Geometry and Rectangular Ratios: Serlio's Villas in the Vienna Manuscript and Book VII

Roberta Spallone(✉)

Department of Architecture and Design, Politecnico di Torino, Turin, Italy
roberta.spallone@polito.it

Abstract. This paper deals with the comparison between the manuscript preserved in the Nationalbibliothek in Vienna - a preparatory work for Book VII of Sebastiano Serlio - with the printed volume, paying particular attention to the drawings and their relationship to the written text. In particular, the comparison refers to the initial section of the book, dedicated to the presentation of 24 ideal villas. The differences between the manuscript and the book noted by historians, in the case of the villas concern both the text, which is punctually rewritten in Book VII, and, to a lesser extent, the images. In this research, variants and invariants in the plans are examined with respect to geometric, proportional, morphological and topological aspects, which have not been investigated so far. The use of geometry and rectangular ratios as compositional criteria is the main reason for attention in the analysis. Five emblematic case studies, through the techniques of graphic analysis, interpretation and digital representation, develop the main observations.

Keywords: Geometry · Rectangular ratios · Serlio

1 Introduction

Sebastiano Serlio's treatise, consists of eight books published between 1537 and 1994 (some of them are posthumous), and, in the field of architectural theories, is an emblematic case of the association between printing by movable type, silography, and use of vernacular language (Italian) aimed at a programme of technical dissemination in which the image asserts its priority over the discourse [1].

The preservation of a manuscript [2] in the Nationalbibliothek in Vienna - a preparatory work for Book VII [3]-makes it possible the comparison with the printed volume, paying particular attention to the drawings and their relationship to the written text.

The comparison proposed in this paper refers to the initial section of the book, dedicated to the presentation of 24 ideal villas (Fig. 1), and is also based on a previous study that focused on the search for rectangular ratios in the plans of the Vienna Manuscript [4]. By comparing the manuscript and the book, drawing techniques, and variants and invariants in the plans will be examined with respect to geometric, proportional, morphological and topological aspects, which have not been investigated so far.

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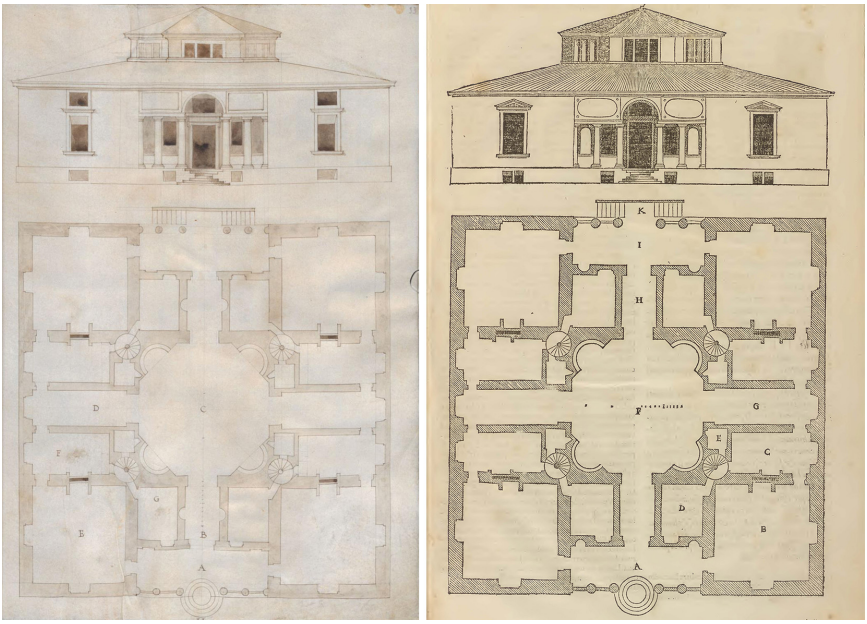

Fig. 1. Villa II, plan and elevation. Sources: left, Wien, Österreichische Nationalbibliothek, Cod. Ser. n. 2649, fol. 33; right, Serlio 1575, p. 5.

2 Book VII in the Treatise Plan and the Vienna Manuscript

Sebastiano Serlio (1475–1554 or 1555) wrote one of the first printed architectural treatises which flanked texts and drawings. The treatise was conceived as divided into books, starting with Book IV on Architectural orders (1537), and Book III on Ancient Roman buildings (1540), both published during Serlio's stay in Venice. Then, in the spring of 1541, Serlio moved to France, where he published Book I on Geometry (Paris 1545), Book II on Perspective (Paris 1545), Book V on Temples and Churches (Paris 1547), and the Extraordinario Libro on Portals (Lyon 1551). Book VI, VII and VIII, remained at his death in the manuscript state, and were published posthumously: Book VI on Private houses in 1966 (Milan), Book VII on Palaces and villas in 1575 (Frankfurt), and Book VIII on Military architecture in 1994 (Milan).

