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Auguste Perret: Invention in Convention, Convention in Invention

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Architectural theories developed at an accelerated rate in eighteenth-, nineteenth-, and twentieth-century France as a result of debates regarding theories based on masonry construction techniques and those based on innovations in structural types. French architectural theory was at once preoccupied with the need to explain the new structural types in terms of the existing masonry theories and the need to develop new theories based on the new types. The consequent tension between these two traditions was both critical to the transformation of architectural language and clearly visible in the work of architects building in Paris, particularly in the work of Auguste Perret. This article proposes a rereading of Perret's work, identifying uniquely French representational and constructional traditions as the context for interpreting his work. Moreover, contradictions in Perret's work from 1928 to 1940 reveal certain aspects of the rationalist debate in France and, thus, aspects of French modern architecture.

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IN EIGHTEENTH-, NINETEENTH-, AND TWENTIETH-century France, conflicts between theories of architecture spurred the advancement of new theories. In the eighteenth century, theories of architecture based on the cosmic order collided with new empirical theories of architecture and engineering based on the discovery of the natural laws of physics. The emergence of engineering as a distinct discipline challenged the realm of the architect, who no longer operated as the descendant of the master builder. Instead, the profession perceived itself as being relegated to addressing superficial questions related to the surface in which visual rules for order and stability guided architectural principles. In the nineteenth century, architectural theory developed even further as a result of the debates between extant theories of architecture based on masonry construction techniques and those based on innovations in structural types: the cast-iron frame and the concrete frame.

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Twentieth-century French architectural theory, debate, and criticism was preoccupied with the need to explain the new structural types in terms of the existing masonry theories or the need to develop new theories based on the new types. The resulting tension was one of the fundamental factors in the evolution of modern architecture and in the transformation of architectural language. This transformation is clearly visible in the work of architects building in Paris and in the work of Auguste Perret in particular. This article traces aspects of the development of modern architecture by exploring the relationship of construction technique to traditions in formal language from the sixteenth century through the twentieth century.

According to Peter Collins in *Concrete: The Vision of a New Architecture* and Kenneth Frampton in *Studies in Tectonic Culture*, Auguste Perret sought to establish a specifically French modern architectural language rooted in the theoretical constructs of the Abbé de Cordemoy and the Abbé Laugier, which are, in effect, the synthesis of Greco-Gothic rationalism. Frampton contends that "the Greco-Gothic ideal was to permeate the work of Perret at every level, and while his use of neo-Platonic form and his particular vision of human destiny were to remain unequivocally Greek, his attitudes toward production were to be drawn from medieval culture."[1] Collins portrays Perret's work as the embodiment of Greco-Gothic ideals and the transformation of those traditions through an abstracted character and new materials, methods, and sequence of construction.[2] Roberto Gargiani, in his book *Auguste Perret*, illuminates the synthesis of classicism, constructional rationalism, and symbolism in Perret's oeuvre that produced a powerful polemic and a poetic architecture rich in metaphor.

In contrast to these interpretations, this article proposes another reading of the work of Auguste Perret in which the architect and aspects of French modern architecture are interpreted in the context of a specifically French tradition: the continuation of the weaving of tectonic and representational systems that formed the practice of masonry construction in France in the sixteenth through eighteenth centuries. Perret's quest to establish a specifically French modern architectural language rooted in certain Greco-Gothic rationalist traditions may be viewed as the result of this weaving. He produced a body of work remarkable in its nature as both mature and transitional. It is a significant, identifiably French classical-modern architecture, however transitional in its role as prelude to a layered system of construction and representation. Contradictions evident in Perret's work from 1928 to 1940 reveal certain aspects of the rationalist debate in France and thus certain aspects of French modern architecture.

Perret

Auguste Perret was born in exile in Ixelles, Belgium, in 1874. His father, Claude-Marie Perret, was a Burgundian mason who came to Paris and worked for three years before the Franco-Prussian war. After fleeing Paris during the Communard Insurrection in 1871, Claude-Marie found employment with an extraordinarily skilled craftsman in Ixelles. After four years of extensive training and experience, especially in stereotomy, Claude-Marie Perret established his own building contracting enterprise.

The Perrets had two more children after Auguste's birth: Gustave in 1876 and Claude in 1880. In 1881, when the French government declared a general amnesty for political offenses, the Perret family returned to Paris, where Claude-Marie began another

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building construction enterprise. Auguste and Gustave were pressed into service as soon as they were old enough, drawing in the office or working on buildings under construction. In addition to this practical technical experience, both sons entered the École des Beaux Arts and were indoctrinated in the embattled, beleaguered traditions of a classical architectural education. Although both Auguste and Gustave were excellent students, neither received diplomas, as this would have precluded their careers as building contractors.[3] Thus in 1895, Auguste Perret left the École des Beaux Arts for full-time employment in his father's firm.

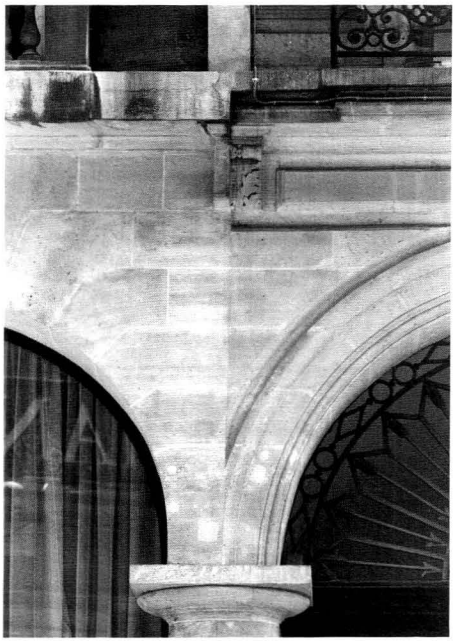
The firm, eventually known as Perret Frères, was certified as being qualified to build using Françoise Hennebique's patented technique for reinforced concrete construction.[4] Hennebique prospered by training contractors in this system, allowing its use under license. It was considered highly prestigious to be a contractor qualified and licensed in the Hennebique system; Perret used this prestige and the possibilities of this system to convince his father to use the system in 1902 for the construction of 28, rue Franklin. The Hennebique system was critical to Perret's expressive use of concrete. Because column and beam connections did not require concrete capitals, Perret was able to create a concrete frame that evoked a simple timber frame. The possibilities of this nuance were to have a significant impact on the expressive dimension of Perret's work.

As a building contractor and architect with a lengthy apprenticeship so thoroughly grounded in both the theory and the practice of architecture, Perret inherited the traditions of both professions and may be considered a twentieth-century master builder or master mason. A formal analysis of Perret's work and an exploration of his construction documents renew the focus on the craft and the representational traditions in French masonry construction as a basis for understanding Perret's work.

1. Building on the Chausée d'Antin, Paris. Although this is an eighteenth-century building, it nonetheless illustrates the degree to which the stone can be carved. (Unless otherwise noted, all images are by the author.)

Flashback: Traditions in French Masonry Construction

The evolution of French masonry traditions provides a context for analyzing Perret's work. Masonry was the predominant building culture in France in the sixteenth through eighteenth centuries.[5] From vernacular to royal construction, masonry load-bearing assembly was the dominant craft. This was largely a result of the building materials available in the region of the Parisian basin, where the passage of the Seine River helped to create an extremely soft type of limestone (Figures 1 and 2). In addition, quarriable stones were of insufficient size and tensile strength to create genuine post-and-beam construction in masonry. Partially for this reason, stone architectural elements of post and beam were not present as elements of construction or representation in France before the sixteenth century. Thus, the tectonic expression of the wall was a continuous and monolithic one.



2. Building on the Chausée d'Antin, detail.

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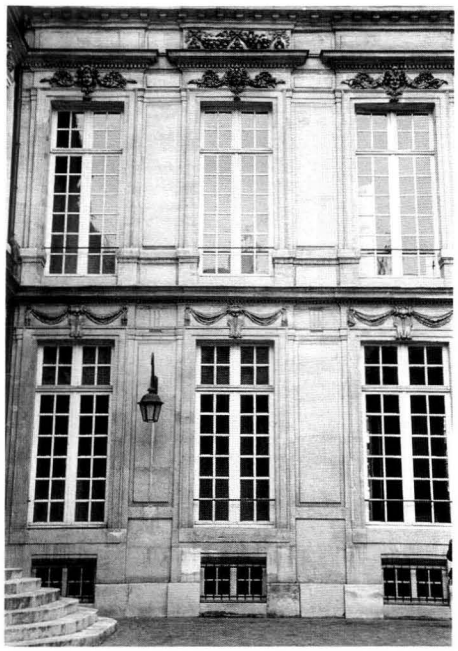
This is not to say that timber construction was absent. In fact, the reverse is true. Medieval timber structures were present in parts of France where forests were plentiful, and an archetypal timber frame was encoded within the articulation of the sixteenth- to seventeenth-century masonry wall. This frame was expressed by carving column, beam, and infill panel elements into the soft surface of the wall. The wall remained the structural element on which the elements were carved. Stone joints of the wall often occurred without regard to the shapes of the superimposed architectural elements. The resulting schism between the structural element of the wall and the representation of superimposed architectural elements demonstrated the impulse to give the wall and the frame equal tectonic "voice." This tension between the wall and the frame laid the foundation for significant conflicts in nineteenth-century architectural tectonic development.

