scholars	Private offices (3 at 22 ea)	66
D22	Staff Restrooms	1 Male at 30, 1 Female at 50	80
D23	Café Kitchen	Adjacent to Café	50
D24	Food Storage	Adjacent to Café Kitchen	20
D25	Non-art delivery and garbage	Completely separate from Art Delivery area	20
D26	Auditorium Projection Booth	Part of Auditorium area. Must accommodate multimedia (analog & digital projectors, lighting, sound) Also support outdoor concerts	20
D27	Packing Material Storage	Adjacent to Art Storage, Crating/Uncrating	30
D28	Dirty Workshop	For carpentry (crates, exhibit furniture, etc)	175
D29	Security Officer	Private office	20
D30	Security Monitoring	Located at Loading dock, includes restroom	30
D31	Entrance Security	Located in Main Lobby	5
D32	Guards' Changing Room	Lockers and changing/restroom areas male/female	40

Table 4 – Zone D – Non-Public Non-Art, continued

D33	Lobby Storage	Off Main Lobby. For wheelchairs, strollers, etc.	5
D34	Mechanical Room	Boilers, chillers, electrical panels, etc.	250
D34	Building Manager Office	Adjacent to Mechanical Room	22
D35	Wall Storage	For display panels not in use in galleries	30
D36	Chair, equipment storage	Chairs, tables for concerts and other events	80
D37	Gift Shop Stockroom	Storage for Gift shop	50
D38	Publications Storage	Storage for museum publications	30
D39	Janitor's Closets	Adjacent to restrooms (3 at 5 ea)	15
D40	Building Maintenance Storage	Cleaning supplies, building materials and small workbench area	50
D41	Lighting, Electrical Storage	Storage for lift, electrical supplies and fixtures, adjacent to Freight Elevator	30
D42	Forklift Storage	Forklift, hand trucks, dollies, etc.	20
Zone D Total:			1719

Table 5 – Summary by Zone

	Zones	(m2)
	Zone A: Public Non-Art	924
	Zone B: Public Art	4500
	Zone C: Non-Public Art	1135
	Zone D: Non-Public Non-Art	1719
	Total Functional Zones:	8278
	Circulation at 30%	2483
	Total Building Space:	10761

VIII. Building Code

The applicable building code for this proposal is the International Building Code. All material below is from Edward Allen's reference book, *The Architect's Studio Companion, Third Edition*. Only the sections applicable to the proposal are included here. The proposed museum is considered a mixed-use building. As the design evolves, additional Building Codes may apply. An example would be the inclusion of an atrium space or mezzanine. Table 6 deals with Occupancy Groups, Table 7 with Construction Types, Table 8 with Life Safety and Fire Protection, Table 9 with Height and Area Limitations, Table 10 with Egress, and Table 11 with Accessibility for Disabled Persons.

Table 6 - Occupancy Groups

A. Assembly	Assembly includes social, recreational, and civic gatherings of 50 or more persons. <i>The applicable sub-groups are:</i>
	A-2: This group includes food and drink establishments.
	A-3: This group includes recreational, amusement, and worship uses not specifically falling under other Assembly groups, including, for example, galleries, auditoriums, churches, community halls, courtrooms, dance halls, gymnasiums, lecture halls, libraries, museums, passenger station waiting areas and the like.

Table 7 - Construction Types

I-A: 3-hour Noncombustible	Requires a fire-resistance rating of 2 hours for floor construction and 3 hours for columns and bearing walls Construction types: Structural steel, Reinforced Concrete, Posttensioned Concrete, Precast Concrete, Brick Masonry, or Concrete Masonry (see Allen, p. 308 for minimum requirements)
I-B: 2-hour Noncombustible	Requires a fire-resistance rating of 2 hours for floor construction, columns and bearing walls Construction types: Structural steel, Reinforced Concrete, Posttensioned Concrete, Precast Concrete, Brick Masonry, or Concrete Masonry (see Allen, p. 309 for minimum requirements)

Table 8 - Life Safety/Fire Prevention

Because the floor areas will exceed 465 m², for either A2 or A3 Occupancy, the museum must have an approved sprinkler system.
At least 25% of building perimeter accessible to firefighting vehicles on street 6.m wide (minimum).

Table 9 - Height and Area Limitations

Presumptions: Type I-A or I-B (Noncombustible) construction
Approved sprinkler system throughout

A2 (Assembly, Food and Drink)	I-A: 3-hour fire rating: Unlimited height and area I-B: 2-hour fire rating: 54 m maximum height and unlimited area
A3 (Assembly, Miscellaneous)	I-A: 3-hour fire rating: Unlimited height and area I-B: 2-hour fire rating: 54 m maximum height and unlimited area

Table 10 - Egress

Presumptions: Occupant Load: 500 or fewer persons
 Floor area/occupant 1.4 m²

Fire Exits	2 per floor, minimum, or 250 persons/fire exit
Door, corridor and ramp widths	1.2 m as either 1 1.2m door, 2 .6m doors (to be verified with actual metric door specifications)
Stairs	1.3m minimum Design to conform to IBC standards, see Allen pp. 283-293, for configuration, tread and riser design limits

Table 11 - Accessibility for Disabled Persons

Presumptions: All areas of the building to accessible
 All restrooms must be accessible

Auditorium requirements:	
	100 person seating
	3 wheelchair places
	Egress at either end of seating rows
	No more than 24 seats/row
	Clear space between rows: 559 mm maximum, 312 mm minimum
	Minimum aisle width: 914 mm
	Maximum slope of aisle: 1:8
	Maximum travel to exit (sprinklered): 76 m

IX. Initial Parti Studies

The initial parti studies refer to the four zones described in the Program.

General considerations

1. The height of the new museum will not exceed any height of the Villa Giulia.
2. The Public Art zone will be excavated and will be comprised of levels around one (or more) open courtyards.
3. The Non-Public Non-Art zone will contain one or more open courtyard.
4. Natural light will be used in every possible situation.
5. The waters of the Acqua Vergine will be used for a water feature in the new museum.
6. General parking will be in the piazza in front of the Villa.
7. The primary sequence through the complex will be from general parking, through the Villa Giulia, then to the new museum.
8. There will be an alternate sequence for the disabled to the museum from one of two entrances: 1) from the general parking area, or 2) from a small, separate parking lot near the service entrance.
9. Staff will enter the new museum in a separate entrance from general parking.
10. The service area will contain separate zones for art and non-art deliveries.

11. Primary circulation from floor to floor will be via ramps. Secondary circulation includes freight and non-freight elevators, and fire-stairs

Figures 25 and 26 present vertical partis, in keeping with the goal of this thesis to place primary importance on vertical section. Figure 27 shows a detail of the Public Art Zone diagrammed in Figure 25. Figures 28 show the horizontal parti, while Figure 29 examines concepts of layering. Finally, Figure 30 shows diagrams of four different types of circulation. The Case Study section contains additional analysis of the Villa Giulia.

Vertical Partis

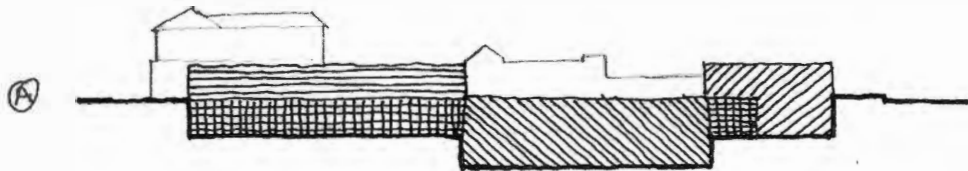
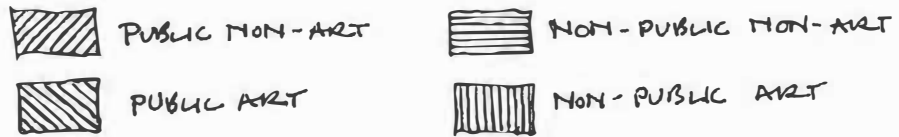


Figure 25 – Vertical Partis at A



Figure 26 – Vertical Partis at B

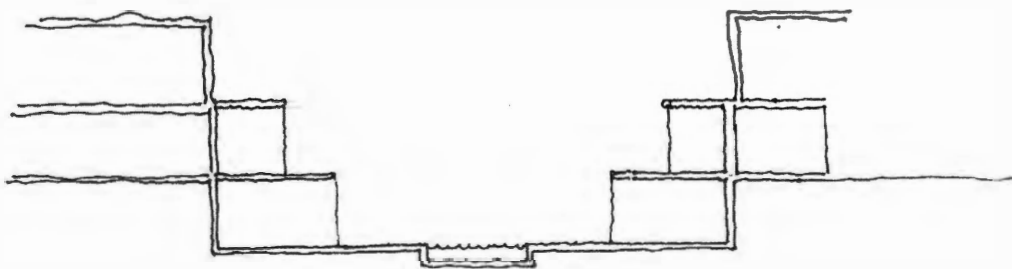
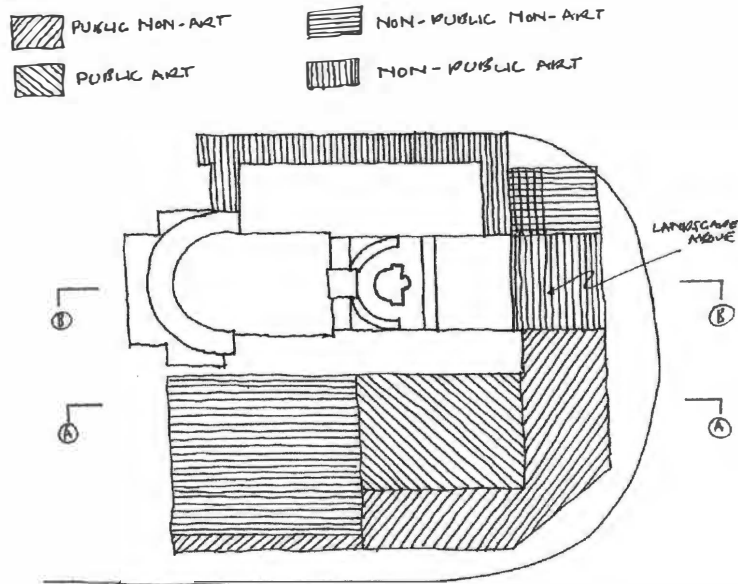
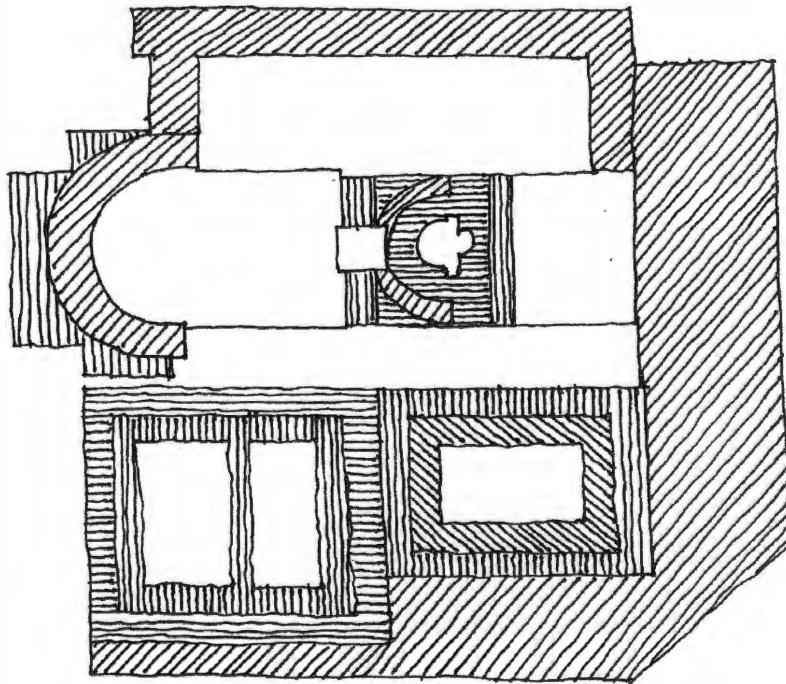


Figure 27 – Detail of Public Art Zone at A

Horizontal Partis**Figure 28 – Horizontal Partis****Figure 29 – Layering**

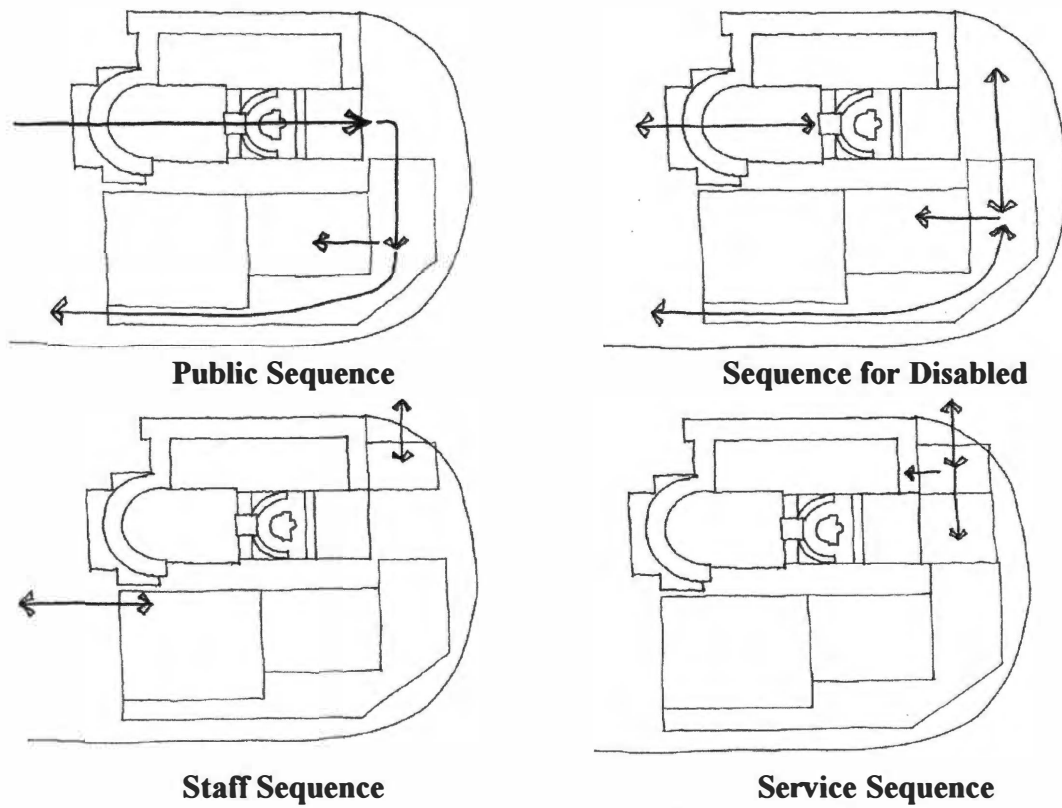


Figure 30 – Sequence Diagrams

X. Resources

Case Studies

The addition to the Allen Art Museum by Robert Venturi and John Rauch

The 1973 addition to the Allen Art Museum by Robert Venturi and John Rauch (Figure 31, von Moos, Stanislaus, 1987, pp. 182, 184) is a useful case study for this thesis investigation for several reasons. 1) The new building is an addition to an existing, significant 1917 building by Cass Gilbert, 2) the site was constrained in size, 3) the buildings that face the site are quite varied in use, form, and style, and 4) the new building contains some of the same program as does this thesis proposal. Another