Rosenfeld highlights the didactic value of the treatise that proposed projects and models, and affirmed that "Serlio's books play a major role in the revolutionary development of the printed illustrated scientific manual in Europe in the sixteenth century" [5]. The first edition of Book VII was published by Jacopo Strada in Italian and Latin translation.

The Vienna Manuscript was discovered in 1919 by Julius Schlosser in the Kunsthistorishes Museum in Wien [6]. It contains original drawings and transcribed texts. One hundred and fifty-two parchment folios make up the manuscript, in which the 29 folios of text precede the 123 ink drawn plates. Only one single autograph sheet by Serlio at the front of the book synthesizes the contents.

Serlio announced the topics of Book VII in the preface to Book IV.

Therefore, if Book VII was foreseen from the beginning of the draft of the treatise, it was more difficult for the historians to reconstruct its elaboration process which involves the manuscript realization phases and dating [7–10].

A further issue concerns the existence of a second version drawn up in anticipation of publication, which was not received. Confirming the hypothesis of Dinsmoor, the Manuscript of Wien should be the first version, from which the Serlio would then draw the definitive one, to send for prints [6].

3 Drawing's Techniques and Graphic Standards in the Vienna Manuscript and Book VII

It is clear that the original drawings have many more reasons of interest than the printed reproductions. Moreover, it should not be forgotten that there are a number of steps between the original drawings and their reproduction (taking also into account the possibility of the existence of a second lost manuscript).

Since these are transcriptions, there is a correspondence between method of representation, type of projection, and layout in the manuscript and the book (Fig. 1).

The use of the double orthographic projection, referable to the letter to Leone X (1519), constitutes an example of standardization of graphic representation within architectural literature, taken up by other masters, first and foremost Palladio [11], who used a new position of the views by placing the elevation under the plan. The representation method of the villas according to the ground floor plan and the main elevation is common to most of the plates. Occasionally, the rear or side elevation appears on the same plate, or other elevations and sections are arranged on a second plate. Only in a few cases the plan includes the garden: it follows that the elevation is larger. Generally, the ground floor of the villas is five feet above the ground: the plans are realized by a horizontal cutting plane that intersects the main openings (doors, windows and niches), and the windows are represented through a thinning of the wall. The stairs are completely drawn; the chimneys hole is blackened.

The full page layout implies that the villas are represented at different scales of reduction, and a graphic scale for each sheet allows the reading of the dimensions not shown in the text.

In the manuscript's plans, the vertical axis is traced with rule and pencil and often is intersected orthogonally by the horizontal one. Referring to these axes, a grid regulates the walls position and the layout of the rooms. In many cases the diagonals of the general perimeter allow the placement of angular rooms. The walls outlines are then traced over by ink and the sectioned masonry is filled in gray. In the elevations, the openings, represented without windows or doors, are filled in with black, while glazing and chiaroscuro define more distant planes and curved surfaces. In the vertical sections,

the structures intersected by the section planes are left white and contrast with the background walls, filled in with grey.

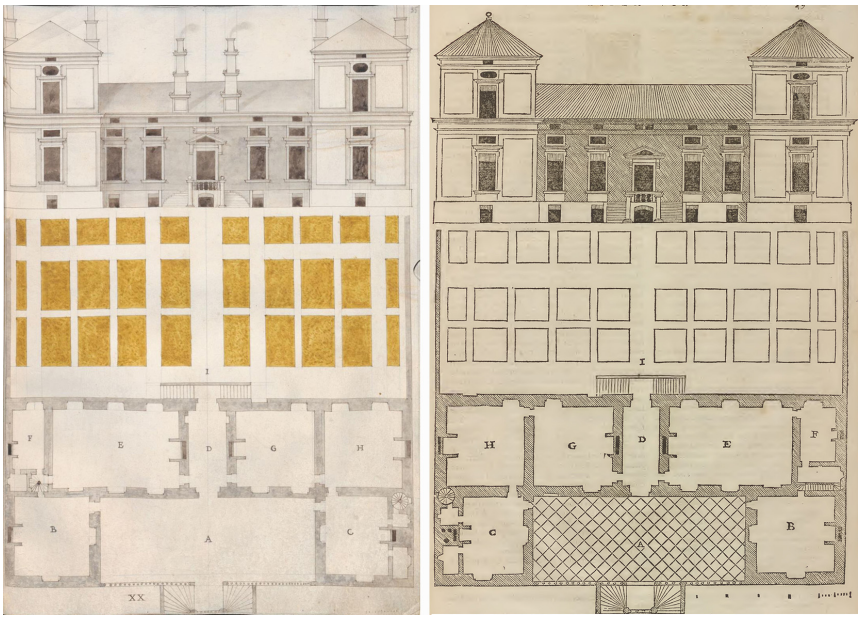

Fig. 2. Villa XX, plan and elevation. Sources: left, Wien, Österreichische Nationalbibliothek, Cod. Ser. n. 2649, fol. 55; right, Serlio 1575, p. 49.