In developing the art of stereotomy, master masons facilitated the transformation of the wall into the frame. Philibert de l'Orme, an architect and master mason, exemplifies the tradition of the master builder, which persisted well into the seventeenth century. The son of a mason, de l'Orme is notable for his contributions to the craft of masonry construction and expression. He was responsible for the château and chapel at Anet as well as many other projects, some conducted when he was superintendent of royal buildings for Henry II, beginning in 1548. He wrote *Nouvelles Inventions pour bien bâtir et à petit frais* in 1561 and *Premier Tome de l'Architecture* in 1567.[6] Having written Books III and IV of the *Premier Tome de l'Architecture*, he is credited with codifying the art of stereotomy, or descriptive geometry in stone.[7] Stereotomic drawings document the specific geometry of stone shapes needed to create complex forms such as vaults and stairs. His most valuable accomplishment was to marry the medieval knowledge of stone masonry with Renaissance knowledge of perspective construction, making it possible to create a proscriptive construction document that related a plan to a three-dimensional drawing. Thus, this drawing established a relationship between conceptualizing and drawing space and methods of construction. It informed the mason in advance of the precise shape required of each piece of stone relative to its place in the three-dimensional construct. The significance of this discovery is that the joint between stones was no longer responsible for taking up the slack between imprecisely cut stones. The medieval stone mortar joint, often thick and variable, was the *poché* of masonry construction. Through stereotomy, the stone mortar joint became quite thin, giving rise to the possibility that the shape of the stone could coincide with the intended character of the architectural element. The promise of this discovery with regard to the evolution of the column and the wall was fulfilled in each successive generation of building craftsmen and architects from Philibert de l'Orme to Perret.

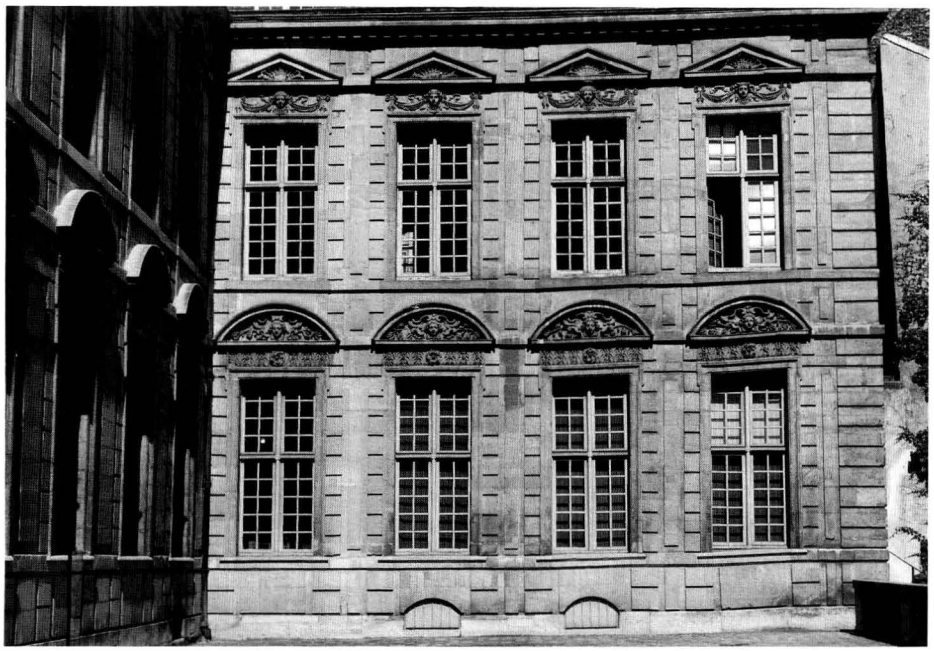
The classical trabeated model was introduced in France in the sixteenth century under the direction of François I. Renaissance Italian architects and artists were commissioned to work in France, and the theory and works of figures such as Leon Battista Alberti, Sebastiano Serlio, Giacomo Barozzi da Vignola, and Vitruvius were carefully studied. However, as the column was commonly conceived by French masons and architects as a modulation on the surface of the wall, trabeated language developed initially as surface articulation on a load-bearing masonry wall (Figure 3). Unlike the earlier relationship between wall and frame, however, the stone shape corresponded more precisely with the architectural element as a result of more sophisticated stereotomic techniques. This compatibility between structural and architectural elements coincided with the coherent development of the classical vocabulary in France by such architects as François Mansart. However, the classical Italian model, described by Peter Collins as a model in which the natural expression of a wall is a frame with non-load-bearing infill, collided with representational systems already present in French masonry construction.[8]

3. Hôtel d'Albret, street facade, 29–31, rue des Francs-Bourgeois, Paris, 1740, J.B. Vautrin. Source for information on this building: Alexandre Gady, *Le Marais: Guide historique et architectural* (Paris: Éditions Carré, 1994).

Representational traditions in masonry construction outside of the classical model may be studied through the way openings were made in the wall and the way walls met at corners. The typical window in public and private buildings of the French Renaissance, and during the classical and baroque periods, was extremely tall. This



4. Hôtel d'Aumont, 5–7 rue de Jouy, facade on the cour d'honneur, Paris, 1631–1650, after plans by François Mansart, executed by master mason Michel Villedo. Source for information on this building: Alexandre Gady, *Le Marais*.

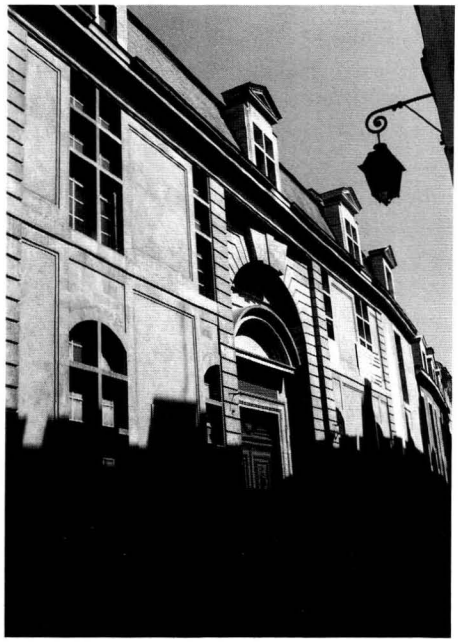


5. Hôtel de Sully, facade on the cour d'honneur, Paris, 1624–1631, after plans of Jean Androuet du Cerceau, executed by master mason Jean Notin. Source for information on this building: Alexandre Gady, *Le Marais*.

verticality, carried from the Gothic tradition, was tempered by the use of strong horizontal belt courses that evolved from Italian Renaissance examples. The solid spaces between the windows were often equal to or less than the width of the void of the window. These proportions yielded solid elements that were thin enough to appear like piers, or a primary frame. Windows were bounded by projecting stone jambs, heads, and sills that were connected to belt courses and pilasters. In effect, this banding expressed a secondary frame into which the window appeared wedged and in which the window jambs became columnar elements. The interconnection of secondary frames essentially broke up the wall into rectangular compartments, at least half of which were void. Thus these walls were not only very porous, but also tended to appear as stone frames with infill panels rather than as continuous surfaces with apertures.[9] This frame did not adopt the language of the classical trabeated system. Rather, the articulation of the constituent part of the window yielded a reading of a frame that is akin to a wood frame transcribed into stone (Figures 4 to 6).

From the beginning of the seventeenth century, the stone infill panels within the compartmentalized wall were often further carved to create the appearance that they were nonstructural elements. In some conditions, the panels were carved so that there was a deep reveal between the flat surface of the panel and the adjacent secondary frame, thus emphasizing the disconnection between structure and infill. In other conditions, human figures, vegetation, or other shapes were sculpted into the panels, disrupting the reading of a continuous masonry load-bearing wall.

François Mansart's treatment of the joining of two walls at a corner pilaster demonstrates an important aspect of the evolution of the frame from the wall through a more sophisticated stereotomic exercise. His technique also illustrates the use of a classical vocabulary more in keeping with the canonical classical model. For instance, Mansart's work, as exemplified by the Hôtel Guénégaud in Paris, reflects conditions of the stone frame as described earlier. However, in the châteaux of Blois and Maisons, Mansart developed a full vocabulary of classical columns, entablatures, and pilasters. Peter Smith observed that instead of pulling the column back a few inches from an outside or inside corner, Mansart emphatically joined the pilaster faces. The result implies a full column embedded in the wall, rather



6. Hôtel St. Aignan, facade on the street, Paris, 145–48, Pierre Le Muet. Source for information on this building: Alexandre Gady, *Le Marais*.

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than applied *to* or carved *on* the wall.[10] There is additional evidence for interpreting Mansart's attitude toward the column through the placement of stones and joints in the elements. The position of the joint supports a discrete reading of the elements on and in the wall. At Maisons, details that reveal Mansart's intentions include the careful placement of joints such that full stones appeared on pier faces. He positioned joints such that none split the stone vertically or horizontally. In Mansart's conception of the column, the representational traditions of the classical model converge with the evolution of the French masonry frame.

