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Orders and Proportions from Serlio to Perrault¹

Proportional Systems in the History of Architecture (dir. C. Van Eck)
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During the Renaissance the treatise writers developed the theory of columns that Vitruvius addressed in books III and IV of the *De Architectura*, the only complete treatise we have from antiquity. In fact the typological and modular studies in these two books go beyond the case of temples: the columns and pilasters in which Vitruvius distinguishes four *genera* (Tuscan, Doric, Ionic and Corinthian) apply to places of worship as well as to secular buildings, public and private. But Vitruvius gives the details on the various parts of a column (bases and capitals) in a disorganized way, as he does for the upper parts (entablatures). Thus architects were led to take a fresh look at Vitruvian precepts which they compared to archaeological vestiges. This in-depth study of the antique text combined with observation of the ruins gave rise to the theory of the orders. For Vitruvius the diameter of the column is the basic unit of reference (the module) which determines its height. Starting with this diameter or its radius, the various parts of the column are also calculated. Without going back to the mythical origin of columns, let us not forget that the origin of the Vitruvian module is the human body and its proportions and that for Vitruvius the beauty of an edifice consists in *symmetria* or its Latin equivalent *commodulatio*. Now the column, the main ornament of an edifice, is not an exception to that rule and reflects the arithmetical clarity among the modular units. The essential module, the diameter, produces some simple operations: multiplication and fractions. The height of the Doric column is seven times its diameter (originally six times), the height of the Ionic column is eight and a half times its diameter (originally eight times), etc. The Doric architrave and cornice are equivalent to a half-module, the frieze to a module and a half, and so on. For the smaller elements, the mouldings composing the main members, Vitruvius uses the system of fractions. A simple example, such as the Attic base, illustrates the procedure. This base, which is a diameter and a half wide on the

¹ See the elaborated version of this paper: F. Lemerle, “Ordres et proportions dans la tradition vitruvienne (XV^e-XVII^e siècles)”, in S. Rommevaux, P. Vendrix & V. Zara (dir.), *Proportions. Science–Musique–Peinture & Architecture*, Turnhout, Brepols, 2012, pp. 409-423.

side, is a half-diameter high. Vitruvius always maintains a numerator equal to the unit: the plinth equals one-third of the radius (R) or one-sixth of the diameter (D). The upper torus is equal to a quarter of two-thirds of the radius (R), that is, one-sixth of the radius, etc. By using the paratactic method of presentation Vitruvius erases the harmonic links among the elements: in fact the ratio of the lower torus and the scotia to the upper torus is three to two, a fifth in the Pythagorean scale. But in antiquity the architect's only objective was to transmit principles easy for workers to carry out. How did Renaissance theoreticians comprehend the Vitruvian heritage concerning the proportions of columns? The concept of an order was an invention of the Cinquecento, and henceforth proportions could only be understood in the unique coherent whole that an order constitutes. In the middle of the Quattrocento, Alberti, more "methodical" than Vitruvius, had an insight into a link among the various parts constituting a column: the base, the shaft, the capital, the architrave, the frieze and the cornice. However it is in three distinct chapters of the *De Re aedificatoria* (VII, 7, 8, 9) that he deals with the three constituent parts of what would be called an "order" during the next century, an organized system going from the base, or even from the pedestal, to the cornice, as it was described for the first time by Serlio in fifteen thirty-seven (1537) and theorized by Philandrier in fifteen forty-four (1544). For Alberti as for Vitruvius there was no order *stricto sensu* and he proportions of the various members are calculated according to the Vitruvian modular and fractional system.

Serlio and the five orders of architecture

Serlio crossed a decisive milestone. In the *Regole generali di architettura* (Venice, 1537), he defined five manners ("maniere") of building, to which correspond five types of ornaments: Tuscan, Doric, Ionic, Corinthian and composite. For the first time a coherent view of ornament was being offered, a synthesis brought about between Vitruvius' text and archaeological reality, in which the column-entablature system, the order ("ordine"), with or without a pedestal, was the protagonist. Serlio added a fifth column to the first fourth described by Vitruvius: the composite column. He confers an organic entity to these five manners of building: the height of the columns, from the squattest to the most slender, was established at six, seven, eight, nine and ten diameters, base and capital included (which Vitruvius did not specify). In addition he does clarify the morphology of the elements which constitute or extend them, like the entablatures or optionally the pedestals. The three Vitruvian bases are integrated into the coherent system of the five types of columns. The Corinthian base described by Alberti (VII, 7), as "Ionic", is part of the