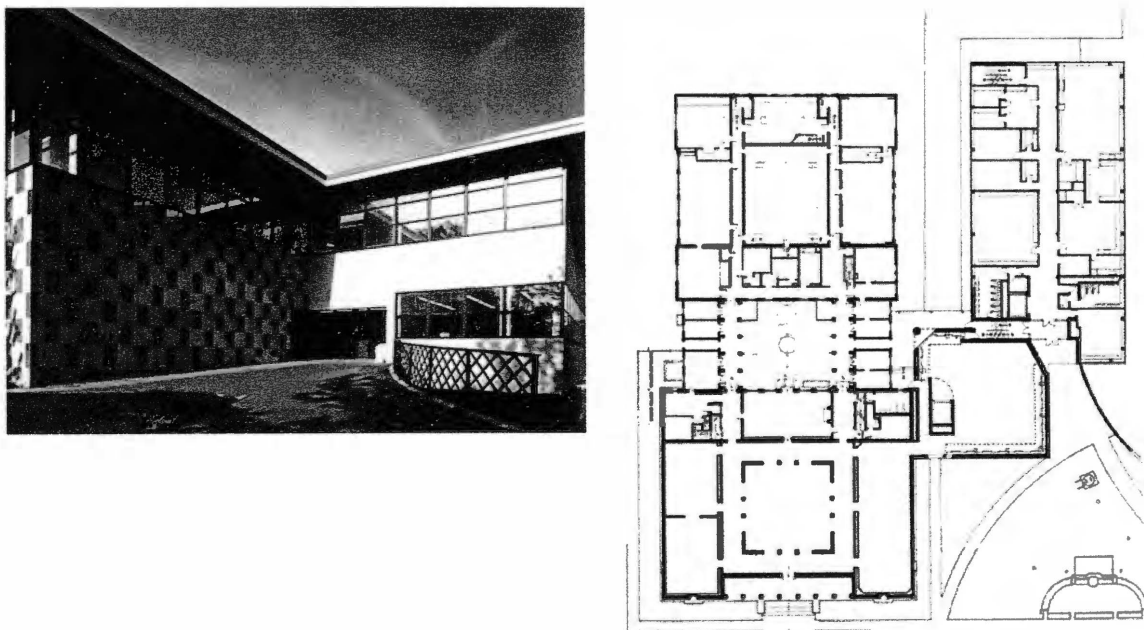


Figure 31 – Exterior and First Floor Horizontal Section – Allen Art Museum

significant aspect of this building is the manner in which the architects used natural light. The horizontal sections of the old and new building complex are spatially interesting. As with most buildings of this period, there is little vertical sectional material available.

Stuart Cohen considers the addition as success, and provides the most useful analysis of the project. He cites Venturi's description of the symmetrical Gilbert museum as "Tuscan Renaissance with Midwestern influences" (Cohen, p. 50). The museum sits on a corner, facing a park lined with other Cass Gilbert buildings. Just to the south of the site sits the Hall Auditorium annex, described as "50s Modern." A Citgo gas station is located directly across the street from the museum. Venturi's challenge was to add yet another structure in this complex site.

Venturi's solution was to provide visual links to the buildings using materials, color and pattern rather than form as the primary tools. The buff-colored brick matches the Hall Auditorium annex. The corrugated metal roof over the exterior walkway at the rear of the addition (Figure 32) is sloped and painted to match the tiled roof of the Gilbert museum building. The cues are "sympathetic," but do not attempt to duplicate. One cannot perceive the addition as separate from its surroundings.

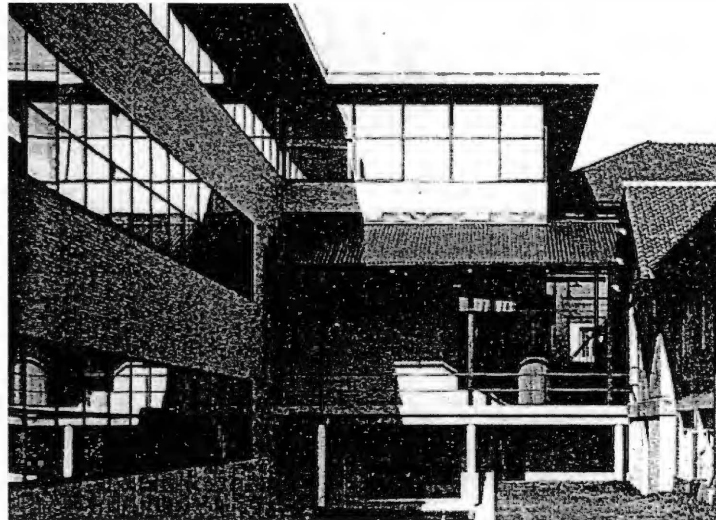


Figure 32 – Painted metal roof, rear of addition – Allen Art Museum

The Allen Art Museum addition program is similar to the program for this thesis in that there is exhibition space, an art library, additional storage, climate controls, and a new shipping and receiving area. The Venturi project differs in that it also accommodated additional teaching facilities for the Oberlin College art department, as well as a laboratory for the Intermuseum Conservation Association.

The manner in which Venturi makes the transition from the older building to the new is significant (Figure 33). Cohen lauds the link element as an “assertive and personal statement” (Cohen, p. 52). Rather than a simple connection or the ubiquitous “glass bridge solution,” Venturi created a two-story near cube of proportions similar to the great entry hall of the existing museum to house the Ellen Johnson Gallery of Modern Art. The exterior colors are the same as those on the older building, but Venturi does not

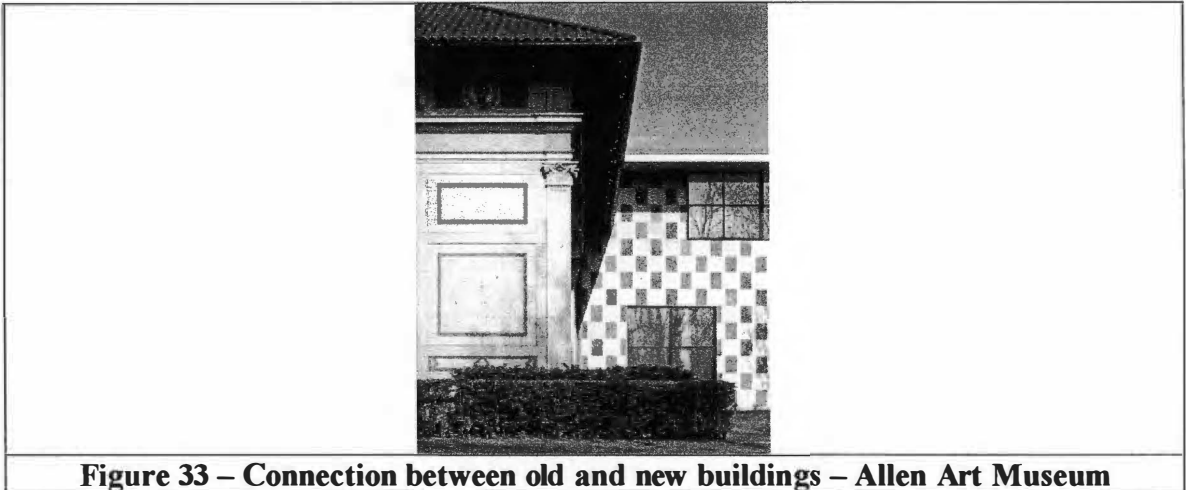


Figure 33 – Connection between old and new buildings – Allen Art Museum

attempt to resolve its visual relationship with the Gilbert museum in form. In fact, as Cohen states,

Gilbert and Venturi simply collide with the most unexpected of modern gestures. A 10-in. vertical strip of gray granite, reminiscent of the ubiquitous 5/8-in. reveal, visually gaskets the connection, while confessing the artistic difficulty of making such a connection. (Cohen, p. 52)

The only vertical section drawing available (Figure 34) reveals Venturi's ingenious solution for naturally lighting the gallery space. Clerestory windows admit daylight, which is "modulated by overhang, deep cove, and 'curtain' of overlapping translucent acrylic panels" (Cohen, p. 54). The resulting "halo" of light is reminiscent of the "light from unseen sources" characteristic of Baroque buildings.

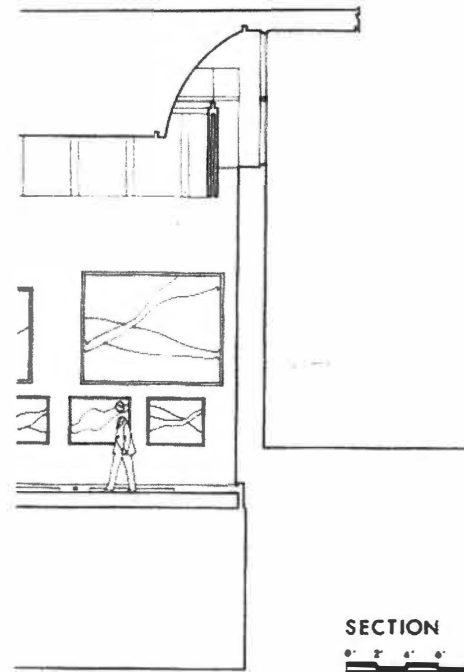


Figure 34 – Section at Johnson Gallery – Allen Art Museum

The Carré d'Art, Nîmes, France, by Norman Foster

The Carré d'Art (Figure 35 Lampugnani, 1999, pp. 35, 36, 38) is an art museum in the heart of Nîmes, France, one of the oldest cities in Europe. British architect Norman Foster won a competition for its design in 1984, but the building was not completed until 1992. This building and its site are a useful case study for this thesis exploration for three significant reasons: 1) The new building sits in close proximity to an historic structure, in

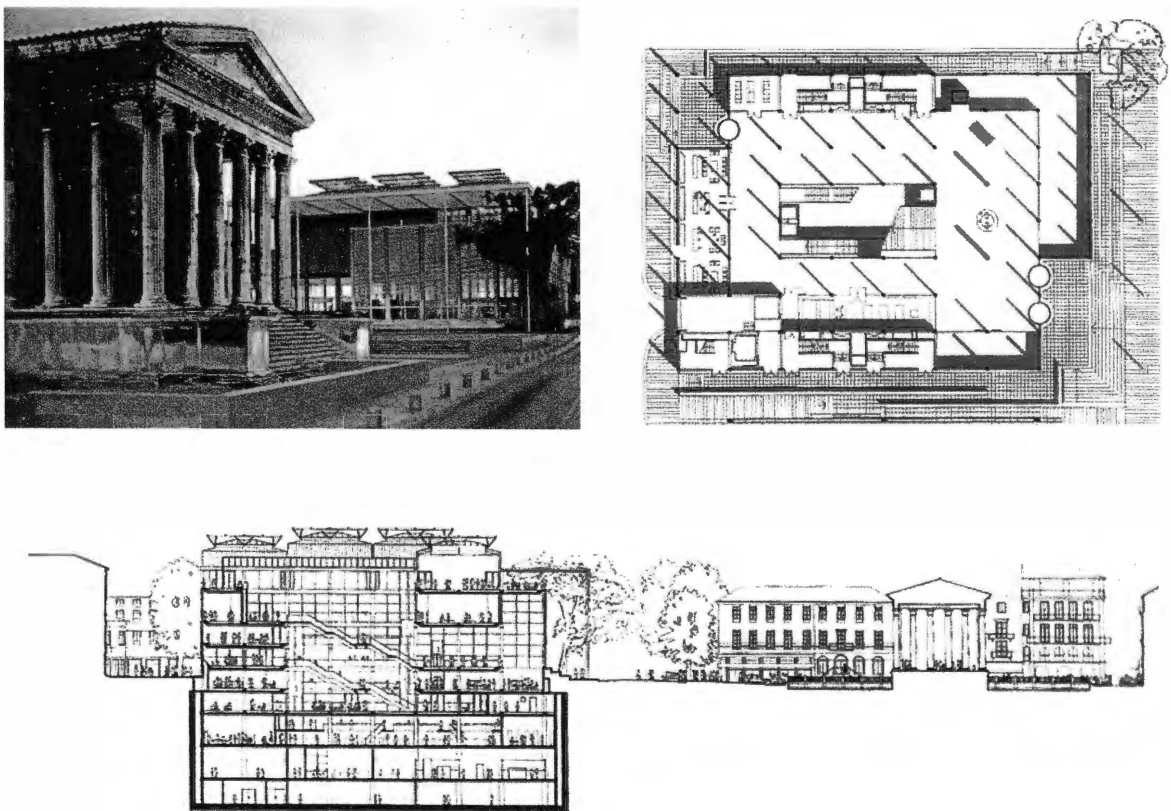


Figure 35 – Exterior, First Floor Horizontal Section, Longitudinal Section – Carré d'Art

this case, the 2000-year old Maison Carrée, a Roman temple, 2) the building houses a museum of art, and 3) the architect used vertical and horizontal section to create a both a building and urban design with complex spatial qualities.

In his design, Foster was highly conscious of the urban space around the ancient building. The square around the Maison Carrée is embedded into a dense urban fabric. A theater, which had burned in 1952, stood on the site for the new museum. The horizontal site section reveals an open atrium in the center of the new museum that mimics the urban square in which the buildings sit. The escalator and stair bank in the museum have the same rectangular proportion as the Maison Carrée (Figure 36).

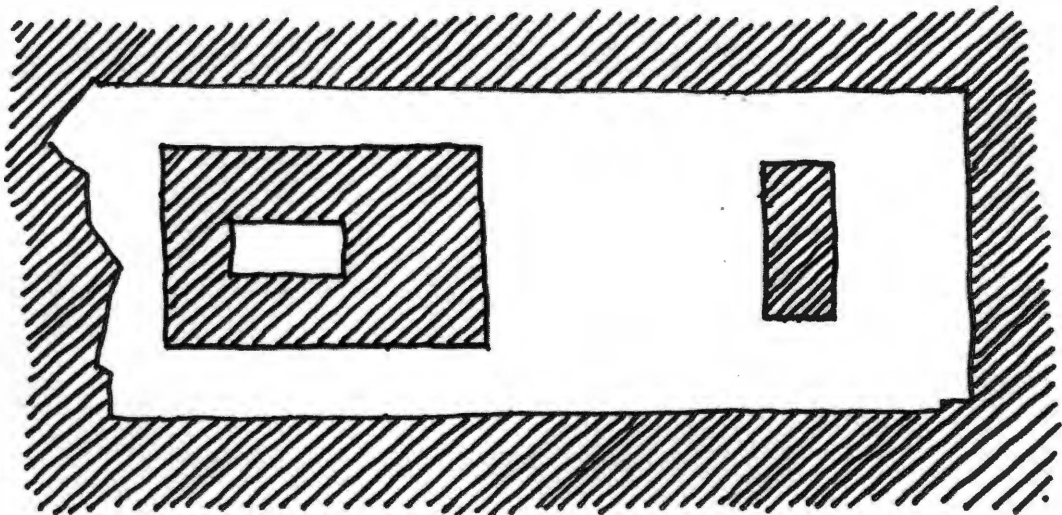


Figure 36 –Relationship of Square and Buildings to Urban Fabric

Vertical site sections show that much of the new building's program is underground so that cornice and rooflines are met. The thin (mostly glass) walls of the aboveground portion of the building contrast with the heavy masonry walls of the surrounding buildings (Figure 37). The vertical site section in Figure 38 also reveals that the roofline of the new building meets the sky in a soft and quiet way, in keeping with the low roofs in the town.