This development of a position between tectonic characterizations of the wall and the frame may be understood with reference to Alberti's resolution of the Greek and Roman models of construction and representation in *de Re Aedificatoria.* Hubert Damisch noted that Alberti arrived at a theoretical model of a structure in which the wall and column are inextricable and interdependent. Damisch observed, "Clearly this kind of wall is not conceived at all as a 'constructed monolith.' . . . Alberti intended to define a mode of construction in which the skeleton could not be isolated out of the paries; [every vertical structure erected to support a covering]. . . . In such a system, the column could not be opposed to the wall any more than it could be coupled with it."[11]

The wall in the *hôtel particulier* in Paris illustrates a critical development in the evolution of the wall and the frame that reflects Alberti's model. This development is particularly evident in the ways in which windows were made in the wall. The typical solid-to-void proportional relationship was such that the wall between the windows became little more than a pier. Masonry construction traditions defined such an element as a *trumeau.* In citing Félibien d'Aviler and Enlart, the *Architecture Inventaire General des Monuments et des Richesses Artistiques de la France* gives conflicting definitions of the trumeau: as wall but not pier, as pier but not wall, thus as neither and as both.[12] In his definition of the structural model, Alberti, in effect, described the trumeau. Damisch observed that "long before other contemporary engineers, Alberti recognized that in spite of its monolithic and regular appearance, the wall of Hadrian's Pantheon was itself articulated by a network of superimposed brick arches in the mass of the masonry."[13] In Alberti's system, the perforated masonry wall was a masonry frame, yet the frame was the wall. In the milieu of seventeenth-century French masonry traditions, the *trumeau* was the solid element in a perforated masonry wall that could, by virtue of its proportions and construction, be defined as an element of the frame or a piece of the wall (Figure 7).

In the *hôtel particulier,* the typical secondary frame was articulated such that the interstitial window and solid wall panels became infill between horizontal and vertical elements of the frame. The handling of the secondary frame prevented the wall from being interpreted as a continuous element, in that the jambs and moldings of the windows projected forward from the wall surface. Like the *trumeau,* this condition was also represented in Alberti's model, especially where the jambs in the secondary frame acted visually as columns. Damisch observes that "it is also certain that an opening, far from being necessarily prejudicial to the stability of the wall, may contribute to it, provided it is itself handled in accordance with Alberti's principle, and the jambs assuming the role of columns, so that they become part of the skeleton."[14] The evolution of the jamb into an element of the frame and the persistence of the *trumeau* led to articulations of the modern frame. Thus the column that eventually developed in twentieth-century French architecture is representationally and tectonically rooted in the transformations of the wall and in the *trumeau,* rather than in classical trabeated models.

The Intervening Period: Context

The world of classical French masonry construction is the background for the eighteenth- and nineteenth-century debates on classical rules of order and ideas of expressive, functional, and structural truths. The Enlightenment left a legacy of a codified structural rationalism that was defined through the polemics of Cordemoy and Laugier. Cordemoy prescribed a unity of the whole, in volumetric terms, wherein each structural element retained its independent identity. Laugier subsequently argued for the primacy of the column. Frampton points out that "it is difficult to adequately represent the cultural complexity of the synthesis that Fremin, Cordemoy, and Laugier successively sought to achieve in their drive to promote a hypothetical Greco-Gothic architecture embodying the character of *dégagement,* that is, columnar articulation within the ordinance of Neo-Platonic form."[15] Regarding the surface, Cordemoy eschewed ornament in the form of surface modeling; he preferred plain masonry surfaces.

In *Essai sur l'Architecture,* Laugier proposed an ethical lens through which architecture could be viewed. He argued that structural logic, seen as a natural principle, was a vehicle for architectural truth, and he proposed *vrai* (truth) and *crime* as moral categories applicable to architecture. The nineteenth century built on this eighteenth-century legacy; the ideals of Eugène-Emmanuel Viollet-le-Duc continued the call for a direct relationship between structural integrity and architectural form. For

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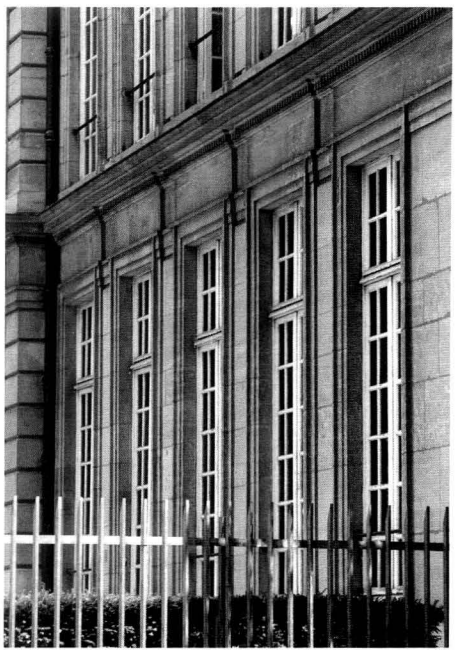

7. Hôtel d'Aumont, facade on the garden, Paris, 1703, Maurissart.

Viollet-le-Duc, any evolution in architectural form could only evolve through the undisguised use of a new structural system or material.

In polemical position and built work, Perret is indebted to these theoretical constructs. What he owes to Viollet-le-Duc Perret himself acknowledged; Perret's father owned a copy of the *Entretiens*, to which Perret was exposed at an early age. Collins observes that "although his later work is usually regarded rightly as extremely Classical, he himself always contended that he was really following the medieval doctrines of Viollet-le-Duc, and that he had remained faithful to them through his life."[16] Regarding an economy of means, Roberto Gargiani noted that "the parameters of economy have multiple implications in the theory of Perret. He reflects the French rationalist orientation that reached conclusion, beginning with Marc-Antoine Laugier then with Jean-Nicholas-Louis Durand, with the expression of a theoretic radicalism centered on the concept of utility. In the work of Perret, this orientation joins that of a modern pragmatism of the building contractor, and often is translated through formal options corresponding to the organizational logic of the construction site."[17] Other influences also shaped Perret's position. Romantics such as Henri Labrouste insisted on a legible iconic program. Engineers, such as Charles Louis Ferdinand Dutert and Gustave Eiffel, contributed their conceptual framework, spirit of innovation, and method of practice.

In addition to these influences, Perret's experience at the École des Beaux Arts considerably influenced his polemical and formal development. Auguste and Gustave Perret passed their formative years under the tutelage of Julien Guadet, a fact of considerable import in any consideration of their professional contributions. Guadet, a pupil of Henri Labrouste, was in 1871 one of the few architects who was prepared, theoretically and technically, to lead and teach. In addition, Guadet's son Paul, who was in the atelier along with Auguste and Gustave, formed a fast friendship with the brothers, allowing them much time in the Guadet home in more casual, but nonetheless significant, contact with Julien Guadet. Although construction was the mother tongue of architecture for Guadet, structure and constructional strategies were but a means to an end. Discovering the internal logic of the structure was not an end in itself, nor did the structure develop through its own evolutionary schema. Rather, the architect's choice of structural system and material reality grew out of the response to experiential, emotional, and programmatic exigencies. Guadet said, "Construction must be the constant guiding thought of the architect, it furnishes him the arsenal of its resources, it limits also his domain. All architectural attempts that would not be constructable do not count, all architectural form that violates or falsifies the construction is vicious. And if by this word construction you hear the structure as well as the building, its entire and effective reality, can you conceive that the executed building expresses other things that this structure, that this construction, expresses itself?"[18] Perret's work fulfilled this promise of a rational *structure parlante* in which an ordered yet expressive armature was formed as a response to functional, formal, constructional, and symbolic programs.

Despite Perret's debt to the theoretical constructs of these figures, he was also exposed to other aspects of practice. The writings of Laugier and Viollet-le-Duc discussed masonry craft and practice as a source of knowledge critical to the practice of architecture. Laugier, in his *Essai*, warned the architect that "those who know the science of stonecutting do wonders at small cost. . . . Therefore, an architect cannot work too hard to gain so precious a knowledge, the most mysterious part of architecture."[19] Viollet-le-Duc proposed that all architects should be specialists in stone. He believed that the architect should decide the shape of the stone and that architects should know the quarry from which the stone came, what size stone was necessary, and the properties and qualities of stone. For Viollet-le-Duc, this knowledge, parallel to that of the medieval master mason, was crucial to the architect's ability to sustain his professional stature and control in light of the growing role of the engineer. And in the end, Viollet-le-Duc firmly believed that the architect who was connected with the properties and methods of working masonry material moved closer to the medieval process and, thus, truth. The architect must operate within the tradition of *homo faber* to be most competent. Perret's theoretical base in

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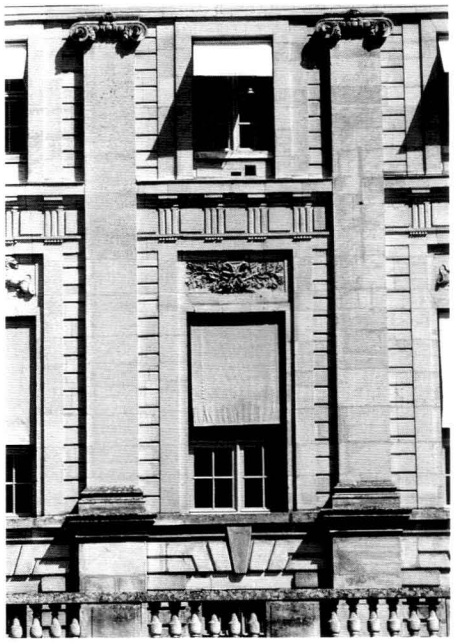
Greco-Gothic synthesis and structural rationalism was grounded in theories of craft from which the Greco-Gothic model grew.