system. If the proportion of the columns varies in relation to Vitruvian or Albertian precepts, the modular system remains the same; Serlio keeps ratios in fractions for the small elements. In addition, proportions of the various members can change. It is not at all necessary to rely on the famous inaugural plate of the five orders; not only does there exist for each of them a decorative alternative (a smooth column and pedestal, a fluted variant without pedestal) but for each constituent part of the order Serlio multiplies the shapes, not to mention the numerous antique models reproduced at the end of each chapter for their ornamental beauty even though they are quite unorthodox. There is no one absolute model for Serlio. The fact remains that the columns are governed by the ratios mentioned above (six, seven, eight, nine, ten). The pedestals, which Vitruvius does not describe, also obey simple proportions, which can be harmonic. The Tuscan dado is square (one to one), the Ionic is *sesquialter*, in other words it is made up of a square and its half, the proportion of the Corinthian is *superbipartiens*, meaning that it is made of a perfect square and two-thirds of it, finally the composite is double (two to one), equivalent to the octave. Only the Doric pedestal is an irrational construction, called “with diagonal proportion”.

The Digression by Philandrier or the theory of the orders

Philandrier reconsidered the Serlian doctrine of the five orders by applying the linguistic model to it. The humanist inserted a *Digression* on the orders in his commentary to book three of Vitruvius (III). It is a fundamental text for the origin of sixteenth century architectural theory. Even if Philandrier takes from Serlio his doctrine of the five orders and modifies the proportions (applying six, seven, eight, nine, ten diameters to the shafts, no longer to the columns) in order to obtain more slender orders closer to archaeological reality, even if he specifies some points of the Serlian morphology, Philandrier dissociates himself from his mentor by defining the very concept of order, a formal system characterized by the combination of vertical and horizontal elements (*columnatio*) and (*trabeatio*). Like each Latin declension, each of the five orders is provided with precise forms and proportions. The height of the columns was determined once and for all. Henceforth a single model will correspond to each order, that is, one pedestal, a single column, a single entablature, all starting from specific proportions. But the Vitruvian modular system which rules the proportions of various members, parts or mouldings of an order is the same as Serlio's and Alberti's.

Vignola and his followers

Things change with Vignola. In the *Regola delli cinque ordini* (Rome, 1562), he incorporated the theoretical advance of Philandrier, while changing in passing the heights of the columns : eight diameters for the Tuscan and the Doric columns, nine for the Ionic and ten for the Corinthian and composite columns. He is neither satisfied to take the radius as module nor the diameter of the column; above all he determines this module from the total height of the column. Thus he proceeds conversely from Vitruvius who calculated this height from the module. Vignola's doctrine, not made explicit in the treatise, is founded on a constant relationship among the three fundamental parts of the order whatever it may be: three to twelve to four. When the heights are the same, the entablature of each order is always equal to one quarter of the column, the pedestal to one third. What changes from one order to the next is the diameter of the column, as we see only in the plate of the edition of 1736.² For the first time the order is considered an abstract entity, the diameter and consequently the module (the radius), being only a relative parameter. This module is divided in thirty parts which allow one to calculate all the constituent elements and members of an order. Unlike his precursors, Serlio and Philandrier, Vignola no longer defines the order by a specific height, but by proportional ratios among the three main elements which constitute it in a unitary mathematical framework. The labourer has to calculate the heights of different parts of the order, starting with the measurements given by Vignola.

	Tuscan	Doric	Ionic	Corinthian	Composite
Height	22 1/6	25 1/3	28 2/3	32	32 m. (m=R)
Pedestal	4 2/3	5 1/3	6	7	7
Column	14	16	18	20	20
Entablature	3 1/2	4	4 2/3	5	5

One can see the regular progression of the orders, with identical proportions however for the Corinthian and the composite. The small module chosen by Vignola, the radius, as well as its subdivision in thirty parts, allow a simple calculation of all the mouldings. And his followers would quickly understand its particular interest.