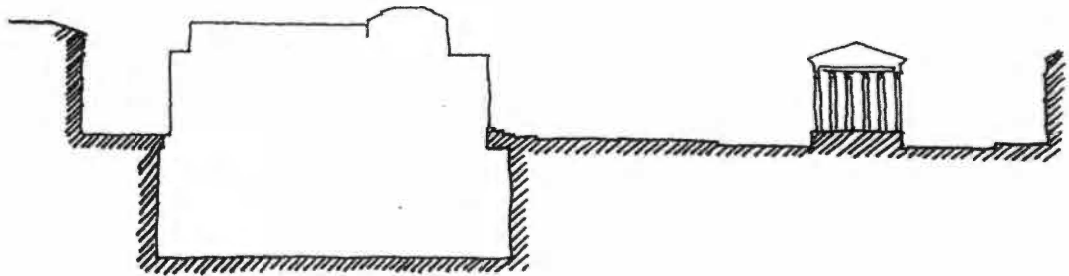


**Figure 37 – Relationship of Building to Ground
Contrast of thin walls of Museum to thick walls of City**

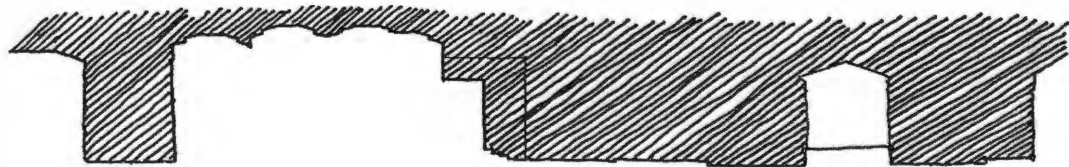


Figure 38 – Relationship of Building to Sky

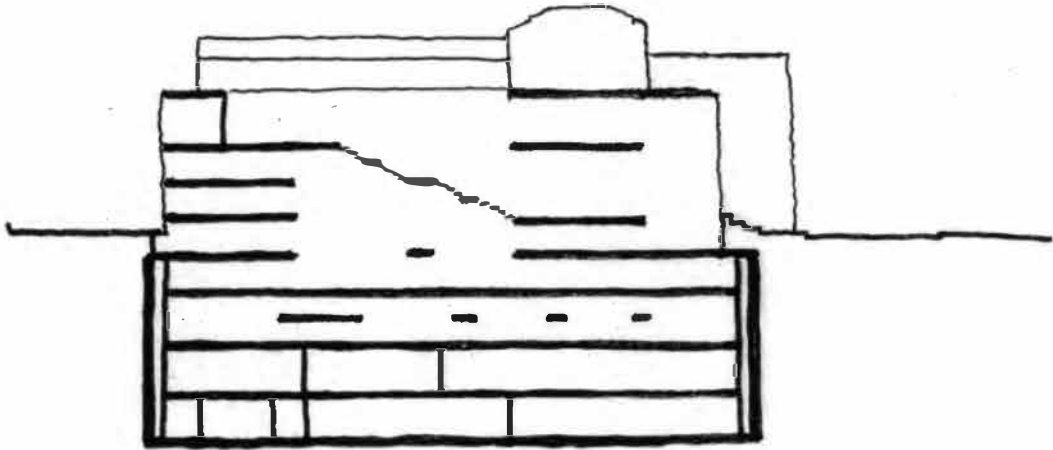
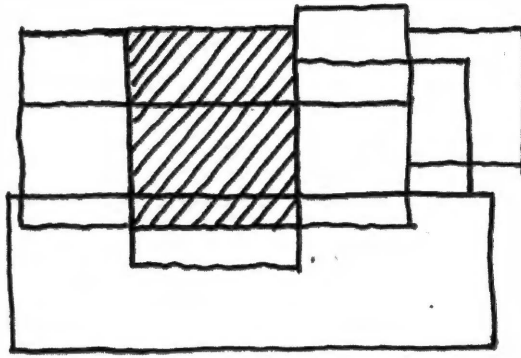


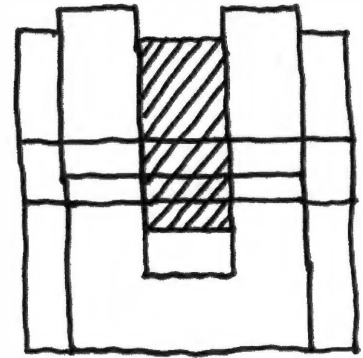
Figure 39 – Spatial Conditions – Longitudinal Section

The longitudinal vertical building section (Figure 39) is asymmetrical, and while the underground levels show no variation, the section through the aboveground atrium demonstrates considerable spatial overlap.

There is a series of layered spaces in the building, visible in both longitudinal and transverse vertical section (Figure 40). The layers occur in both horizontal and vertical sequence. The visitor passes through the portico layer to enter the building. The atrium is embedded both in the building form itself and into the earth as it drops below grade. As visitors ascend or descend the stairs or escalator in the atrium, they pass through a series of strata, much like at the Villa Giulia. In this museum, floor plates demark the strata.



Longitudinal Vertical Section



Transverse Vertical Section

Figure 40 – Spatial Layering

Foster took cues from the classical Roman architecture, but he did not imitate it. Both the new museum and the Maison Carrée have porticoes, but the museum has five slender columns with no capitals while the Maison Carrée has six tall Corinthian columns. The museum has no pediment.

As a way to understand the scale of both this museum and the proposed museum at the Villa Giulia, Figure 41 shows the site plan for the proposal with the Carré d'Art superimposed on the site. Both images are at a scale of 8mm = 10m. While, understandably, the formal configuration of the Foster building is not appropriate for the site, the scalar relationship is useful. The expanded walls that wrap Foster's atrium are almost the same thickness as the Hemicycle of the Villa and the nineteenth century museum additions. The layering of the expanded walls, atrium and central circulation may prove useful precedents for the new museum design.

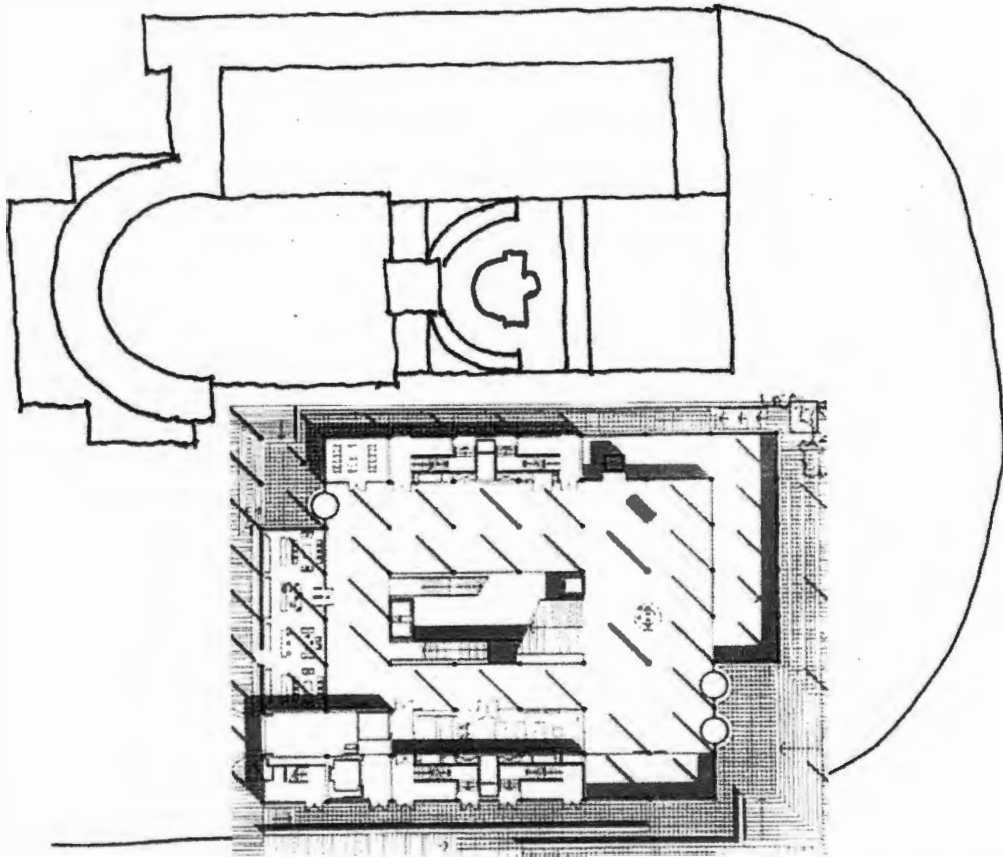


Figure 41 – Villa Giulia Site with Carré d' Art Superimposed

Scale: 8mm = 10m

St. Peter's Basilica, Vatican City

Architects: Bramante, Raphael, Antonio da Sangallo the Younger, Peruzzi, Michelangelo, della Porta, Vignola, Ligorio, Fontana, Maderno, Bernini

St. Peter's Basilica, as has previously been discussed, may be considered as the first major architectural project in which orthogonal drawings were used during the design and construction of a building. It is important as a case study for this thesis proposal both as an example of the value of multiple horizontal and vertical sections to the design process, and because Vignola and Michelangelo worked on both St. Peter's and the Villa Giulia. Sections through St. Peter's reveal qualities of spatial complexity using the Sectional Taxonomy developed for this thesis proposal. Where noted, the sections are from the 1882 engravings by Paul Marie Letarouilly, included in Spence R. Kass's essay, "The Voluminous Wall." The additional sections are by Kass, done while he was a Fellow at the American Academy in Rome, 1980-1981. The analytical drawings are my own.

Architects traditionally cut the horizontal section at approximately four feet above the finish floor. The Letarouilly horizontal section in Figure 42 is such a section. Of course, the visitor cannot experience the entire section at one time. This section reveals what the visitor "experiences" somewhat at eye level².

² In reality, it is impossible to separate the overwhelming sensory experience of St. Peter's into different categories. A single section, in either direction, forces us into this unreal situation, thus emphasizing the need for multiple sections to enhance our understanding of the spatial experience of a building.

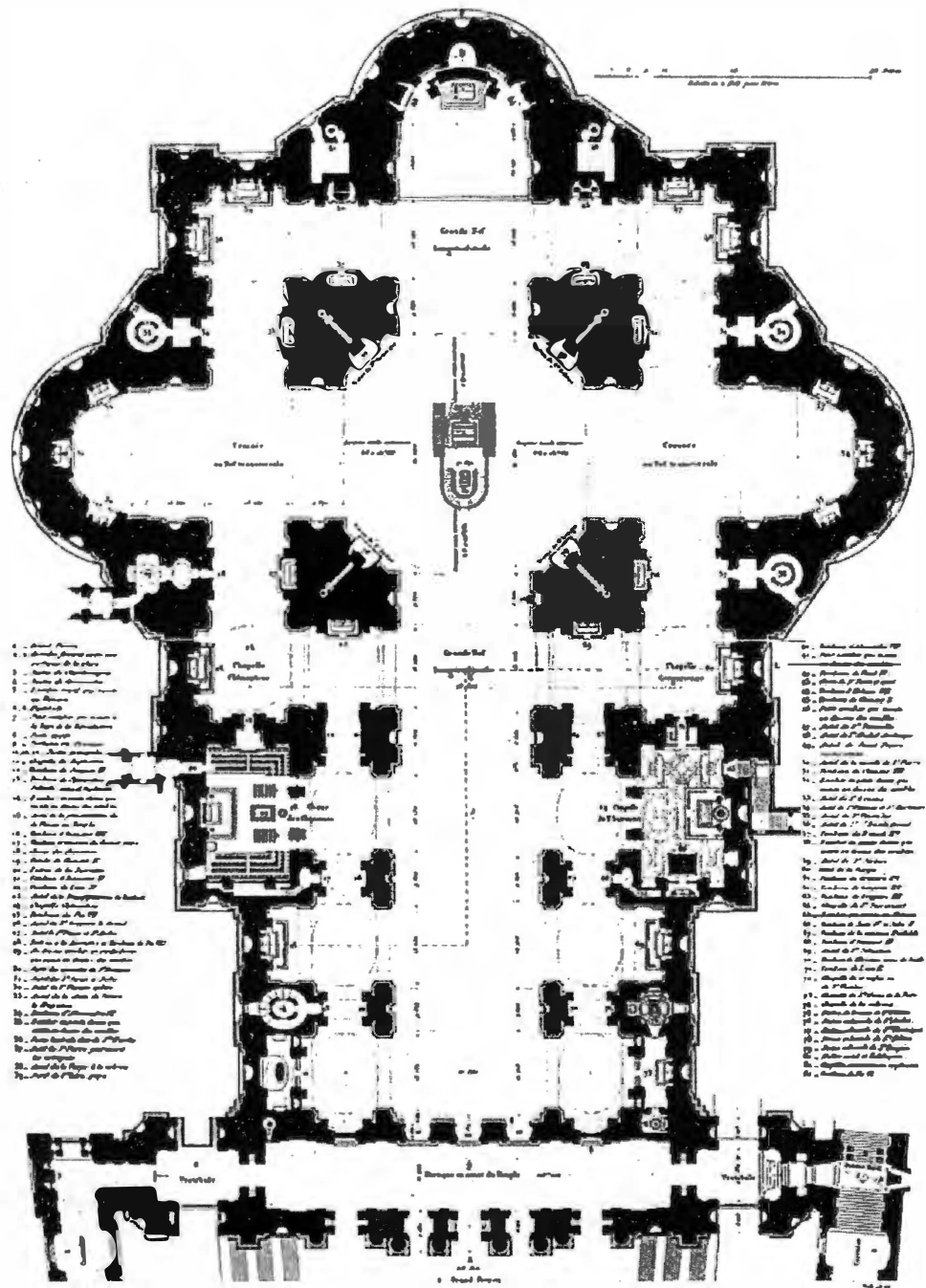


Figure 42 – Letarouilly Traditional Horizontal Section of St. Peter's

The horizontal section of St. Peter's reveals several different types sectional types, as well as layers. The visitor passes through layers of space during the entry sequence. He ascends the wide stairs to the basilica, and then enters one of five entryways into the narthex. Each entryway is formed by piers that narrow, widen, and then narrow again. The narthex feels like a release from the constriction of the entryways. One may also read the narthex as an expanded wall. From the narthex to the nave, there are three entryways. Smaller piers bound these entryways, but again the piers are hollowed out so that there is an almost imperceptible experience of contraction, expansion, and contraction before the visitor enters the expanse of the nave. (Figure 43)

Once inside the nave, the spaces expand dramatically. The encroachment of the walls is at a distance. Continuing, the visitor passes piers of increasing thickness that define the hierarchy of spaces from the narthex to the crossing and Bernini's baldacchino.