Rereading Perret

The evolution of the exterior wall in Perret's work demonstrates the continuity of the French masonry tradition. The promise of a rationalized stereotomy was fulfilled in mature examples of his work (from 1900 through the end of his career, most powerfully from the twenties on). He guided the primary and secondary frames initiated by the translation from wood into stone along their evolutionary journey, however transformed in concrete. The frame evolved to the point where it and the wall were no longer materially homogeneous or coplanar, but discrete, such that their relationship raised the possibility of two interdependent systems. This possibility spawned the idea of a layered rather than a monolithic wall and eventually, the condition in which the roof and its supporting frame were disengaged from the wall and its supporting frame.[20] Despite the clearer identity of the frame as it became disengaged from the wall, the seventeenth-century masonry waxing and waning of dominance between the wall and the frame still lurked in the reading of the exterior wall.

Several aspects of Perret's polemic and his built work provide a context for this discussion. In 1944, Perret wrote a volume of aphorisms entitled *Contribution à une théorie de l'Architecture* that constituted his theory of architecture.[21] The volume includes fifteen epigrams; the introductory portion is devoted to the notation of essential spatial and structural archetypes, and the central portion is concerned with technique and construction. In the introductory portion, Perret established the conception of the *abri souverain*, or an all-encompassing protective overhead cover. In the central portion,

8. 51, rue Raynouard, Paris, 1928–1930, Perret.



9. Vaux-le-Vicomte, facade on the garden, Melun, France, 1657–1661, Louis Le Vau.

Perret described the *ossature* (skeleton) of an animal as the analog for the structural framework of a building and proposed *le charpente* (carpentry) as the archetypal structural framework. For Perret, the very definition of a building is carpentry: "The building is carpentry accompanied by elements and forms imposed by the permanent conditions to which nature submits it, and that connect it with the past and confer upon it the ability to endure."[22] He proposed the continuation of the carpentry model in steel or concrete, ready "to cover the world with an authentic architecture."[23] In Perret's polemic, the *abri souverain* is supported by the archetypal *ossature*. Also, in this polemic it is a crime to hide the supporting element. He stated that "he who disguises any part of the wood frame deprives himself of the only legitimate and the most beautiful ornament in architecture. He who disguises a column commits a fault. He who makes a false column commits a crime."[24] Thus, Perret dedicated particular attention to the moral categories of Laugier and made certain to differentiate between that which read as *ossature* and that which read as *remplissage* (infill). He carefully chose and detailed infill materials to highlight their non-load-bearing nature, using textures, joint placement, color, and relief to emphasize the distinction between *porteur* and *porteuse*—that which carried and that which was carried.

He illustrated these principles in several built works. In the apartment building and offices at 51, rue Raynouard in Paris (1928–1930), Perret reinterpreted elements of French masonry construction through concrete construction. The building included the primary frame, the secondary grid of the window system and its attendant parts, window jambs that acted as columns (as in Alberti's model), and the tertiary panelized wall surface beyond. The building at 51, rue Raynouard may be compared to the château and stables at Vaux-le-Vicomte,

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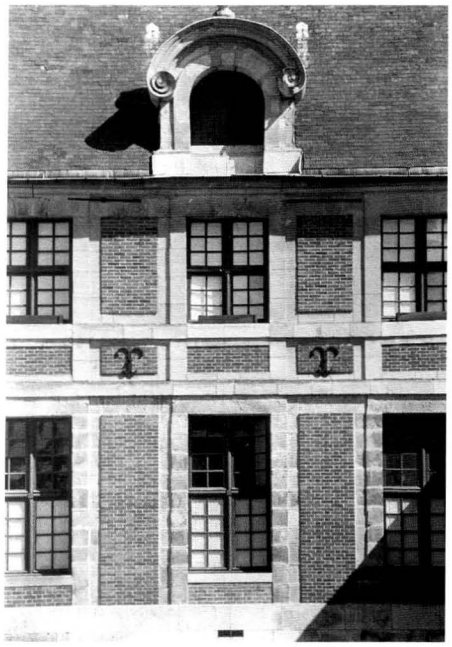

10. Vaux-le-Vicomte, stables.

11. Vaux-le-Vicomte, stables detail.

12. 51, rue Raynouard, detail.

built by Louis Le Vau in 1657 to 1661. The compositional order and constituent architectural elements of the facades of 51, rue Raynouard restated the classical compositional order of Vaux-le-Vicomte. The cornices, pilaster, entablatures, window jambs, sills, and heads of Vaux-le-Vicomte are all present but are reinterpreted in austere concrete shapes. Even Perret's panelized wall surface both echoed and reinterpreted the rustication of the main château. However, the facades are more closely linked to the facades of the stables at Vaux-le-Vicomte. For example, the use of a reveal to separate the masonry panel from the frame by a reveal in the service buildings was restated in 51, rue Raynouard (Figures 8 to11).

Perret not only reintroduced the French masonry tradition in terms of facade order and detail, but revived the stereotomic tradition. Each element—the pilasters, the wall surface, the window frames, and the cornices—was an individual unit shaped as required for assembly and representation. Perret refused to allow the glazing of a window to disappear into the wall. In 51, rue Raynouard, he resolved a dilemma of construction fabrication and sequence, designing a precast window frame that was inserted into the site-cast concrete structural frame. Perret wedged this window frame into the concrete frame as it was in seventeenth-century masonry traditions. A typical window treatment in sixteenth- and seventeenth-century masonry buildings (and in the Gothic tradition in some cases) had a wide frame that projected and another thinner frame that made the transition to the wall.[25] Perret's window also had this thinner frame that anchors, aligns, and thus standardized the thin, precast concrete masonry panels (Figure 12). In this effort to resolve the technical and sequential dilemmas by combining precast elements with a site-cast frame, Perret "unwittingly reproduced a form evolved for decorative purposes in France in the classical age."[26] However, the significance of his solution lies not only in the translation of an architectural element from one idiom to another, but also in the reinstatement of stereotomic logic through modern construction technique.

Projects conceived or built before this discovery did not include a facade expression of primary *and* secondary frame with infill. Once Perret established the primary and secondary frames and infill, he was able to consider separating the wall into layers. In the Siege du Service Technique des Constructions Navales (1928–1931), the facade expression indicates the existence of both primary and secondary frames; however, the roof is expressed as joined to the wall. This is also true of the Siege du Garde Meuble (1935–1936). Ultimately, Perret achieved and clearly expressed the separation of the wall and the roof in the Musée des Travaux Publics (Museum of Public Works, 1936–1937[27]), supporting the roof on a primary

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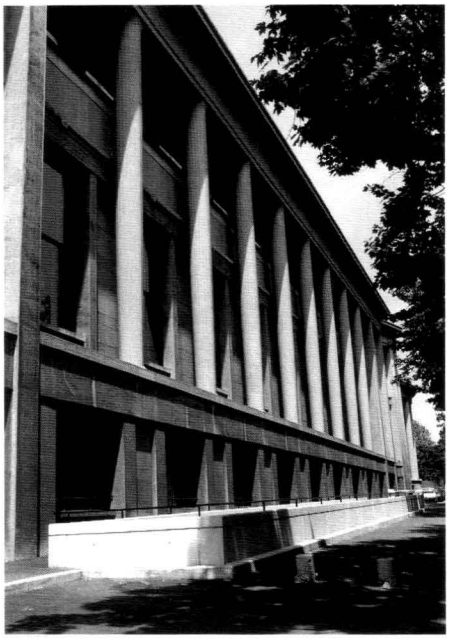
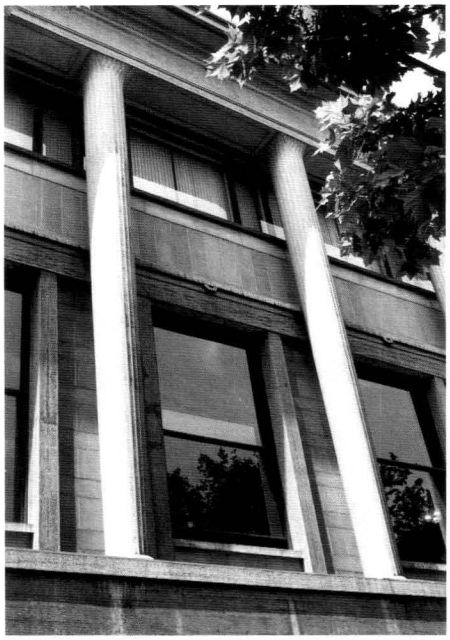
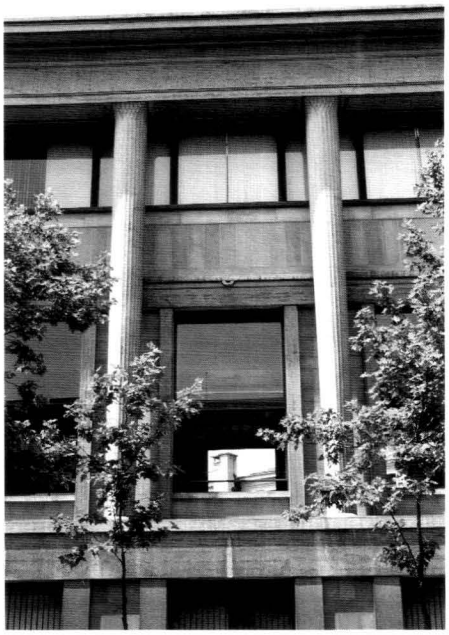


13. Musée des Travaux Publics, facade on the Avenue d'Iéna, Paris, 1936–1946, Perret.



14. Musée des Travaux Publics, typical bay from the facade on the Avenue d'Iéna.



15. Musée des Travaux Publics, typical bay from the facade on the Avenue d'Iéna.

frame and the wall on a separate secondary frame. In fact, the expression of frame and the wall in Perret's work reached maturity in the Musée des Travaux Publics.