In the book, the conspicuous loss of graphic quality - also noted by Rosenfeld who hypothesizes that that Book VII was printed from copies after Serlio's original drawings and not from his manuscripts [7] - is probably due to an unthought-out transcription of the original drawings, which relies on the use of line and graphic standards that were not strictly used.

The line does not have a homogeneous thickness, the hatching on the plan is done with very fragmented oblique lines, in the elevations the attempt to represent the openings splays does not respect the projective rules, the search for shading is resolved in sketchy lines, the horizontal or converging lines for the roofs are randomly used, and the back façades are filled in with parallel vertical or oblique lines with no apparent reason for the difference. The beautiful chimneys that adorn the elevations of the manuscript also disappear (Fig. 2).

4 Analysis of Villa Plans in the Vienna Manuscript and Book VII: Methodological Framework

The differences between the manuscript and the book noted by historians [6, 7, 12], in the case of the villas concern both the text, which is punctually rewritten in Book VII,

and, to a lesser extent, the images. In the text, the dimensions of the main rooms are in Vicentine feet (1 foot is equal to about 35.7 m), and in the plates are identifiable through capital letters. Moreover, in Book VII referring to the graphic scale, Serlio says that if the other measurements are missing, the feet that are in the middle of the room will make up for it [3].

Carunchio assumes that the text of the book indicates the real size that can be read on the drawings. The differences between the measurements in the texts of the manuscript and those of the book would therefore not be corrections by Serlio, but by the publisher Strada, who may have taken into account the slight variations due to the change from drawing to engraving [10]. Therefore, the dimensions would present adjustments, readable in imperfect ratios between the rooms sides from which even the Manuscript is not totally exempt (rooms sides 6×7, 11×10, 26×25,…) or, and this is a much more widespread in the treatise than in the manuscript, of non-whole values.

Moreover, as Rosci notes, Serlio does not include wall thicknesses in the measurements of the rooms: they have to be added to the sides of the rooms to obtain the perimeter dimensions of the villas [13]. The comparative analysis of manuscript and book shows certain differences from a geometric, proportional, morphological, and topological point of view.

The reference to the square as the perimeter of the villa, only sometimes made explicit in the manuscript, recurs in the book that several times speaks of houses "of perfect squareness" with internal courtyards.

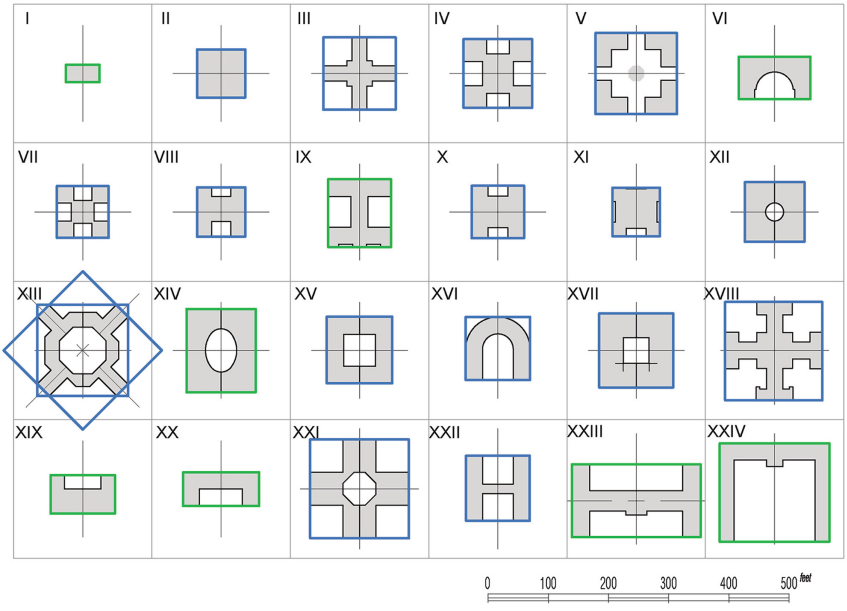

Fig. 3. Typological scheme of Serlio's 24 villas with identification of the square perimeter in blue and rectangular in green. Drawing: R. Spallone.