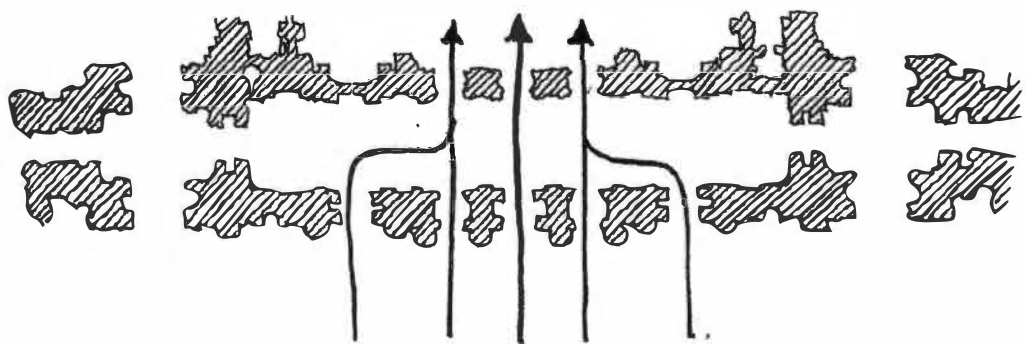


Figure 43 – Entry sequence into St. Peter's

Upon arrival at the baldacchino, the visitor is aware of a second type of layering and sectional type in the basilica – the additive and subtractive surfaces of the walls and piers. The huge piers undulate with engaged columns, pilasters, and niches. Embedded in the poché of the walls and piers is yet another layer. Visible in the horizontal section are the many passages and staircases to spaces above and below this level (Figure 44). The visitor is unaware of most of these, but a few are accessible, prompting curiosity about what is inside the other thick, sculptural walls.

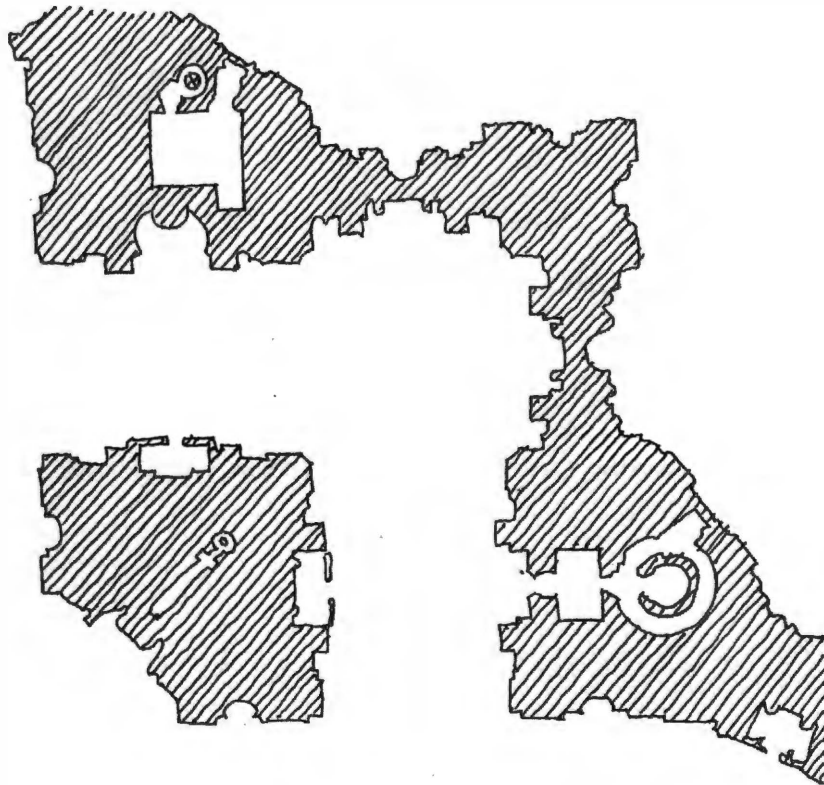


Figure 44 – Walls and Pier at the Crossing – St. Peter's

The fragment of the basilica in Figure 44 is revealing in another way. The large pier defines a distinctly modern space. In horizontal section, the pier reads as the same type of free-standing object that Mies van der Rohe used to define spaces in the Barcelona Pavilion or the Tugendhat House, although certainly much thicker. There is also considerable spatial overlap from the main part of the crossing to the side aisles and chapels, again, a modern element in this very traditional space. Figure 45 shows only some of the many spatial overlaps (these at the crossing) present in this horizontal section.

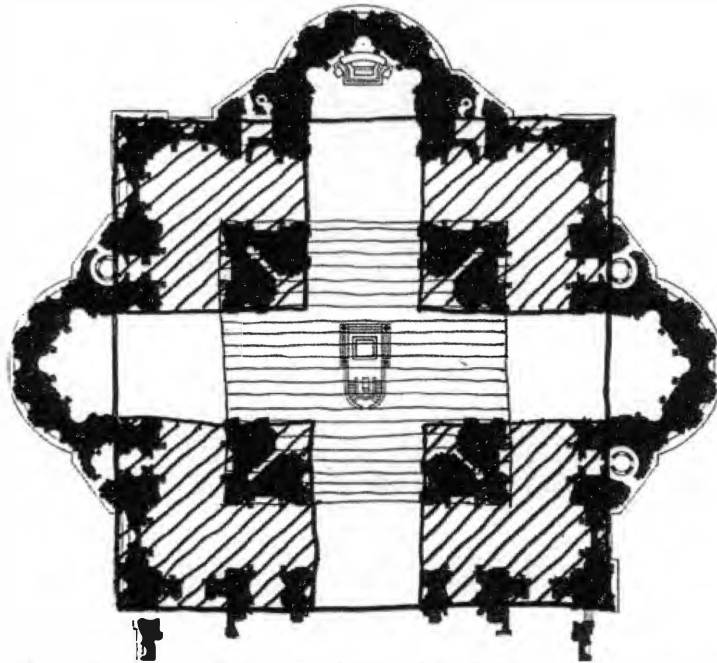


Figure 45 – Spatial Overlaps in Horizontal Section – Crossing of St. Peter's

The horizontal section at this level reveals the relationship between the interior and the exterior of the building. Not only are the interior walls replete with additive and subtractive sectional elements, their counterparts on the exterior are as well. Major bays and minor niches align giving the feeling that the building is wrapped in a thick, textured, undulating blanket that has neither front nor back.

In his essay, “The Voluminous Wall,” Spence Kass laments the fact that “the complexity of the section was replaced by the liberties of the free plan set between continuous floor slabs,” and acknowledges the “prejudice towards the plan” that the early modern architects displayed (Kass, p. 45). In his investigation of St. Peter’s, he provides additional horizontal sections through the basilica, cut at higher and higher levels, as seen in Figure 46 (Kass, p. 47). These horizontal sections reveal a complexity of the spaces in the upper part of the basilica that the traditional horizontal section cannot. The visitor can experience only some of these spaces. Others are embedded in the thick *poché* that forms the walls and piers of the church.

The section at the level of the first floor windows reveals what appears as a circulation path through the church. The other two sections read as intricate figure/grounds, almost ornamental in their composition. It is as if Michelangelo were playing with the spaces that very few would ever see.

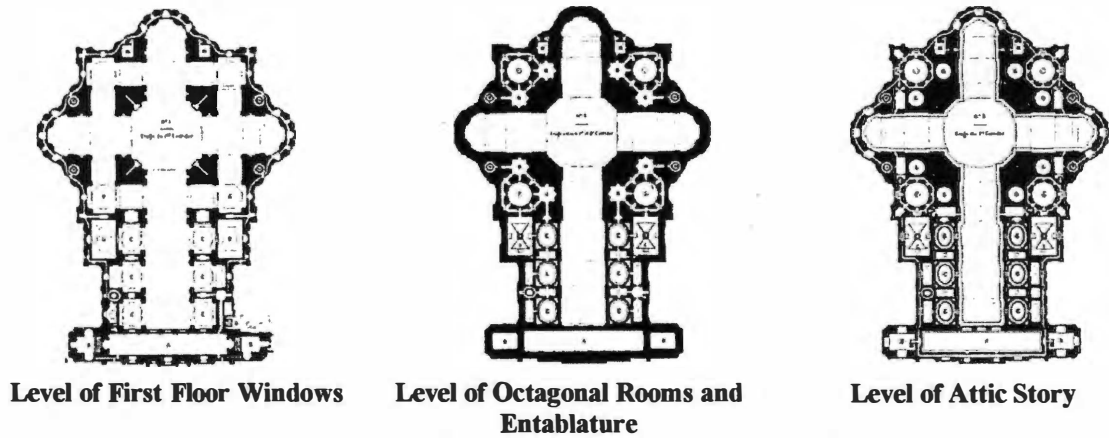


Figure 46 – Kass Horizontal Sections – St. Peter's

The longitudinal vertical section of St. Peter's is surprisingly simple. The nave itself is a long, tall box as seen in Figure 47 (Kass, p. 47). It meets the sky in an equally simple way. Michelangelo's double-shelled dome may be clearly seen, as can its relationship to the sky. While there is a difference between the interior and exterior understanding of the dome, it is not as dramatic as that of Mansart's Saint-Louis-des-Invalides (Figure 1).

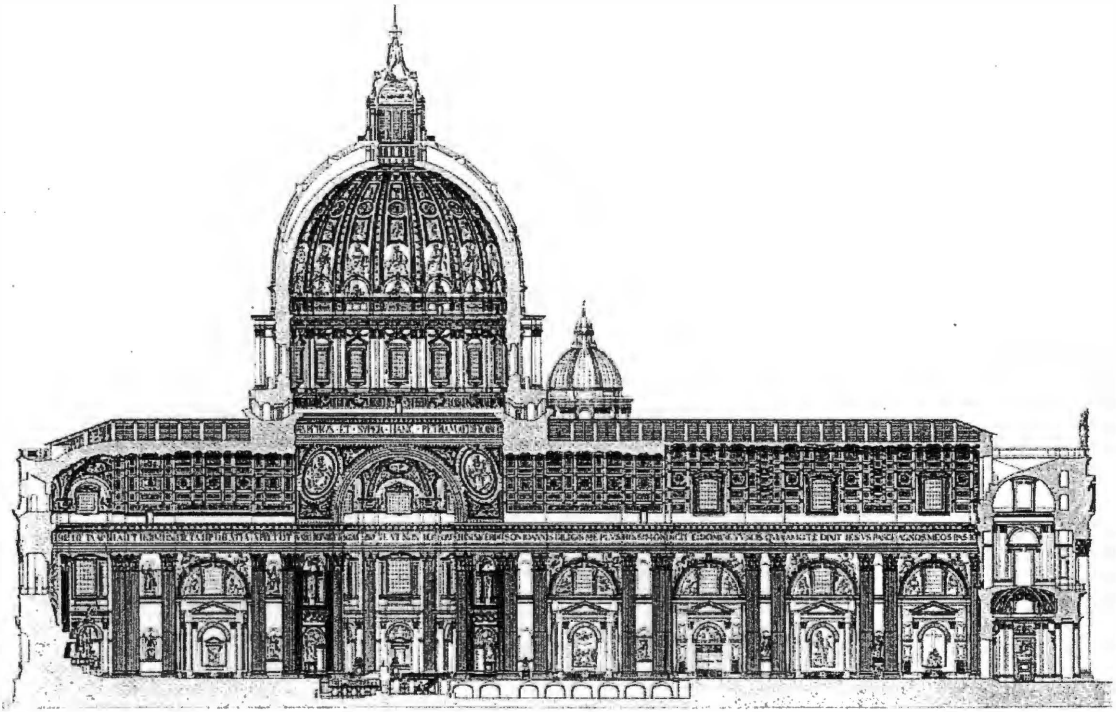


Figure 47 – Letarouilly Longitudinal Section – St. Peter's

If this were the only section of St. Peter's, we would never understand the spatial complexities of this building. Letarouilly understood this, and drew a transverse section that is actually two drawings. (Figure 48, Kass, p.46) As Kass explains, "The left half is taken through Maderno's nave while the right half presents a section through Michelangelo's square of vaults that surround the main crossarms. Occupying the barrel vaults is one of the eight octagonal storage rooms that reduce the mass of the church" (Kass, p. 48). These rooms are seen in the middle horizontal section in Figure 46. In this drawing they appear more as stars than octagons.

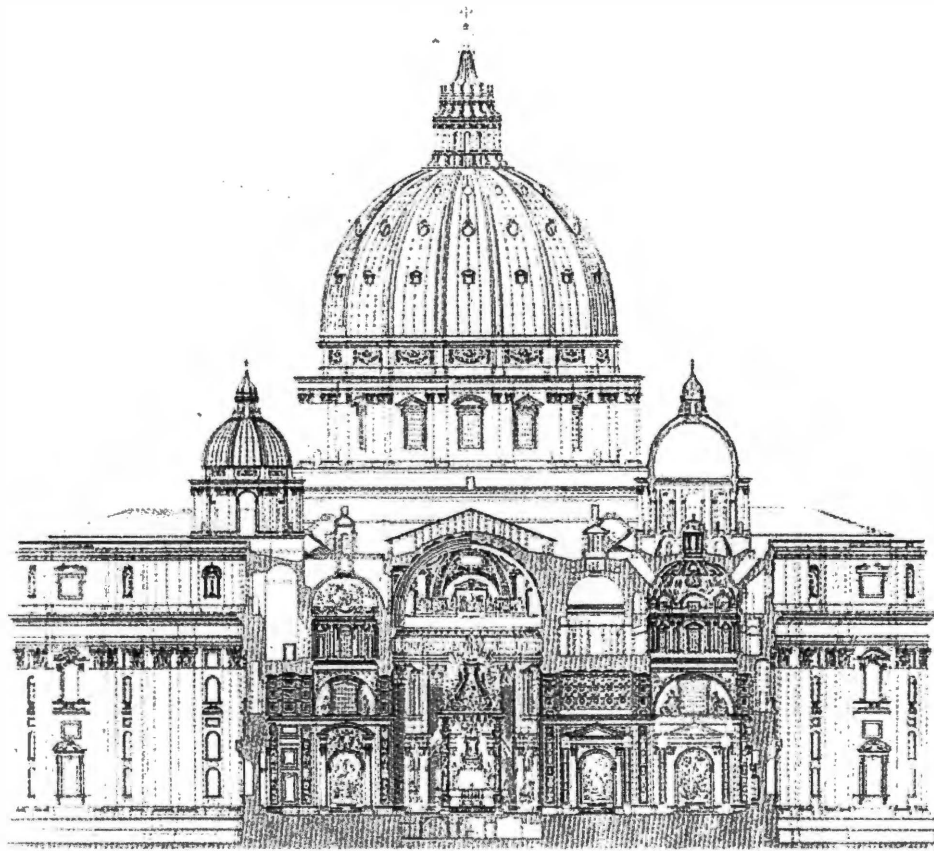


Figure 48 – Letarouilly Transverse Section – St. Peter's

This section reveals the hierarchy of the spaces, a use of both thick and thin walls, and the relationships between interior spaces with each other, and interior spaces with exterior spaces.

Extracting the sectional cuts alone from Letarouilly's drawing yields even more information and other readings (Figure 49). The intricate series of punctures designed to allow in natural light are visible. The modulation of wall and floor thickness is revealed. The hierarchy of spaces is clear. As pure composition, the section is lyrical. It reads as a

Calder mobile, its parts dangling in careful balance. On another level, is this a vertical or a horizontal cut? This section could be either. We can see cupolas; we can see chapels.

Kass expands the number of vertical sections of St. Peter's using an innovative combination of axonometric drawing and vertical section as seen in Figure 50 (Kass, pp. 49, 53). Each drawing reveals additional information about this complicated building.