In 1934, Perret designed an entry for the competition at Chaillot for the new Palais du Trocadéro, intended for the 1937 Paris Exhibition. Although the project was not chosen to be built, Perret was commissioned, as a consolation, to build the Museé des Travaux Publics next door.[28] The purpose of the building was to exhibit objects and information regarding public architectural and engineering projects. The first floor of the building was to contain large models and heavy installations. The site of the building was a triangle whose vertex was a circular *place*.[29] The two equal legs of the triangle that converged on the *place* were sloping. Thus the side of the building facing the Avenue President Wilson was nearly four meters higher than the side facing the Avenue d'Iéna. The intent was to create two equal wings, converging in a rotunda that faced the place.[30] Perret created a site section that included a base, or dais, in which all the mechanical and electrical equipment is located (Figures 13 to 15). This dais resolved the sectional differential across the site. Following the model of the Greek Temple, Perret placed giant order columns that support the roof and located the enclosing wall approximately a half meter behind the columns (Figure 16).

The typical conditions of the facade, as exemplified on the Avenue d'Iéna, constitute a lexicon of many of the traditions in French masonry wall construction. The facade composition on the Avenue d'Iéna consisted of a giant order that created a shallow loggia on a base. The wall behind this loggia at the ground floor is the wall that demonstrates the transformation of French masonry technique into precast and cast-in-place concrete, as does the wall in the rue Raynouard building. The windows in the ground floor of the facade were designed as large, vertically oriented double-hung windows with the same types of stone jamb, head, and sill details found in the masonry traditions of the *hôtel particulier*. Perret detailed these jambs, heads, and sills as precast concrete elements that performed several tasks. They created a secondary frame and held in place the concrete panels between the windows. These concrete panels were assembled such that they recall traditionally laid-up masonry, as do those on the rue Raynouard apartments. The terminology in Perret's construction documents for this area between the windows of the facade was *trumeau*. Perret was very specific in his nomenclature for architecture elements regarding constructional logic and symbolic content.[31] In this case, he purposefully used a traditional masonry term whose definition oscillates between wall and pier to describe an element of construction and representation

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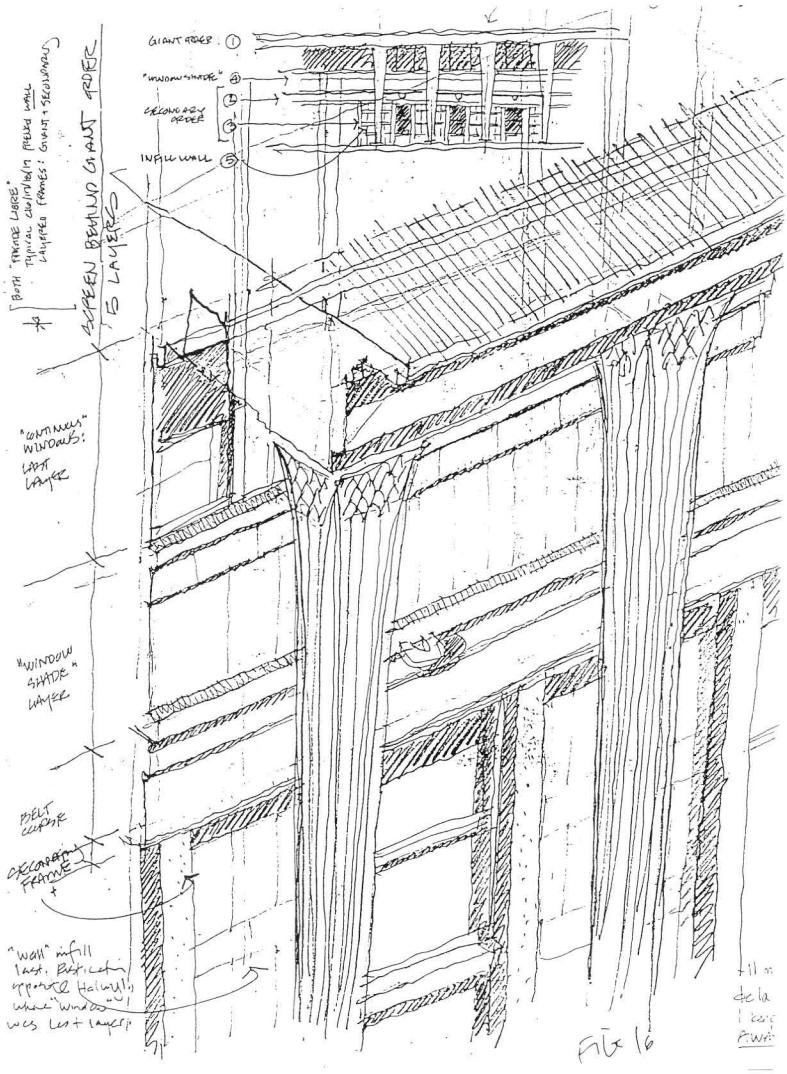
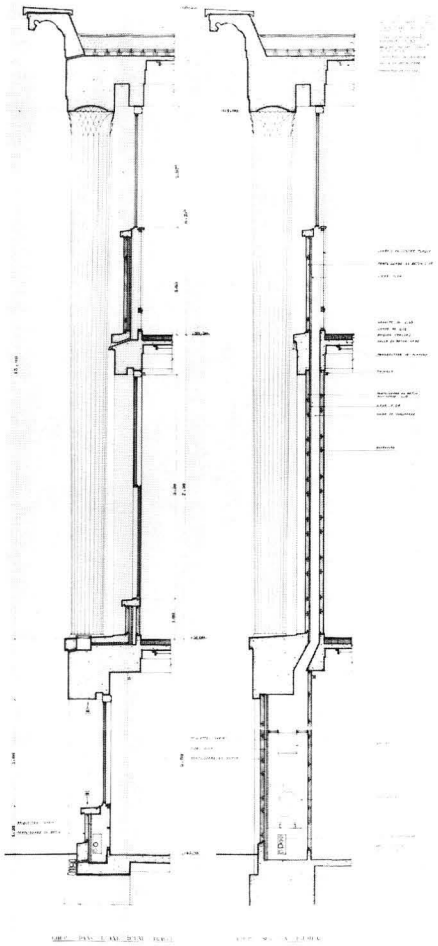


16. Musée des Travaux Publics, axonometric sketch by the author.

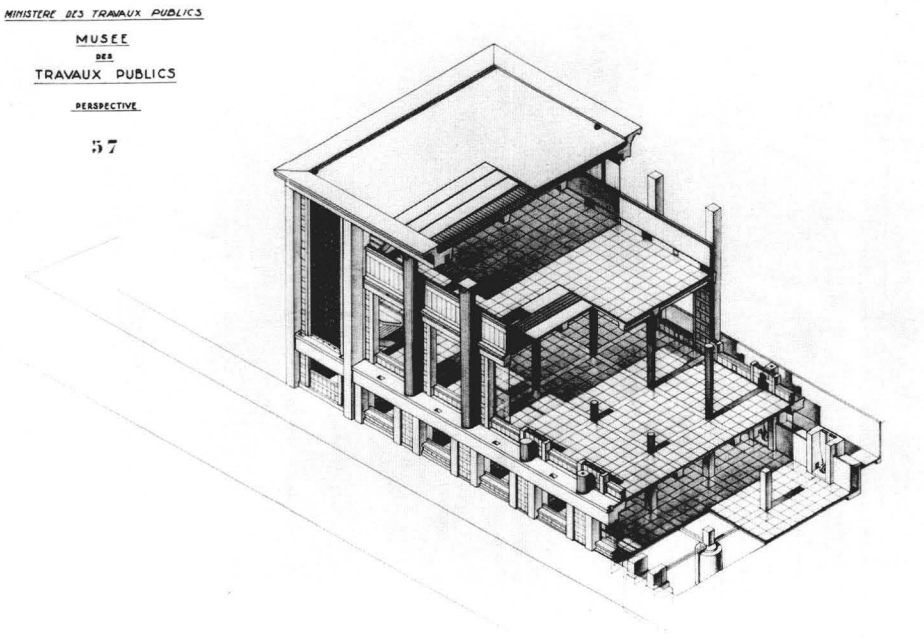


17. Musée des Travaux Publics, wall sections through the center of the bay and through the trumeau. (Courtesy of Archives d'Architecture du XXè siècle de l'Institut Français d'Architecture.)

on the building (Figure 17). The definition of *trumeau* given in the *Architecture Inventaire General des Monuments et des Richesses Artistiques de la France* also includes a reference to the pier that typically divides a portal into two openings, as in Romanesque examples.[32] This pier was typically a masonry layer behind the outermost plane of the facade. Perret's *trumeau* divided the bay of the giant order into two bays on next layer behind the columns. In using the *trumeau*, Perret allowed the constructional and compositional nuances of the masonry precedent to resonate.

In the museum, the first-floor windows were not detailed as windows in a masonry wall, but as horizontal ribbon windows that extended up to the roof. The columns, not the walls, carry the roof. It is significant that Perret oriented the windows vertically rather than horizontally. In debating Le Corbusier, Perret vehemently promoted the vertical window as superior and more correct than the horizontal format because of its anthropomorphic character.[33] The vertical window framed the viewer and the viewer's position relative to the landscape being viewed, not the expanse of the horizon beyond the enclosure.