The square circumscribes in plan 16 of the 24 villas and results, through rotation and/or subtraction of surfaces in the overall shape of block, courtyard, horseshoe, cross, H, X and U shapes (Fig. 3).

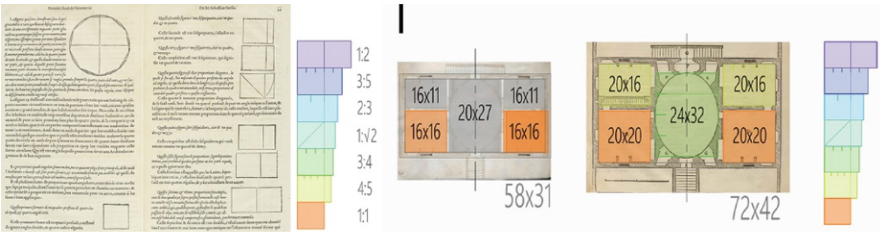

Fig. 4. Left: Serlio's rectangular ratios. Source: Serlio 1545, pp. 20–21. Right: Serlio, Villa I. Sources: Wien, Österreichische Nationalbibliothek, Cod. Ser. n. 2649, fol. 32v; Serlio 1575, p. 3. Graphic overlay and ratios' analysis: R. Spallone.

In Book I on Geometry, on the other hand, the author defines the square as the most perfect shape [14].

The rectangular ratios, recognized by Wittkower [15] (1949) as an architectural principle in the Renaissance [16]), are introduced by Serlio at the end of Book I: the square, which has a ratio of 1:1, is preceded by a progressive series of rectangles, with a ratio of 4:5, 3:4, 1:$\sqrt{2}$, 2:3, 3:5, 1:2 between the sides (Fig. 4, left).

Unlike Palladio, Serlio does not deal with proportional criteria in elevations.

The comparison of the written measurements of the plans in the manuscript and the book reveals numerous differences in the values of the rooms sides, but not a lack of attention to the rectangular ratios which, in the variations, are sometimes lost, sometimes achieved. Following the hypothesis of a possible second manuscript, these values could have been changed there: in any case, Strada's direct reading of the dimensions on the drawings would not have affected the research of rectangular ratios as a compositional rule.

Variations of half, one or two units can indeed be traced back to this practice, considering also the problem of identifying the thickness of the walls. Larger variations, in fact present in few cases, must be attributed to different choices of room sizing, affecting above all the vestibules (Villas VI and XII), or to compensations between one room and the adjacent one. Interesting are the variations in scale involving the whole plan, enlarging it in the book (Villas I and IX).

With regard to the morphological and topological differences of the plans, the most evident are found in Villa VI, which has two longer wings in the book, in Villa IX, which shows a different internal articulation of the entrance, and in Villa XVII, which presents some differences in the distribution of the lateral wings, achieving a double symmetry in the book.

The slight location differences of niches and staircases are less relevant to this study. It should be added that, on the basis of the geometric investigations carried out, Serlio seems to have had to reconcile the main figure, mostly square, in which to inscribe the plot of the villa by placing the rooms, as far as possible corresponding to the rectangular

ratios, with their functions, the alignments of openings, walls and partitions, and the walls thickness.

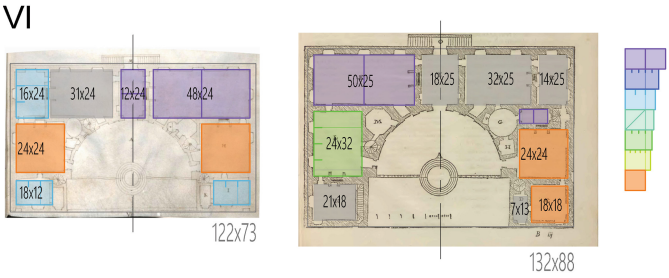

Fig. 5. Serlio, Villa VI. Sources: Wien, Österreichische Nationalbibliothek, Cod. Ser. n. 2649, fol. 38r; Serlio 1575, p. 13. Graphic overlay and ratios' analysis: R. Spallone.

5 Case Studies: Comparative Interpretation

Five villas can be taken as emblematic case studies of the above observations.