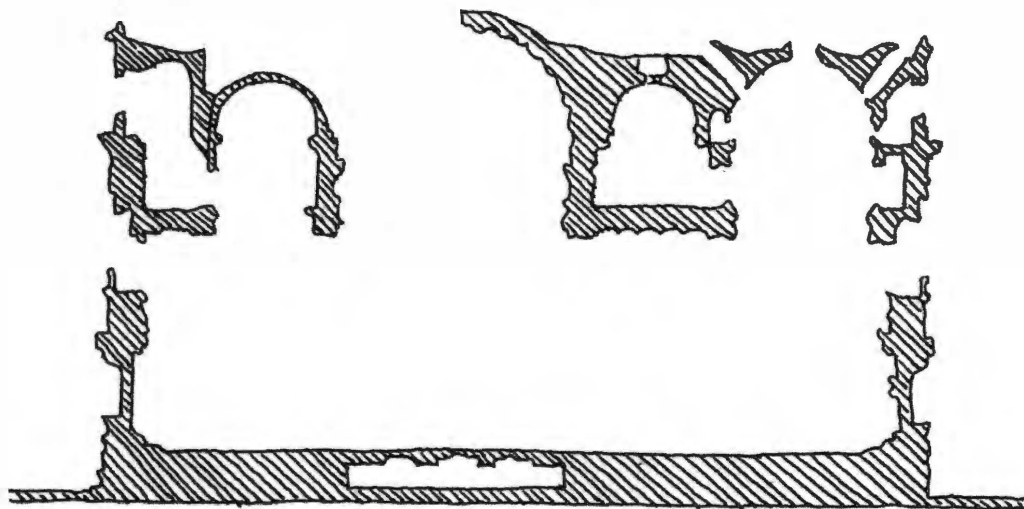
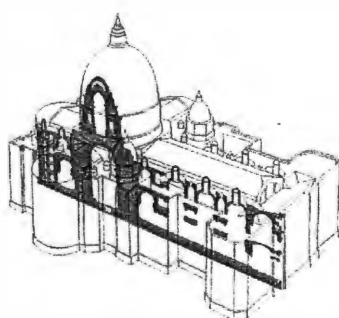
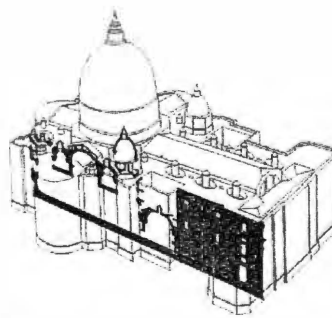


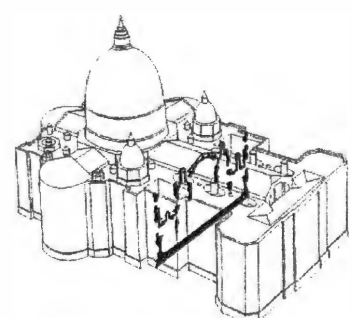
Figure 49 – Extracted Transverse Section – St. Peter's



Section through side aisles



Section through Corner Domes



Section through Chapels

Figure 50 – Kass Vertical Sections – St. Peter's

The Villa Giulia, Rome, Italy, by Vignola, Ammannati, and Michelangelo

Section IV, “Site Selection,” examined the sectional ideas contained in the Villa Giulia, especially as they relate to sequence and layering. This case study concentrates on the formal aspects of the Villa that may be useful as precedents for the design of the new museum.

The proportioning system for the Villa is quite an anomaly, although the façade is a rectangle two times wider than it is tall³. Figure 51 is the Letarouilly drawing of the main façade (Letarouilly, plate 207).

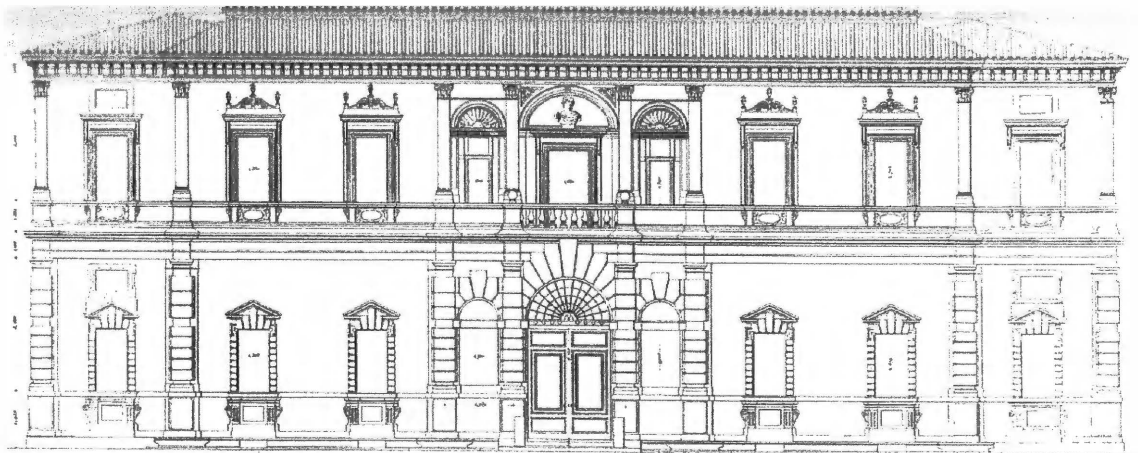


Figure 51 – Letarouilly Main Façade – the Villa Giulia

³ The physical survey of the Villa undertaken by Stanislaw Cocchia et. al., published in 1987, describes the construction of the Villa. The unusual use of different orders on various façades led the researchers to examine the Villa's proportions in great detail. Many of the proportions and details do not conform to the dictums of the day – either the Treatises of Vignola or Serlio, although, as expected, they are closest to those of Vignola.

What is interesting for the purposes of this thesis are the spatial overlaps present on the façade (Figure 52). They appear, as well, on the other façades throughout the Villa. The center bay of the façade is almost a third in the Palladian sense. If the huge rustications are added to the side windows, the middle “third,” itself divides into thirds.

The windows and door combination forms what first appears as a triumphal arch (Figure 53). Their proportions, however, do not conform to those of a classical triumphal arch. Instead, the composition forms a serliana with proportions that correctly follow Serlio’s Treatise (Cocchia, p. 8). The windows above on the second level, while at first appearance form yet another serliana, in fact, do not. The side window caps are too tall and the middle window cap is too wide. In typical playful Mannerist form, however, if only the windows were placed next to each other, they would form a true serliana.

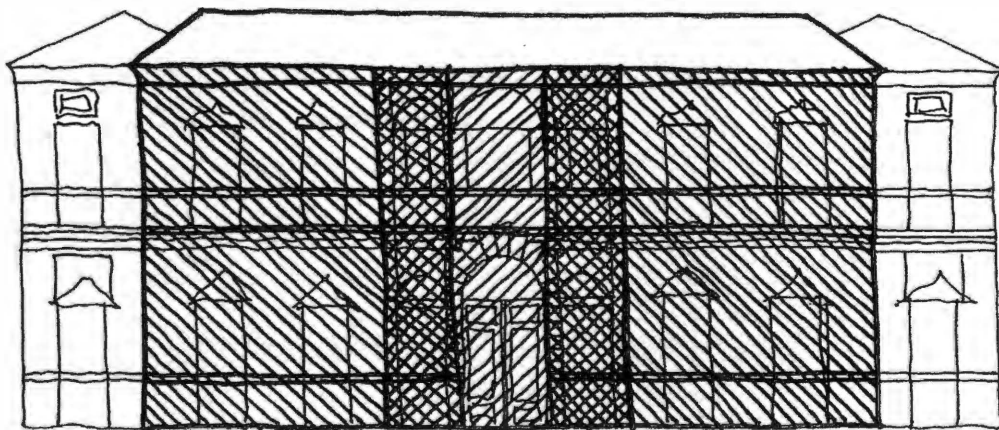


Figure 52 – Main Façade Overlaps – the Villa Giulia

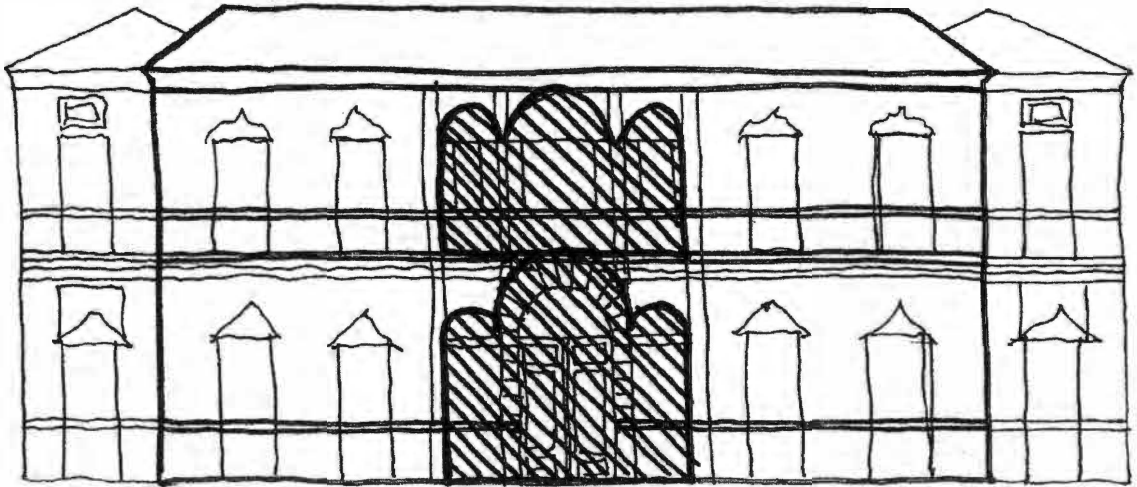


Figure 53 – Serlianas on Main Façade – the Villa Giulia



Figure 54 – Window Overlap on Main Façade – the Villa Giulia

The façade yields yet another series of overlaps – the first floor windows appear to sit on bases, the tops of which are defined by a kind of plinth (Figure 54). This blurs the definition of the window locations. A similar situation occurs on the second floor with the window “bases” defined by the continuation of the top of the balustrade.

The main façade of the Villa (Figure 55) is highly carved. This carving appears throughout the Villa in both modulation of wall surfaces using both additive and subtractive elements such as engaged columns and niches, and in the many interstitial spaces embedded in the poché. As at St. Peter's, the architects of the Villa Giulia used the thickened wall for both circulation and service areas. As has been discussed, the abundant use of cornices and niches contribute to the sense of strata in the Villa, particularly in the courtyard that leads to the Nymphaeum.

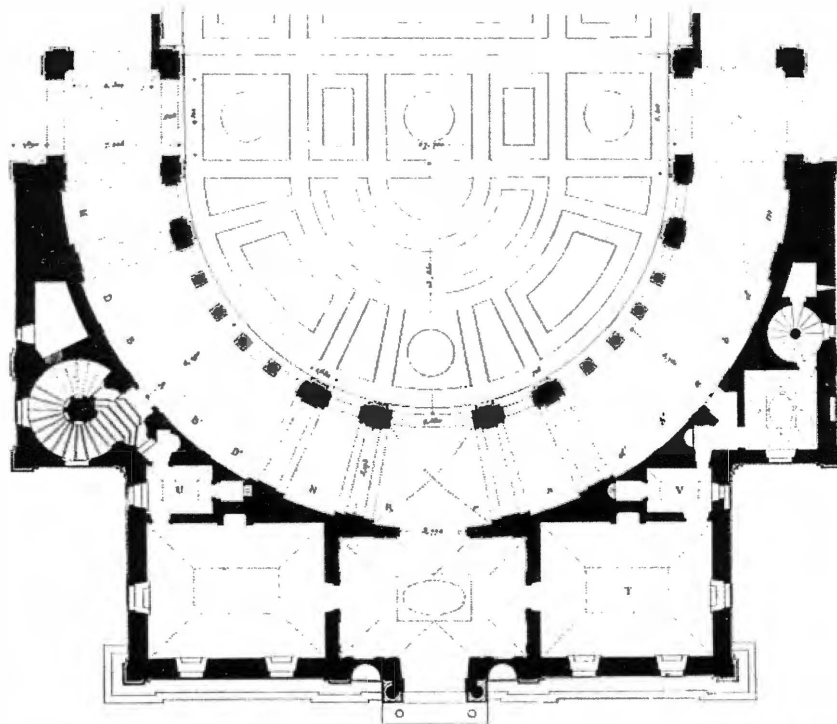


Figure 55 – Wall Modulation and Interstitial Spaces – the Villa Giulia

In horizontal section, the geometry of the Villa is more apparent (Figure 56). Even though we know that the Villa's measurements are far from ideal. It is not difficult, however, to discern the architects' intent. Squares and circles are the primary geometric forms. Geometric overlays appear to align with primary columns, niches, and passageways.

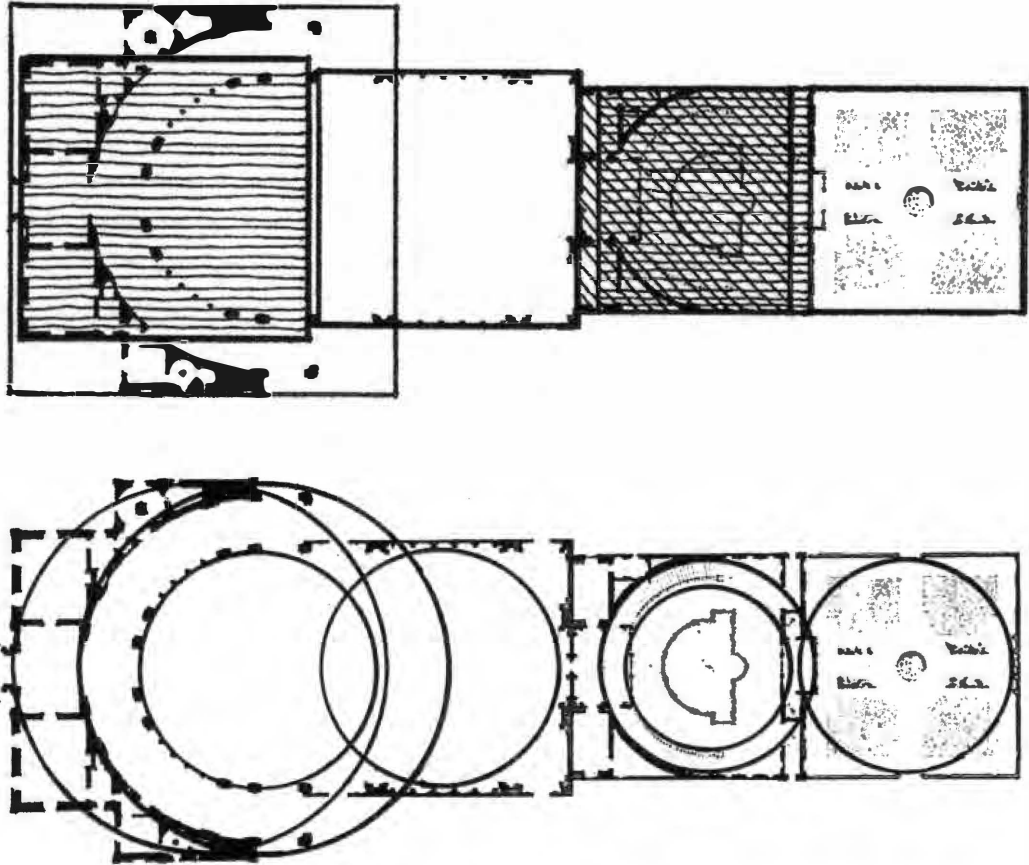


Figure 56 – Geometric forms in Horizontal Section – the Villa Giulia

There is some rhythm to the relationship between the walls and openings, particularly perpendicular to the main axis of circulation. There is less to align in the direction of circulation (Figure 57).