On the facade in front of the first-floor level, just below the ribbon window, the spandrel element was treated as a band that could "slide" up and down the building, almost like a window shade. This band is similar to elements in the same position in the Hôtel Lamoignan (Paris)[34] and in Vaux-le-Vicomte. In the Hôtel Lamoignan, the band of stone "balconies" and their attendant frames are joined to create a secondary frame that appears to slip behind the giant order. At Vaux-le-Vicomte, there is an entablature that appears to have slipped down behind the giant order. At the bottom of the spandrel element, Perret designed a concrete "shade pull": a whimsical device that further emphasizes the illusion of mobility. Despite the visual evidence on the facade that points to an earthbound, masonry wall/frame condition, there is yet another interpretation of the wall that coincides with the role of the ribbon window: Perret's "sliding" panel ful-



18. Musée des Travaux Publics, axonometric. (Courtesy of Archives d'Architecture du XXè siècle de l'Institut Français d'Architecture.)

fills the promise of a wall fully disengaged from the structure that the ribbon window implies.

The tectonic logic of the building clarifies the intent of those oscillating, conflicting conditions described earlier (Figure 18). Construction documents for the museum indicate that the window jambs of secondary frame on the facade also acted as columns that support the ground and first floors. These elements fall within Alberti's structural model in which the wall and column are inextricable and interdependent; that is, elements that appear as structure on the facade *are* structure. They also fit within Damisch's interpretation of Alberti's model, previously cited, in which Damisch contends that "it is also certain that an opening, far from being necessarily prejudicial to the stability of the wall, may contribute to it, provided it is itself handled in accordance with Alberti's principle, and the jambs assuming the role of columns, so that they become part of the skeleton."[35]

This secondary frame is part of the *trumeau*, whose identity is ambiguous. Structurally, it acts as a concrete frame. Representationally, it is a masonry wall. The ambiguity of the actual element parallels the ambiguity inherent in the eighteenth-century definition of *trumeau*. This ambiguity is a vestige of the tension between theories of wall and frame. However, the ambiguity in Perret's *trumeau* also suggests a curtain wall assembly. His detailing of the *trumeau* indicates that this building is monolithic *and* layered.[36] Perret created shafts in the *trumeau* through which mechanical and electrical equipment could be run. This illustrates the potential for the development of a layered wall, in which structure and enclosure, and interior face and exterior face, are not coincident. This layering contributes to compositional and technical theories of the curtain wall.[37]

The tectonic logic of the building also depicts the cast-in-place columns of the loggia as supporting the roof. Axonometric drawings found in the developmental drawings for the project reveal that the project was detailed as a building within a building. The inner building was a masonry building wherein the French masonry tradition was transformed by a method of concrete construction. Inside the inner building on the Avenue d'Iéna was a great hypostyle hall, which was built to be able to carry the heavy installations of the Musée des Travaux Publics on the ground and first floors. The outer building was a temple that took the form of a giant concrete frame that gives the building a monumental public presence. In addition, as the outer building bridged the inner building, "the notion of the architecture joins that of the public works program."[38]

Perret placed a deep reveal at the soffit behind the columns, which allows the giant order columns of the outer building to be interpreted as further disengaged from the wall of the inner building (see Figure 17). The ribbon window acts as a visual gasket between the two buildings, and the window shade spandrel below amplifies the separation between the two buildings. The spatial strategy for the interior plan making of this building, that of a free plan, is represented by the gasket of ribbon windows at the first floor. The independence of the two buildings presented Perret with another opportunity in the development of concrete construction: It created logical locations for expansion joints. Because expansion is a primary cause of degradation and failure in a concrete structure, the ribbon window was the logical place to separate the two buildings.

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The Musée des Travaux Publics represents a lexicon of traditions in French construction: the load-bearing masonry tradition, the primary and secondary masonry frame, the *dégagement* of the column and the wall, and the ribbon window. Details support the architectural role of any given element of the lexicon. The fact that details support the architectural role of any element is evident at many scales; from the scale of the *parti* to the scale of the detail. For example, Perret carefully placed precast concrete panel joints to indicate whether any given condition was expressive of load-bearing or masonry infill. At the ground floor, the joints allow the panels to be interpreted as laid-up masonry, whereas at the spandrel of the first floor the joints are vertical. This vertical orientation, which suggests that the panel does not act in a load-bearing capacity but acts as a skin instead, is underscored by the existence of the shade pull. In fact, the pull is not a capricious addition to the facade. Rather, the wall section through the pull indicates that the hole in its center ventilates the air space between the exterior skin and interior surface of the wall, further emphasizing the non-load-bearing character of the panel.

Other details similarly indicate tectonic intentions. At the first floor are large horizontally oriented ribbon windows, divided into square increments between mullions. At the ground floor, however, are double-hung windows. Although this is not a window type found particularly often in traditional French construction, it nonetheless represents a type found in masonry load-bearing conditions. The tectonic logic of the double-hung window is in contrast with that of the ribbon window of the first floor. The choice of double-hung and ribbon windows highlights the contrasting tectonic readings of load-bearing and non-load-bearing wall types. In addition to the handling of the windows, the creation and assembly of the concrete elements in this building also tend to support the architectural role represented. The concrete was formed and detailed in a variety of ways—as if it were representing stone, wood, or a plastic material. What it was to represent and, by extension, how it was formed and detailed depended on the architectural program of the context: load-bearing wall, frame, or free facade.

Perret's detailing of the *trumeau* exemplifies the collision between wall-based and frame-based theories of architecture. Since Viollet-le-Duc, "we tend to view structure in terms of the frame and articulate discontinuous systems."[39] In his use of the *trumeau* and its transformation through concrete construction, in a paradoxical way Perret resolved and continued the tension between the wall and the frame. The solution not only parallels Alberti's structural model of continuity, but also further develops the discontinuity inherent in a curtain wall assembly.

Contradictions and the State of the French Rationalist Debate

"Ambiguities" in Perret's work can also be interpreted as contradictions. The nomenclature that revealed the concept of the *trumeau* as the root form of a facade element is one contradiction. The possibility that the building could be identified as both monolithic and layered is another. The fact that the section of the exterior wall between the base and the first floor ribbon window may be simultaneously analyzed as part of the representation of a load-bearing tradition and understood as a wall disengaged from the primary structural frame is another contradiction. The coexistence of ribbon and double-hung windows is yet another. Similarly, Perret's studies of the facade demonstrate the range of expression and tectonic resolution that he considered for the exterior enclosure. These contemporaneous studies resonate with a range of formal and technical expressions from Louis Métézeau's Hôtel Lamoignan to Claude Perrault's colonnade for the Louvre to Pierre-Françoise-Henri Labrouste's Bibliothèque St. Geneviève to Le Corbusier's free facade (Figure 19). The contradictions that lurk in the museum indicate Perret's complicity in the evolution of French architectural traditions: invention within convention, convention within invention.

These contradictions also represent aspects of the debate between Perret and Le Corbusier during the twenties and thirties. Perret argued against the avant-garde and the international rationalist architecture characterized by the work of Le Corbusier. In December 1923, he gave an interview published in the daily *Paris-Journal*; this particular issue was dedicated to an overview of new tendencies of French architecture presented at the Salon d'Automne. Gargiani observes that Perret "criticizes the formal orientation of the new architecture and attacks in particular Adolf Loos and Le Corbusier, defining the latter as the ultimate 'student' of a school of 'paper architecture.' The interview marked the beginning of the polemic between Perret and Le Corbusier, which continued well into the 1930s, and was centered on the role of the structure in the formal characterization of architecture, on the form of the window, on the cornice, and on the materials of construction."[40] In the thirties, the French cultural debate also turned on the issues of the representation of the human figure in architecture, focusing in addition on themes of classicism, modernity, ornament, and "nudity" of the surface. Again, a principal figure in this debate, Perret espoused representational traditions of the structure and the surface that supported the goals of the latest "neo-Humanism."[41]