² And earlier in Frémin de Cotte's treatise (*Explication facile et briesve des cinq ordres d'architecture...*, Paris, 1644) (<http://architectura.cesr.univ-tours.fr/Traite/Notice/Cotte1644.asp?param=en>).

Palladio and Scamozzi

Palladio and Scamozzi were to adopt a solution which I would describe as “composite”. Even if Palladio keeps the diameter as module (or the radius for the Doric) and keeps the principle of Vitruvius’ fractional ratios, at the same time he points out in the text that he is dividing the diameter into sixty minutes (“minuti”) into thirty for the radius (which comes out to be the same). Why mention this division so brief that it could almost seem anecdotal? Because it gives in fact a key to the plates. Modules and half-modules are next to measurements expressed in minutes, in particular for the small members and the various mouldings. Two radically different systems are presented out of their proper places, the Vitruvian system in the text whereas in the illustrations its transposition into a handy system inspired by Vignola, by making rough estimates, because the illustrated book on architecture was read practically like a comic strip, with the image more important than the text for practitioners.

Scamozzi is more complex. Like Palladio he divides the module, the diameter of the column, into sixty equal parts or minutes. Then he determines the height of the column (including its base and its capital) and indicates the proportions of the entablature and of the pedestal in relation to this height. The height of the Tuscan column is established at seven and a half modules, the Doric at eight and a half, the Ionic at eight and three-quarters, the composite at nine and three-quarters and the Corinthian at ten. The theoretician’s originality consists in placing the composite column between the Ionic and the Corinthian, according to the relevant idea that it has elements belonging to the other two and that consequently its proportion must be the average of the other two. Thus the Tuscan and Doric entablatures are one quarter of the corresponding columns, the Ionic, Corinthian and composite entablatures are one fifth. The pedestals range between a third and a quarter of the columns. I won’t go into the details, but as François Blondel, distinguished mathematician and director of the Royal Academy of Architecture, points out in the preface to his *Cours d’architecture* (Paris, 1675), “the difficulty comes in the measurements of the specific mouldings of each of these members, which he mentions not at all in his discourse and which are shown in the diagrams with figures that are quite extraordinary”. I add that they are not the transposition of Vitruvian fractions as in Palladio.

Fréart de Chambray et Abraham Bosse

In the seventeenth century, Roland Fréart de Chambray, gravitating around his cousin the powerful Superintendent of the King's Buildings, François Sublet de Noyers, saw very well how he could take advantage of the subdivision in thirty parts for his famous *Parallèle* (Paris, 1650). In it he presents a selection of the five antique orders taken from the finest edifices of Antiquity and the models of ten theoreticians of the Renaissance, Italian and French, organized in pairs (in the order of presentation, of excellence, Palladio and Scamozzi, Serlio and Vignola, Barbaro and Cataneo, Alberti and Viola, Bullant and De l'Orme). The unification of the illustrations by the choice of a common module, the radius of the column, divided into thirty parts, facilitates the comparison between the various models he proposes. As I have shown elsewhere, this presentation, which in part made for the great success of the *Parallèle*, is very often arbitrary. Chambray was only able to reduce the antique and modern orders by making rough estimates for the most part of the theoreticians, not to mention the esthetic choices he had to make in the presence of the variants of a same order (Serlio and Bullant) or necessary but questionable mixtures which he used in order to create Albertian or Delormian orders.

Abraham Bosse, close to this milieu, also drew his inspiration from Vignola in his treatise on architecture. He was one of the finest engravers of his time and a friend of the father of projective geometry, the mathematician Girard Desargues, whose work he popularized. In the *Traité des manières de dessiner les ordres* (Paris, 1664-65) Bosse takes up again Vignola's concept of the order as an architectural entity determined by a constant connection among the three fundamental constituent parts (the pedestal, the column and the entablature), but he changes the ratios among them, five to fifteen to three instead of four to twelve to three for Vignola. As in the *Regola* the Corinthian and composite orders have the same proportions. But he goes still further: once the height of the column is fixed, it is divided into fourteen parts for the Tuscan, sixteen for the Doric, eighteen for the Ionic and twenty for the Corinthian and the composite, each one of these parts being subdivided into thirty parts. This is what is used as the module or the "pied fondamental". Once again, the module, the radius for Vignola or "pied fondamental" for Bosse, is a relative parameter determined in retrospect. Bosse, as Vignola, is addressing himself to labourers whose task he wants to facilitate. In this respect he presents two scales, one with the module divided into thirty parts and the other with its equivalent, the "pied fondamental" divided into twelve inches, the inch into twelve lines and the line in ten points, according to the traditional subdivision of the foot, easy to use by any labourer in France. The value of the foot is unimportant. He was not the first. A century earlier, De l'Orme presented a few plates in his *Premier tome de l'architecture* (Paris, 1567) (Tuscan base, capital and entablature; Ionic base and cornice of the pedestal and architrave) which he probably intended for the second