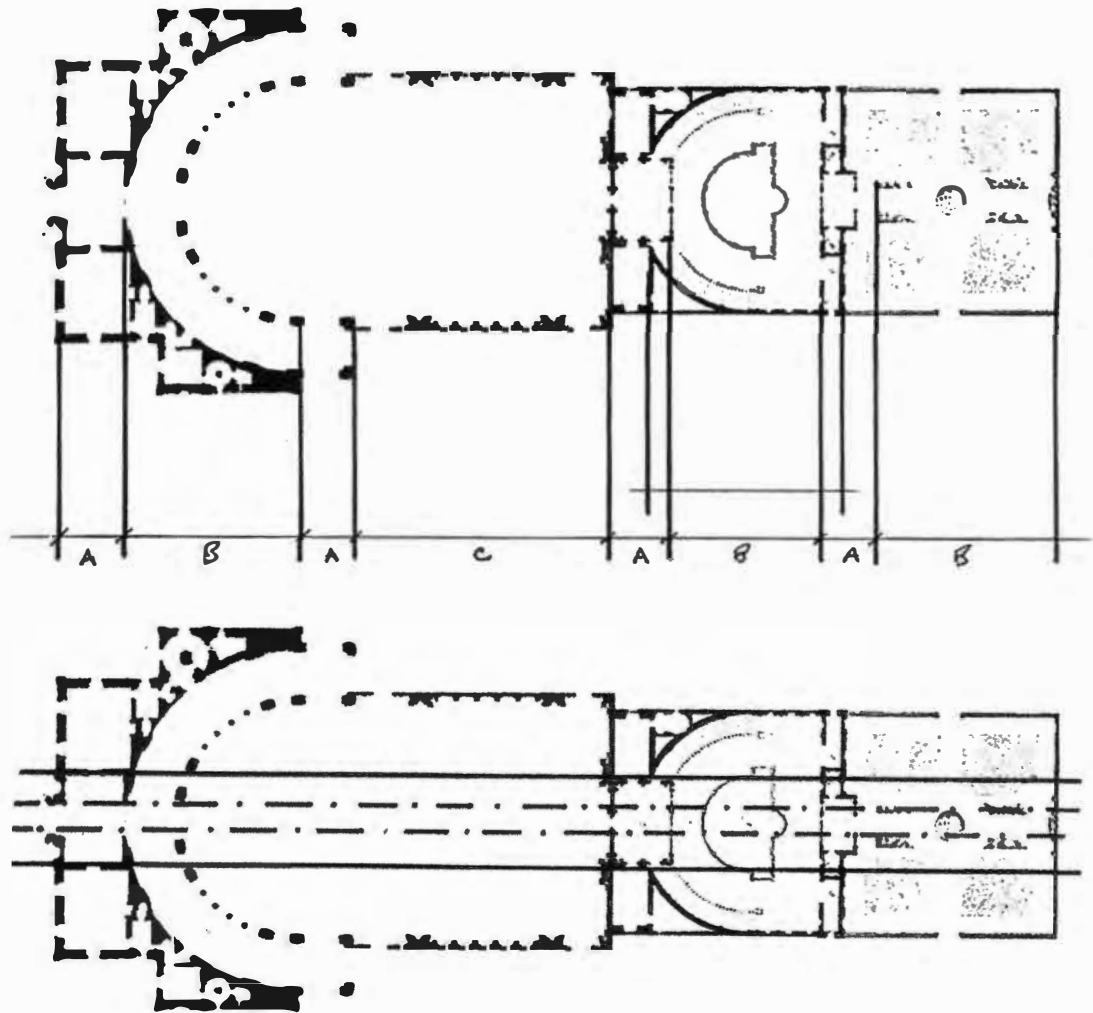


Figure 57 – Patterns of Alignment in Horizontal Section – the Villa Giulia

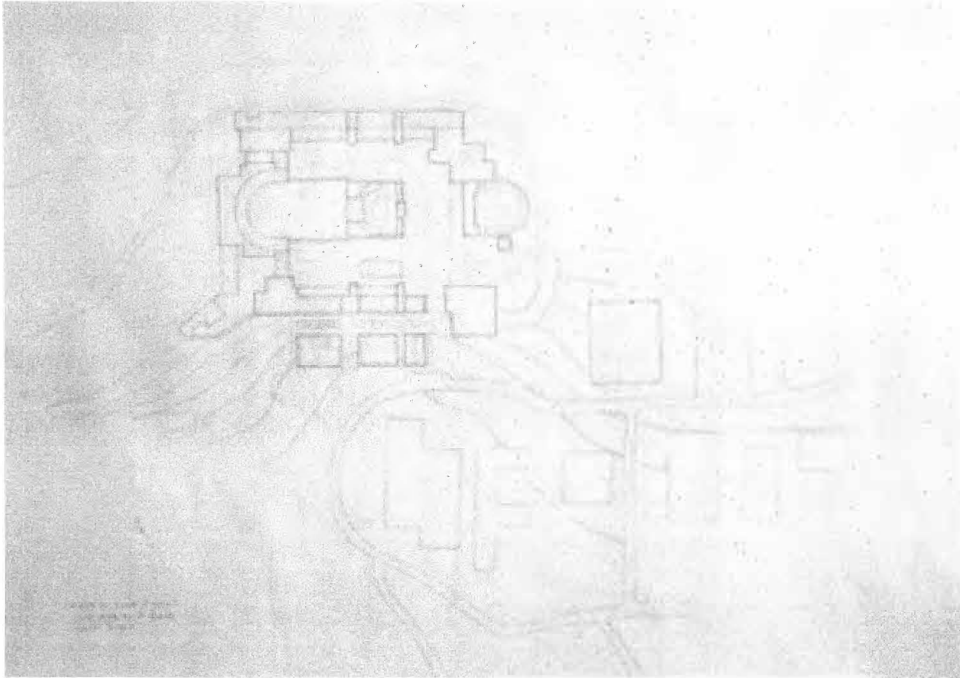
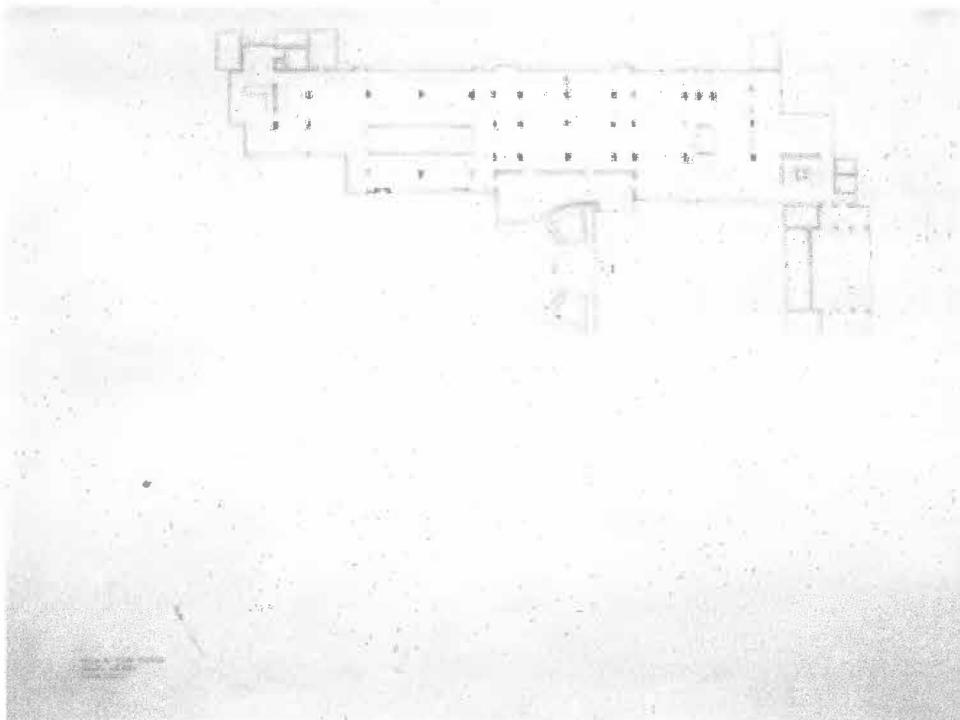
XI. Design

The final project for the Museo di Villa Giulia takes into account the topographic information gathered during the site visit in January, 2003. A hill rising approximately 12 meters just to the south of the Villa precipitated a re-thinking of program location. The hill also provided the opportunity to use sectional design to programmatically link the various academies along the Via Omero to the new program at the Museum: a library, workrooms and offices, and housing for visiting scholars.

The North wing retained its function as a museum. The Bookstore is relocated to the South wing at the lower level of the Nymphaeum. The walls around the last garden of the Villa were removed (they were not there when the Villa was built), providing continuous green space to the newly opened Grottos. The Auditorium recalls the circular spaces of the Hemicycle and the Nymphaeum stairs, but rather than the circle embedded in poché as are the other two, this circle breaks free and is prominently featured at the East end of the complex. The café is also at the East end of the property. Additional storage for the program was provided at the east end of the South wing with a loading dock added.

Figure 58 is a site/roof plan. Figure 59, 60, 61, 62, and 63 are horizontal sections.

Figures 64, 65, and 66 are transverse sections. Figures 67, 68, and 69 are longitudinal sections. Figures 70 and 71 are the West and East Elevations.