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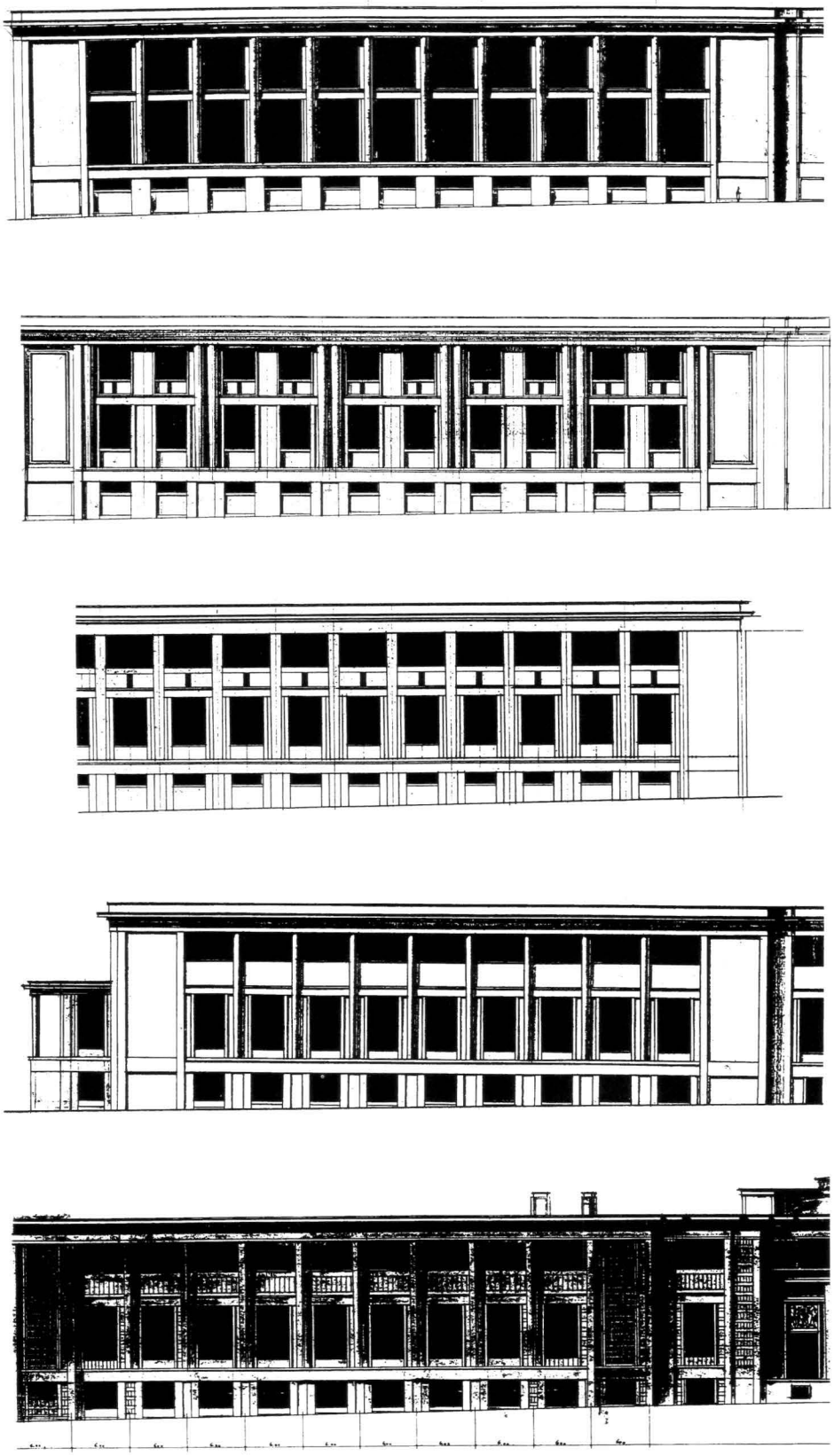

19. Musée des Travaux Publics, details from facade studies. (Courtesy of Archives d'Architecture du XXè siècle de l'Institut Français d'Architecture.)

Indeed, questions regarding the surface were central to these debates. As opposed to the proponents of the International Style movement, for whom the facade was abstract, "nude," and a skin to cover the plastic manipulations of pure geometric volumes, Perret believed in the representational possibilities implicit in a trabeated structure. He also believed that to cover the *ossature* and *remplissage* was tantamount to a crime, and in the thirties he even renounced some of his work from ten and twenty years earlier in which he covered the facades with plaster. Perret attacked the use of *enduit* (covering) in terms of a logic of construction and representation; he argued for a more durable material that could reflect regional characteristics. With regard to the Musée des Travaux Publics, "There is not one sack of plaster here," he proudly declared.[42] Perret said that "thanks to stucco, the aesthetes churn out untruthful designs," and "for that which concerns the exterior, the stucco under no matter what form should only be utilized as a last resort, and should even be forbidden. It is too tempting for the bad builder to disguise, with the aide of this means, a badly studied structural framework, made barely 'in order that it stand' and infilled with badly chosen materials. But a stucco covering constitutes monolithic surfaces, carried by other surfaces that do not have the same coefficient of expansion. So, following differences of temperature, fissures are produced and will betray, in a random way, in a badly studied structural framework. By the same effect, this stucco, inevitably faienced, that is to say that it will be cut with innumerable capillary fissures, through which the rain will penetrate; when below freezing, it will blister and fall. This is the inconvenience of large bare surfaces."[43]

For Perret, the idea of stone was critical for the surface of the enclosing wall. In

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stone, one expresses the tradition of a *grande charpenterie*, which in Perret's terms was the very definition of architecture. In concrete, the tradition could be made more durable, economical, more heroic, and thus more beautiful. Regarding the Siege du Garde Meuble, Perret explained that "I do not use cladding materials of which the usage has always been demonstrated to be precarious. The Greeks never did it. The concrete is self-sufficient. The concrete is stone that we fabricate much more beautifully and in a much more noble manner than natural stone. It is necessary to honor it by highlighting it. One can work it with a hammer, one can bushhammer it, one can cut it, one lays it with all the implements that serve to bring the stone to life."[44] Joseph Abram observed that the Musée des Travaux Publics is a homage to stone, rendered in concrete, treated with all the regard given to stone. The pieces of concrete were even put in place with the same precautions as *pierre taillé*, and even the handling of the joint between different panels revealed a significance. Abram concludes that the conception of the museum as a "monument parfait" in stone was realized to the most intimate of material detail.[45]

Perret's polemical position regarding the surface was not based solely on questions of a rationalized construction process. Perret wanted to create French modern architecture, not an abstract international architecture.[46] In Perret's polemic, the very definition of a French modern architecture is created within the logical construct of a masonry tradition translated into the medium of reinforced concrete construction. This position, supported by many artists and journalists in the debate, was poignantly demonstrated in Marcel Mayer's article in *l'Art et les Artistes* in 1936 entitled "Le Gentil Esprit Français: Méditations Architecturales." In this allegory, Mayer weaves a tale in which Auguste Perret makes an automobile voyage to Château Anet. At Anet, Perret is warmly greeted by the spirit of Philibert de l'Orme, architect of Anet. For de l'Orme, the vision of Anet "suffices, in effect, to bear witness to one of my greatest worries: to make French architecture. This worry, I know, is yours as well, and I do not ignore how you oppose the gentle French spirit against the tendency towards impersonality, towards the 'internationalization of taste,' which certain bad masons propagate."[47] Later in their conversation, de l'Orme confesses to Perret that "the reinforced concrete amazes me. It resolves the problem closest to my heart: to build well, economically. How it leaves far behind my beautiful inventions in carpentry, my stone vaulted staircases, and others of note."[48] Perret and de l'Orme continued their discussion, arguing against other aspects of the International Style. In summoning Philibert de l'Orme to bless Perret's position, Mayer illustrates the tie that binds a French architectural tradition, masonry construction, and Perret's work.

Perret's insistence on the establishment of a French modern architecture also bears a relationship to certain aspects of the general cultural climate in the thirties through the fifties. Faithful to methods employed in stone construction, Perret approached the use of concrete in a manner that both dovetailed with and diverged from the economic needs of France in 1932. Perret was interested in aspects of labor that involved the alliance between stone and concrete: labor of the hand, standardization, and prefabrication. Perret refined the concrete surfaces at the Musée des Travaux Publics to a degree that remains unequaled in his subsequent work, and his method of working concrete is labor-intensive. Only with a trained and highly skilled labor force could he achieve the control of admixtures for color, choice of aggregate, carefully crafted form work, bushhammering by hand, washing, brushing, the careful making of the joint, and especially the method of making corners of panels through a separate mix of concrete and a mold to be applied and hand finished. In the twenties, concrete received much attention for its potential universality. In the thirties, during the rationalist debates, Perret espoused the use of a regionalized concrete. To be regional, concrete would have to replace or be treated as stone. In translating the métier of the stonemason to that of the "concrete mason," Perret encouraged the employment of skilled craftsmen, which was both good for the economy and sustained the lineage of master craftsmen.

Although Perret's approach spurred the economy in some ways, his approach ran contrary to it in others. Gargiani points out that after World War II, urgent economic difficulties encountered in reconstruction constrained possibilities for concrete construction, but that nevertheless Perret, in his quest to create an identifiable French modern architecture, never abandoned his effort to exploit technical means to effect modalities in concrete surfaces. Gargiani notes that in the forties and fifties, at projects in Le Havre, Amiens, and at Saclay, the prevailing logic of prefabrication was imposed on the construction site, impeding Perret's quest to evoke stone in concrete. Yet, until his death, Perret maintained his confidence in the expressive dimension that could be achieved by carefully working concrete by hand rather than by electrically or pneumatically powered bushhammering. Gargiani summarized Perret's position: "Thus, even at the same moment when France and other countries showed an increasingly greater interest in research regarding prefabrication and industrial production of reinforced concrete structures, Perret's technique remains anchored in manual processes and in finishes that are

characteristic of the previous construction sites in stone."[49]

In "Technique and the Metaphysics of Science," Marc Angelil distinguished between two definitions of technique. The first has to do with the craftsman's ability to employ the particular skills for an art form, or *techne*. The second involves the body of specialized knowledge necessary for production. Angelil described the distinction between the two definitions as follows: "The former definition is direct and active, engaging the maker with his means of production. The latter is distanced and general, assuming a certain objectivity for the systematization of the field."[50]

Although transformed through innovation growing out of enhanced skill and knowledge gained through the process of working, *techne* nonetheless acquires the patina of convention through the passage of time and knowledge. It may be said that the second realm of technique includes invention as a necessary component of the advancement of specialized knowledge. Perret operated within both definitions. In Perret's *oeuvre, techne* is represented in his treatment of concrete, in which he continued a masonry tectonic that resonates with a labor of the hand. The second definition of technique is manifested in the sophistication of Perret's production and technical inventions. Like the absorption of new methods of production into extant formal and technical theories, Perret's *oeuvre* was informed by convention and invention: convention in *techne* and invention in production.

Acknowledgments

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Notes

Translations offered are by the author.