volume (unpublished) on the “Divine proportions” with a specific method of calculation. For the module he used the radius equivalent to a foot. This foot was used as “pied fondamental”, which he subdivided into thirty-six parts for the Ionic, into twelve inches for the Tuscan (one part equalling one inch). But this system remained as a preliminary draft.

Claude Perrault

It seemed there was nothing left to say about the orders after Vignola. One must take into consideration the ambitious Claude Perrault who imposed a modern and definitive view of the orders in his *Ordonnance des cinq espèces de colonnes* (Paris, 1683). The discrepancy in the proportions of antique edifices as well as the absence of consensus among modern theoreticians led him to establish a synthesis of the Ancients and the Moderns. In a preliminary reflection on Beauty in architecture, Claude justifies using a geometric and mathematical method, the “médiocrité moyenne”. In other words he suggests a midpoint among the extremes observed in Vitruvius’ treatise, in Roman antiquities and the Renaissance theoreticians. If, following Chambrey, Perrault recognizes that the characteristics of the order are based more on its ornaments than its proportions as did Vitruvius, he nevertheless suggests increasing their heights as they become more slender in order to characterize the five orders. This rigid, formally impeccable system, is founded on simple increasing geometric proportions, easy to carry out thanks to the choice of a new module, called the “petit module” which corresponds to a third of the diameter of the column and is equal to twenty minutes or parts, to distinguish it from the two used traditionally, the “grand module” or diameter, divided into sixty minutes, and the “module moyen”, half-diameter or radius, equivalent to thirty minutes.

	Tuscan	Doric	Ionic	Corinthian	Composite
Height	34	37	40	43	47
Pedestal	6	7	8	9	10
Column	22	24	26	28	30
Entablature	6	6	6	6	6

Thus the orders progress regularly by three “petits modules”, the pedestals increase by one, the column by two. Only the height of the entablature is the same for all the orders, equivalent to six “petits modules”. Thanks to the choice of the little module they can be expressed in whole numbers. In brief, with the intention of rationalizing and standardizing the orders, Perrault

applies simple principles to determine the different parts composing the pedestals, the columns and the entablatures. Thus the pedestals are characterized by more and more numerous mouldings, according to whether the order is richer and higher; for example, the base of the Tuscan pedestal has two mouldings, the Doric has three, etcetera; the Tuscan cornice has three, the Doric cornice has four, and so on. To attain his averages, Perrault used Chambray (the proportions of the mouldings expressed in minutes come from the *Parallèle*) which he completes for the pedestals. The diversity of the measurements of reference (diameters, half-diameters, minutes or parts, the Paris foot or “Royal foot”), the difficulty of the conversion into little module explain the errors in the measurements and the calculations in the *Ordonnance*, which are not very important since Perrault figures an average between two extremes. But like Chambray before him, he cheats: he began by inventing his system of proportions founded on the “médiocrité moyenne” before choosing the comparative numbers of the antique and modern orders permitting him to establish it.

For the theoreticians of the sixteenth and seventeenth centuries the perfection of the numbers is finally incidental, for beauty is rational and not harmonic. The Vitruvian modular system, nothing more than the theorization of a practical experience which had proved itself for a long time, is perfected but not challenged. The proportions are never mentioned for their numerically perfect values founded on harmonic ratios deliberately sought out. With the *Ordonnance* Perrault definitively resolved the theory of the orders, in the same way that his annotation of the *De Architectura* put an end to the consideration of all the various problems posed by Vitruvius, by sanctioning the superiority of the Moderns over the Ancients. But the “médiocrité moyenne” leads to a totally frozen theory of orders. Other themes would appear in the eighteenth century, and other models would appear. But the extraordinary effervescence aroused during the Renaissance by the reflection on the orders and their proportions would never be found again.