**Figure 58 – Site and Roof Plan****Figure 59 – Grotto Level**

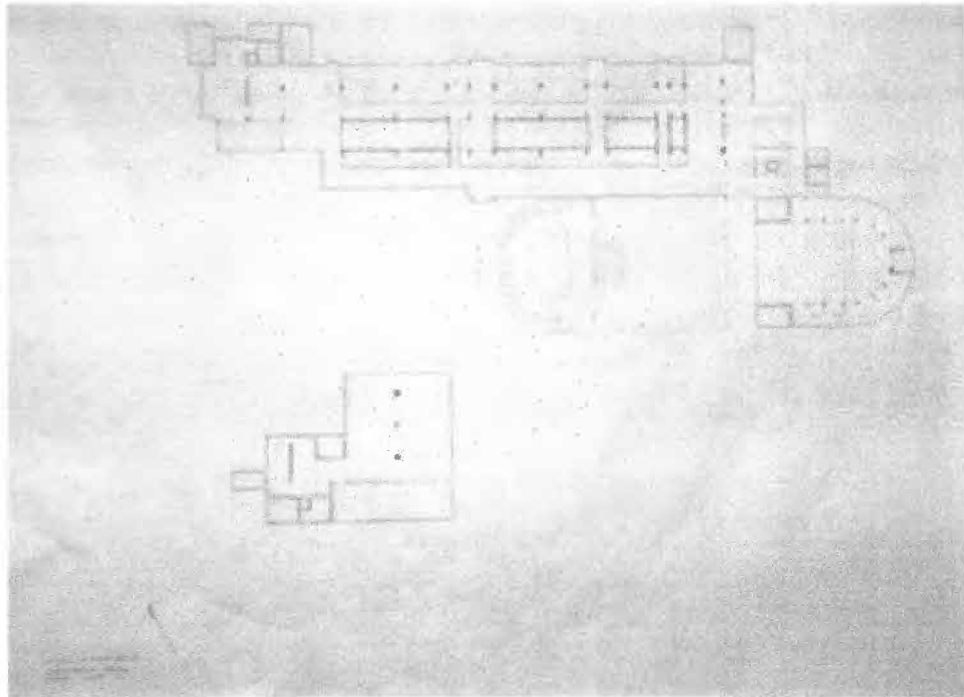


Figure 60 – Nymphaeum Level

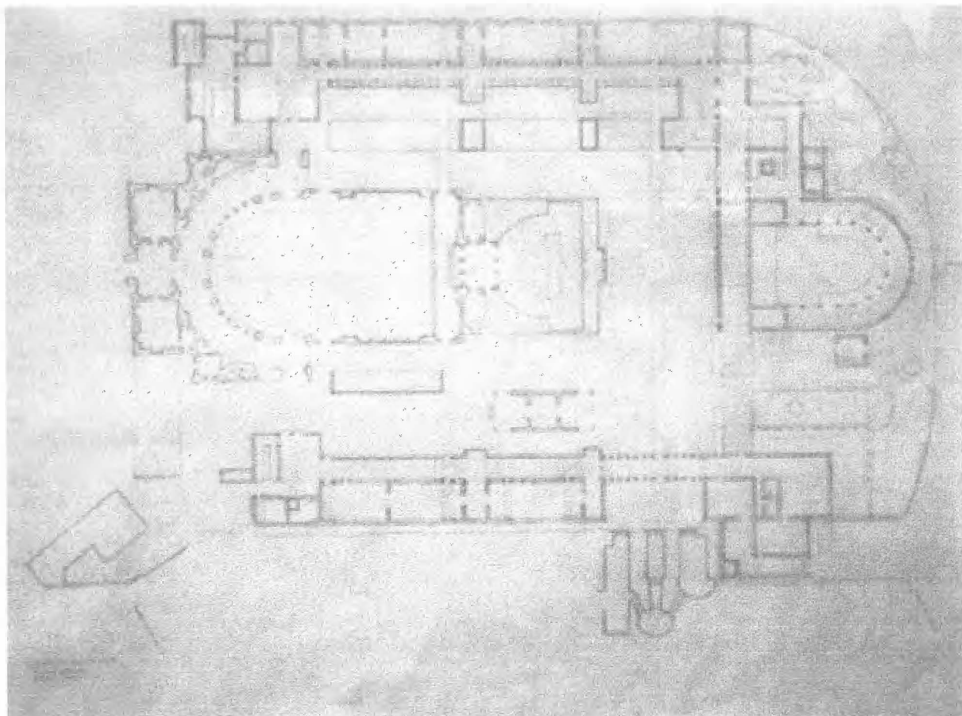


Figure 61 – Main Level

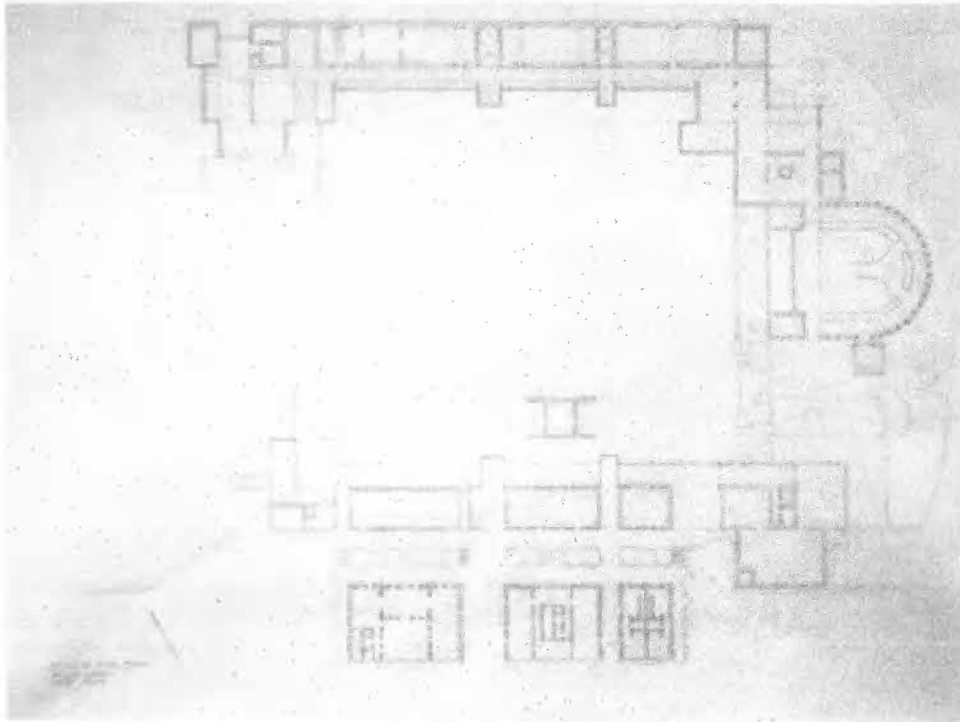


Figure 62 – Second Level

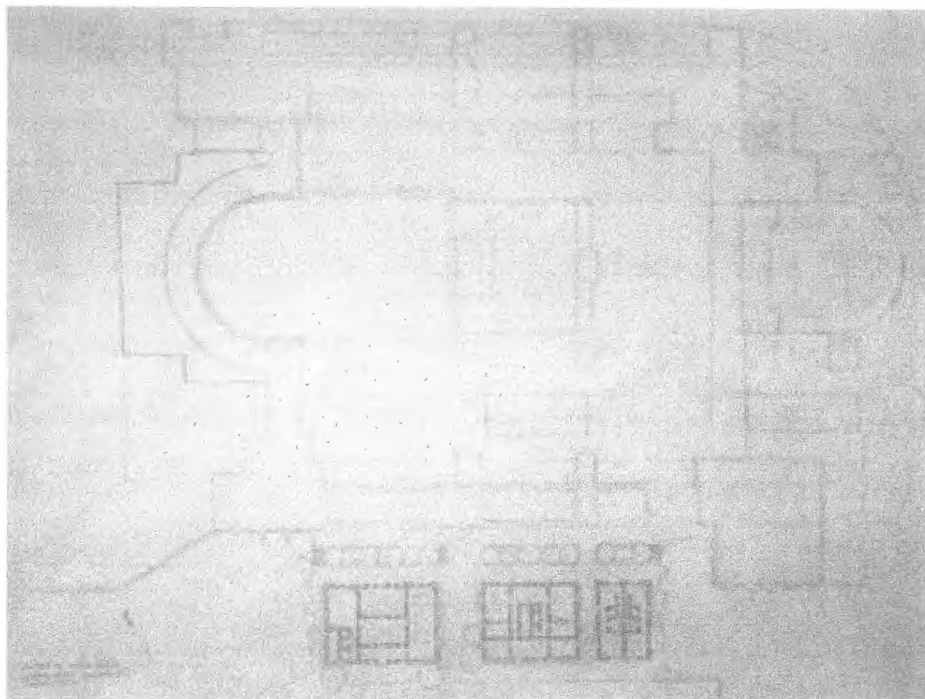


Figure 63 – Upper Level (Via Omero)

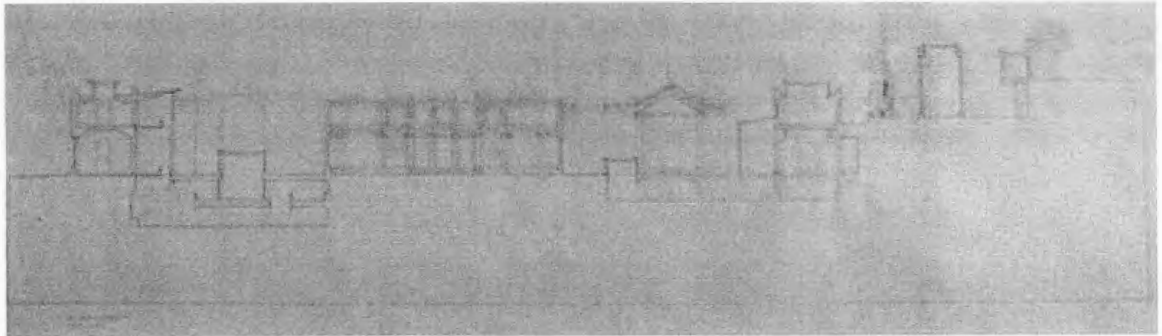


Figure 64 – Transverse Section A - Courtyard

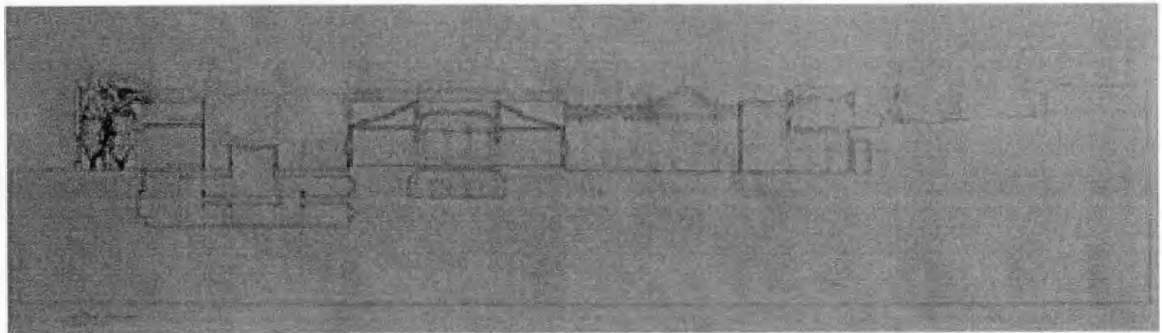


Figure 65 – Transverse Section B – First Loggia

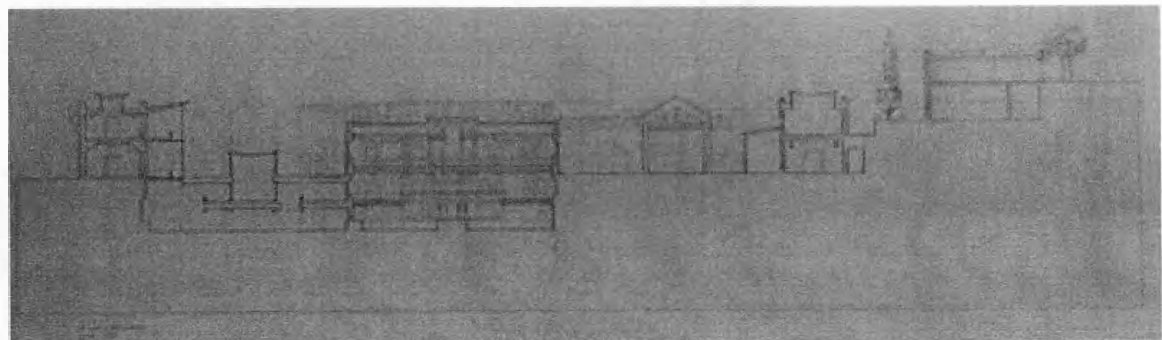


Figure 66 – Transverse Section C - Nymphaeum

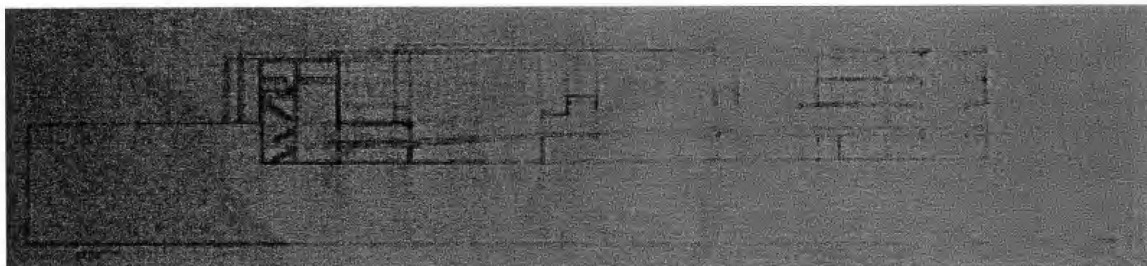


Figure 67 – Longitudinal Section D – North Wing

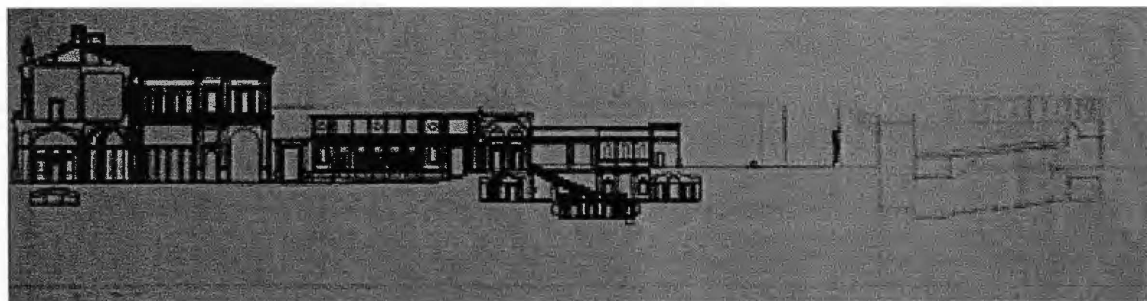


Figure 68 – Longitudinal Section E – Traditional/Auditorium

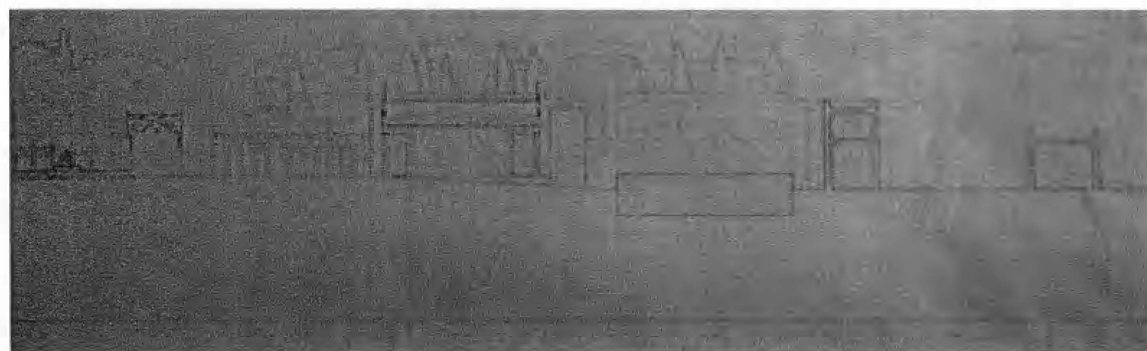


Figure 69 – Longitudinal Section F – South Wing

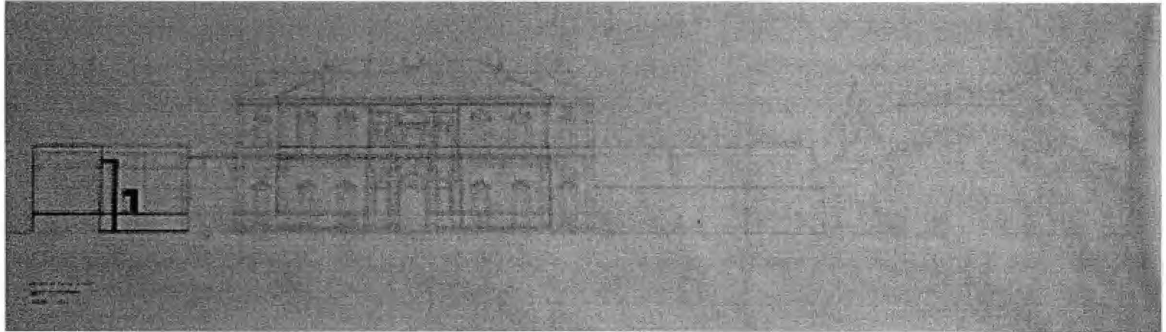


Figure 70 – West Elevation

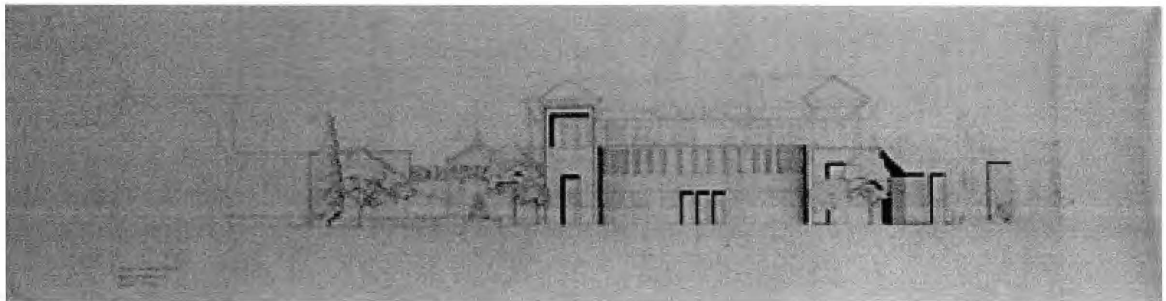
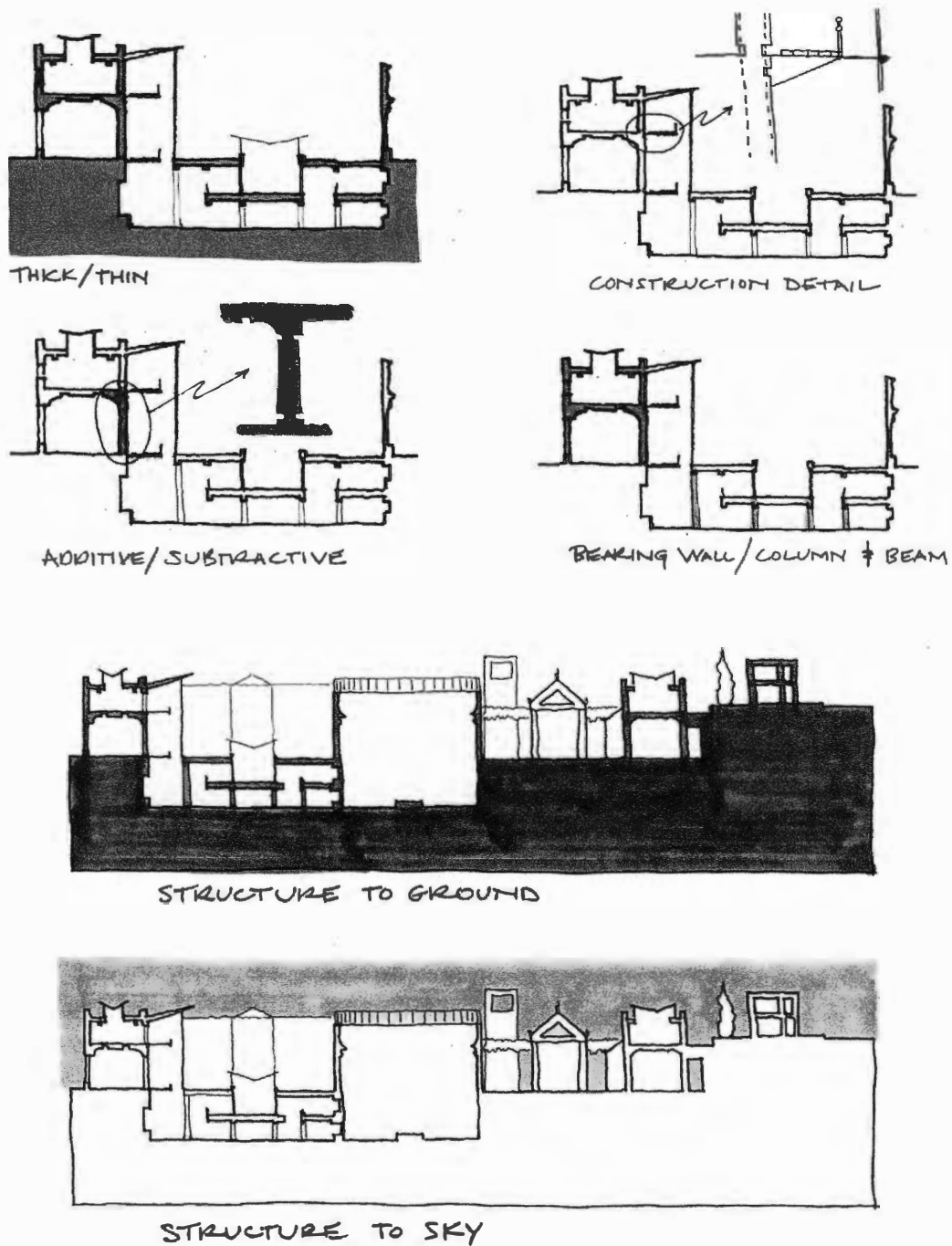


Figure 71 – East Elevation

The analytical drawings that support the thesis exploration follow. Figures 72 and 73 show how the project explored the sectional taxonomies developed for this thesis. Figure 74 shows the layering developed in both vertical and horizontal sections in the project. Figure 75 shows the relationship between the old, existing construction and the new project, as well as the use of green space. Figure 76 explains how the project sectionally connected the new academic program at the Villa Giulia with the existing academies at the top of the hill on the Via Omero.