1. Kenneth Frampton, *Studies in Tectonic Culture*, ed. John Cava (Cambridge, MA: MIT Press, 1995), p. 155.

2. Peter Collins, *Concrete: The Vision of a New Architecture* (London: Faber and Faber, 1959). Although Collins describes one context for Perret's work as the theory and practice of French masonry construction in Chapter 7, in general Collins places specific focus on Perret's work as the culmination of Greco-Gothic rationalist theoretical positions.

3. Ibid., p. 160.

4. The architectural office of Auguste and Gustave Perret was known as A and G Perret, Constructeurs, and the building contracting enterprise was known under many different names over the years. See Roberto Gargiani, *Auguste Perret* (Milan: Gallimard/Electa, 1994), pp. 8–9.

The Hennebique system used iron stirrups to resist shear forces in concrete beams. Illustrations of the quintessential Hennebique system showed a column-beam moment connection through the use of stirrups and rebars.

5. "The progressive conversion of all of France to masonry is incontestably one the strongest traits of the evolution of French architecture." Jean-Marie Pérouse de Montclos, "Les murs en maçonnerie," *Histoire de l'Architecture Française* (Paris: Éditions Mengès, 1989), p. 159.

6. *Nouvelles Inventions* was dedicated to the presentation of a technique in carpentry that Philibert de l'Orme claimed to have invented. As timber was dear, this technique demonstrated a method for joining small pieces of wood to span greater distances.

7. Jean-Marie Pérouse de Montclos proposes that "Book IV is the keystone to the treaty. . . . Book IV is a monument of French architecture of the Renaissance: from the spiral staircase of Saint-Gilles to the Romanesque and southern heritage, with vaults in the modern French manner it refers to the national Gothic tradition, it borrows from Italian perspective new methods of spatial representation; from all of the above, it creates a new technique, stereotomy, from which the success in France will be exceptional." Jean-Marie Pérouse de Montclos, "Présentation," in *Premier Tome de l'Architecture* ([156] Paris: Laget, 1988), p. 9.

Pérouse de Montclos also observes, "The empirical development of the medieval art of stereotomy left very little written traces. Philibert's pretension of being its inventor is not inaccurate, if one understands that here the inventor is really an editor. Philibert wouldn' have been able to translate this technique if he hadn't benefitted from the progress in perspectival drawing. . . . Finally, he gives to stereotomy the stature of a major technique that it maintains in French theory. It is only in perfectly mastering this technique that one can systematize the plan of the "old [medieval] château." Thus, stereotomy appears as a clever invention that permits one to make as new with the old, at the same time that it appears as the holy grail on which the transformation is made from the null Middle Ages to a triumphant Renaissance." Pérouse de Montclos, "Les murs en maçonnerie," p. 163.

8. Collins, *Concrete*, p. 165.

9. Another reason masonry walls tended to be very permeable is that glazed areas of buildings were very large due to a tax on the number of windows from approximately 1600 to 1938.

10. Peter Smith commented regarding Blois: "In contrast with the arrangement of corner pilasters usually to be found in French buildings at that time, Mansart here moves the end pilasters right to the extremities of the façades so that they themselves become the corners of the building. This treatment was frequently adopted in Italy and had already made its appearance in France, at Ancy-le-Franc for example. . . . Mansart was apparently well prepared to pay [a] price for a system which not only gives greater definition of the building masses, but also imparts new meaning to the pilasters, for when the end pilasters are moved to the corners they produce what appears to be a square pier with two faces exposed and two partially hidden in the wall. This by implication suggests that all the remaining pilasters are in face square piers embedded in the wall and only partly visible, rather than mere undulations in the wall surface or applied ornament."

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Allan Braham and Peter Smith, *Mansart* (London: A. Zwemmer, 1973), pp. 45–46. Peter Collins also made the same observation regarding Mansart's work in general; see *Concrete*, p. 167.

11. Damisch further comments, "Long before other contemporary engineers, Alberti recognized that in spite of its monolithic and regular appearance, the wall of Hadrian's Pantheon was itself articulated by a network of superimposed brick arches in the mass of the masonry. . . . For the Albertian skeleton is not necessarily, nor even principally, made up of elements sunk in the wall: it is a reinforcement of the wall, a reinforcement which can, if required, be external to it so that the applied order has its contribution to make to the stability of the whole, while at the same time fulfilling its own function which is to support the rib elements of the roof." Hubert Damisch, "The Column and the Wall," *AD*, Profile 21, 49/5–6 (May–June 1979): 21–22.

12. Defined in *Architecture Inventaire General des Monuments et des Richesses Artistiques de la France* (Paris: Imprimerie Nationale, 1989), p. 197 and index:

> Trumeau, *n, m.* Pan de mur entre deux embrasures au même niveau. Ne pas appeler trumeau le pilier central qui sépare deux baies jumelées ou divise une porte à deux vantaux.
>
> and
>
> *Trumeau* ou *tremeau* [*Fébilbien D'Aviler*] Désigne également le pilier central séparant les baies d'un portail [*Enlart*]: bien que D'Aviler écrive que "les moindres trumeaux sont érigées d'une seule pierre à chaque assise," cet élément central, tant par sa fonction que par sa forme, est bien, comme le remarque *Brutails*, un pilier et non un pan de mur.

13. Damisch, "The Column and the Wall," pp. 21–22.

14. Ibid.

15. Frampton, *Studies in Tectonic Culture*, p. 131.

16. Collins, *Concrete,* p. 155.

17. Gargiani, *Auguste Perret,* p. 60.

18. Quoted in Gargiani, *Auguste Perret*, p. 61.

19. Marc Antoine Laugier, *Essai sur l'Architecture* (Los Angeles: Hennessey and Ingalls, 1977), p. 77.

20. This study adopts the terms of Edward Ford's definition of monolithic and layered construction in *Details of Modern Architecture* (Cambridge, MA: MIT Press, 1991).

21. Auguste Perret, *Contribution à une théorie de l'Architecture* [1952], reprinted in Gargiani, "Contribution à une théorie de l'Architecture: Histoire d'une texte," *Auguste Perret,* pp. 34–92.

22. "The building is carpentry accompanied by elements and forms imposed by permanent conditions to which nature submits it, and that connect it with the past and confer upon it the ability to endure." *Auguste Perret*, ibid., p. 43.

23. Ibid., p. 46.

24. See ibid., pp. 34–92.

25. Collins, *Concrete,* p. 218.

26. Ibid.

27. Now occupied by the Conseil Économique et Social.

28. The design and construction of the building spanned the years 1936 to 1946.

29. The first floor in France is the second floor in the United States.

30. The wing on the Avenue President Wilson was not completed in the initial building phase but was completed in 1961 in a project by P. Vimond.

31. See Leonardo Benevolo, from *Storia del Architettura,* as quoted in Frampton, *Studies in Tectonic Culture*, p. 121.

32. See Damisch, "The Column and the Wall," pp. 21–22.

33. See Bruno Reichlin, "The Pros and Cons of the Horizontal Window: The Perret-Le Corbusier Controversy," *Daidalos* 13 (Sept. 1984): 71–82.

34. Authorship of this building is debated. Some sources cite Thibaut Métezeau as the original architect in Paris in 1584. Others cite Robert de Beauvais as the original architect, with Baptiste Androuet du Cerceau completing the reconstruction for Diane de Poitiers. Purportedly, this is the first building in Paris to use the giant order.

35. Damisch,"The Column and the Wall," pp. 21–22.

36. *Monolithic* and *layered* are herein used according to Edward Ford's definitions in his descriptions of theories of construction in *Details of Modern Architecture.*

37. Le Corbusier's polemic of the Five Points of Architecture included the *concept* of the free facade. However, although many of his buildings have compositionally "free" facades with ribbon windows that indicate the wall is not load-bearing, the construction of the wall and the relationship of the wall to the floor are within masonry traditions. They are traditionally laid up concrete block masonry walls that sit on the floor. The wall is not liberated from the structure. Perret's model introduced the technics of a layered system. See Ford, *Details of Modern Architecture*, chap. 8.

38. Léandre Vaillat, "Le Nouveau Musée des Travaux Publics," *l'Illustration* (Oct. 1938): 224.

39. Damisch, "The Column and the Wall," p. 18.

40. Gargiani, *Auguste Perret,* p. 14.

41. For Perret's activities and positions against those of the International Style, see Gargiani, ibid., pp. 7–33, and F. Fanelli, and R. Gargiani, *Perret e Le Corbusier: Confronti* (Rome: Bari, 1990).

42. Joseph Abram, "Classicisme et le béton armé," *Monuments Historiques* 140 (Aug.–Sept. 1985): 5–13.

43. Gargiani, *Auguste Perret,* p. 88.

44. Abram, "Classicisme et le béton armé," p. 12.

45. Ibid., p. 12.

46. "[Perret] told him angrily that he would no longer tolerate that my works be reproduced; that I destroy the correct French tradition." In 1926, Perret severed his relationship to *l'Architecture vivante.* Le Corbusier made this observation during Perret's conversation with Albert Morancé, editor of the journal. Gargiani, *Auguste Perret*, p. 15.

47. Marcel Mayer, "Le Gentil Esprit Français: Méditations Architecturales." *L'ART et les artistes*, XXX, n. 163 (1936): 115–24.

48. Ibid., p. 122.

49. Gargiani, *Auguste Perret*, p. 198.

50. Marc Angelil, "Technique and the Metaphysics of Science: The Rational-Irrational Element of Science-Technology within the Making of Architecture," *Harvard Architectural Review 7* (1989): 63.

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