**Figure 72 - Wall and Space Sectional Relationships**

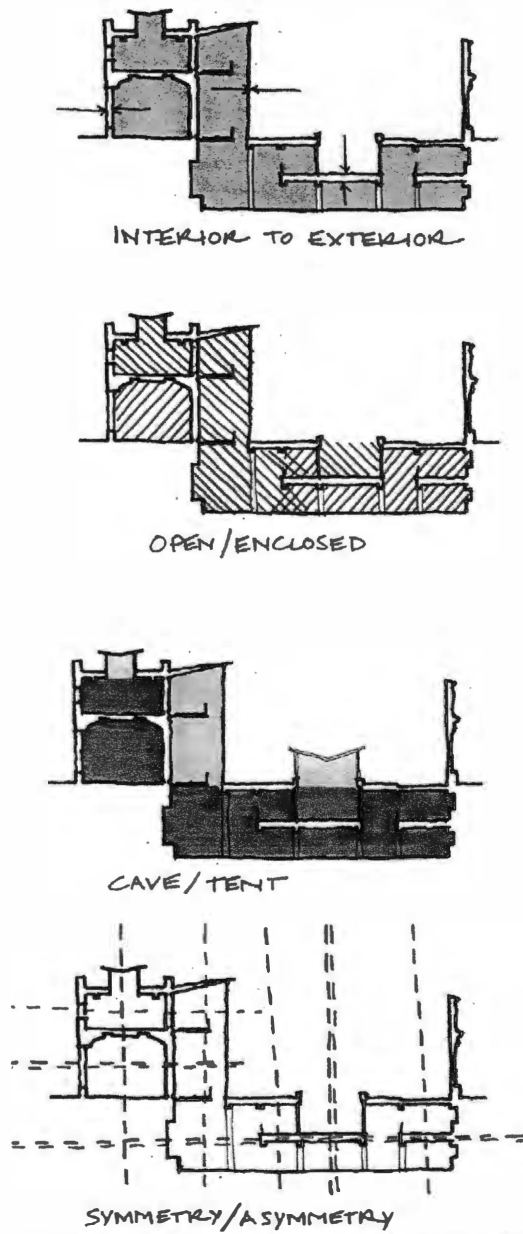
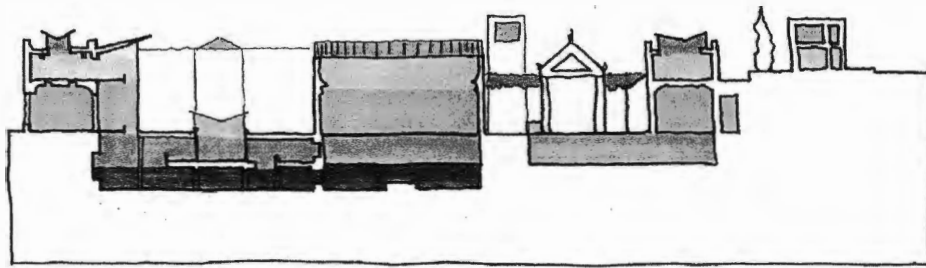
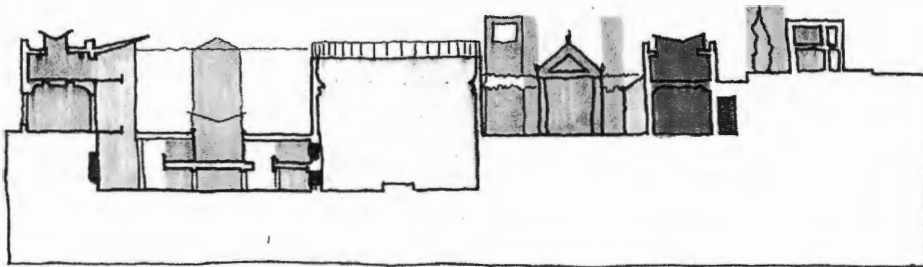


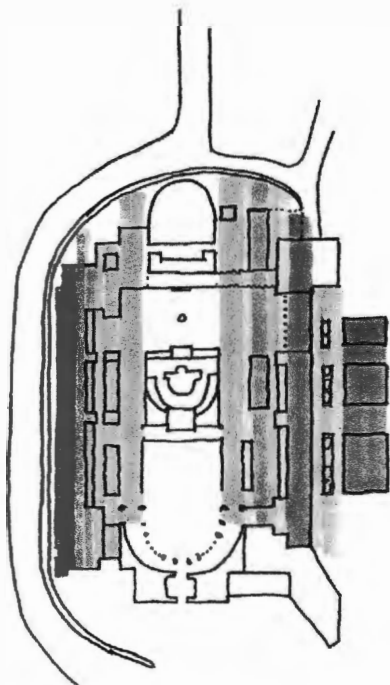
Figure 73 – Relational and Abstract Sectional Relationships



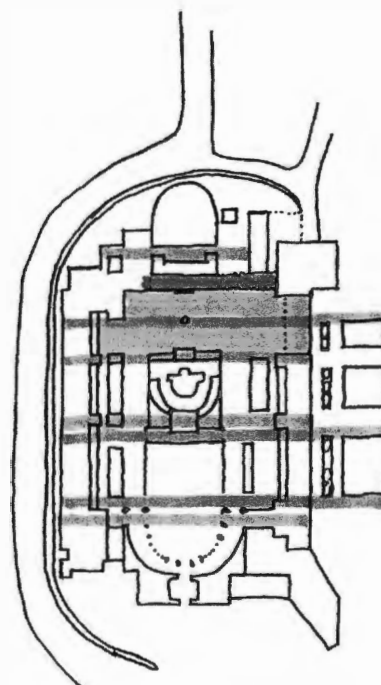
HORIZONTAL LAYERS



VERTICAL LAYERS

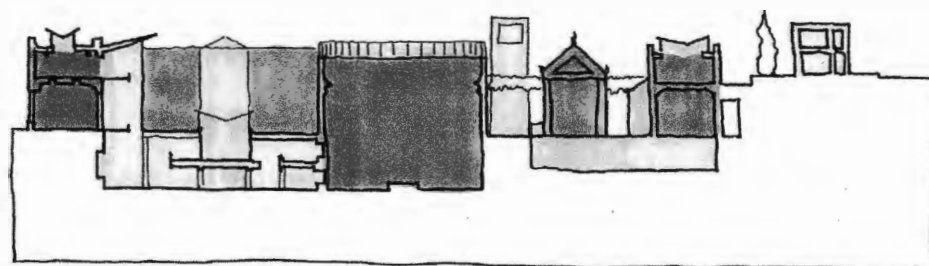


VERTICAL LAYERS

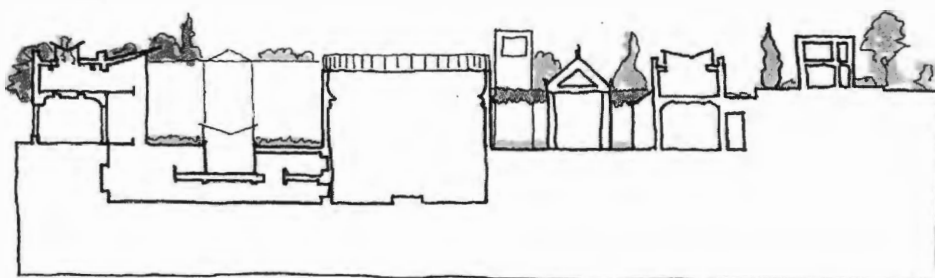


HORIZONTAL LAYERS

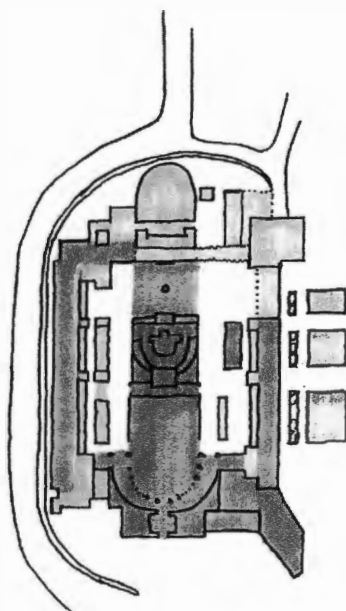
Figure 74 – Layering in Vertical and Horizontal Sections



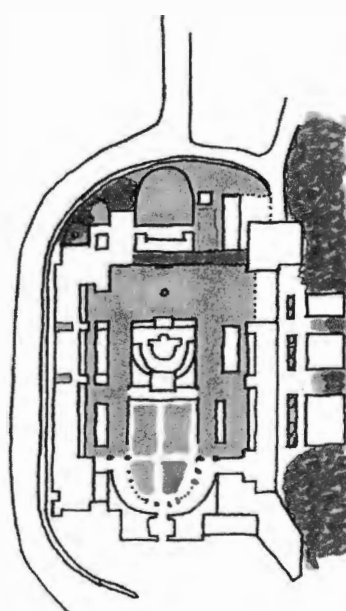
 VILLA GIULIA & ORIGINAL MUSEUM
 NEW CONSTRUCTION



GREEN SPACE

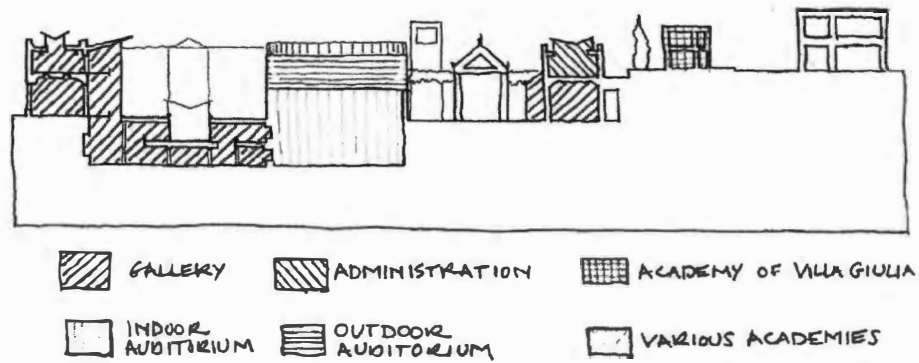


 VILLA GIULIA & ORIGINAL MUSEUM
 NEW CONSTRUCTION



GREEN SPACE
 & LANDSCAPE AS
 SPACE-DEFINING ELEMENT

Figure 75 – Old and New Construction and Green Space



PROGRAM DISTRIBUTION IN VERTICAL SECTION

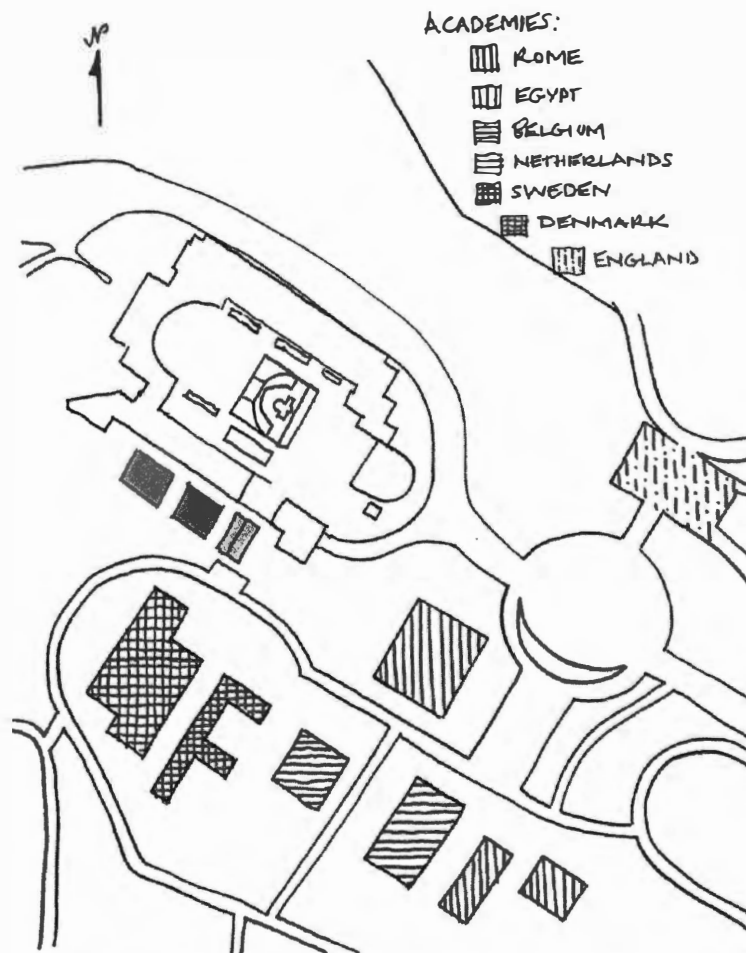


Figure 76 – Sectional Program Distribution – the Academy Connection

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Vita

Barbara B. Laurent was born in St. Louis, Missouri. She has lived in Boston, Massachusetts and Sarasota, Florida, and will now reside in Naples, Florida. A Russian History major as an undergraduate, Ms. Laurent has maintained a long-term interest in architecture and interior design. She renovated a Queen Anne Shingle Style home north of Boston, and continues to enjoy the hands-on side of the process, renovating two homes in Florida. Through her career, Ms. Laurent has held project management positions in Information Systems departments of large corporations, as well as been a marketing and sales business consultant to high technology firms involved in electronic imaging.