Villa I (Fig. 4, right), a compact block, in the manuscript is of much smaller proportions than all the others. Including hypothetical wall thicknesses, it is 58 × 31 feet. In Book VII the area is increased by about 40% (72 × 42 feet). Due to the enlargement, all the rooms, including the oval hall of which we have considered the circumscribed rectangle, assume rectangular proportions, demonstrating a compositional research reasonably attributable to the architect. It is also worth noting the attention paid to the choice of these ratios, which are the first three: 1:1, 4:5, 3:4.

Villa VI (Fig. 5), described in the Manuscript as having "in part the form of a theatre", enters Book VII as one of the "new inventions", possibly located on a hill. The courtyard, in fact, takes on a semicircular plan that generates a concave façade extending into two wings. The comparison between the plate of the manuscript and the book shows an enlargement of scale in the latter, especially in the extension of the wings.

In the enlargement, however, the rectangular ratios are lost and also generates some residual rooms. Instead, in this case, they appear more carefully studied in the manuscript, where seven of the eight main rooms are in rectangular ratios (1:1, 2:3, 1:2).

Villa IX (Fig. 6), whose plan takes the shape of a rotated H inscribed in a square, undergoes a significant increase in scale in the transcription from the manuscript to the book: the square plot including the two side gardens is estimated to be 84 × 84 feet in the manuscript and 134 × 134 feet in the book. The area of the plot in the manuscript is therefore just under 40% of that in the book. At the beginning of the book's description of Villa IX, an overall dimension along the axis of vertical symmetry is given as 134 feet for the covered passage that includes the central hall and the two entrances. This data, unique in the description of the 24 villas, should be carefully considered. As a matter of fact, the villas are often described through their plan shape but never in terms of their overall size. Assumed this overall dimension and considering the interpretative drawing of the rooms' ratios and the internal alignments offering hypothetical wall

thicknesses, the plausible thickness of the perimeter walls is 3.5 feet. This singularity in the description could also mean that the morphological complexity forced the search for an overall measure, whereas the descriptive logic is generally additive. This peculiarity does not appear in the manuscript, which, as we know, has been rewritten.

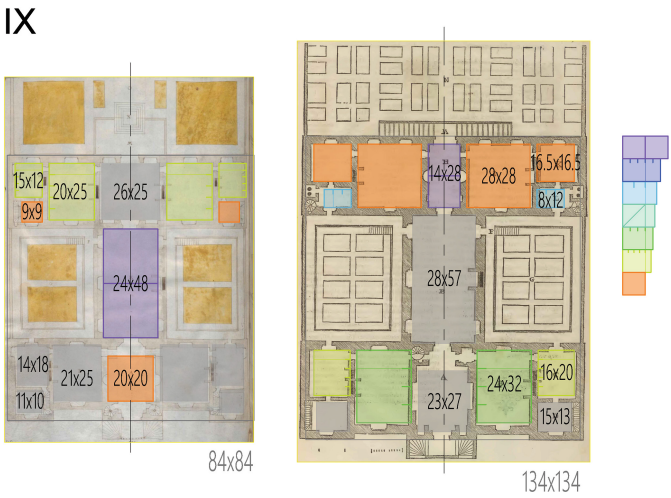

Fig. 6. Serlio, Villa IX. Sources: Wien, Österreichische Nationalbibliothek, Cod. Ser. n. 2649, fol. 40v; Serlio 1575, p. 19. Graphic overlay and ratios' analysis: R. Spallone.

In the passage from the manuscript to the book there is also an increase in the number of rooms with rectangular ratios, 8 in the manuscript, 11 in the book, with the same total number of rooms, i. e. 15. In the book a greater variety of ratios can also be observed - 1:1, 4:5, 3:4, 2:3, 1:2 - than in the manuscript - limited to 1:1, 4:5, 1:2 -.

Also evident in the book is the probable reading of the measurement of the room along the axis of symmetry (28 × 57), which is inattentive to the 1:2 ratio of the drawing in the manuscript. The 1:1 ratio of the entrance is also lost in the book, compared to the manuscript, in favour of rectangular ratios for most of the side rooms. Furthermore, the hall width of 23 feet is not stated and must be derived from the walls alignments and assuming 3 feet of thickness for the interior walls.

Villa XII (Fig. 7) is described in the book as a house of "perfect squareness" with a circular courtyard in the center and is characterized by double symmetry, longitudinal and transverse. The concept of perfect squareness, also present in the description of other houses, underlines the interest, in the book, in specifying the general morphology of the villa and returns in the definition of the four corner rooms.

In the manuscript, the hall is declared to be 24 × 48, i.e. in a ratio of 1:2, but this ratio is contradicted by the sum of the measurements of the rooms, including the partitions, along the two adjacent sides, which is 42, as confirmed by the drawing, so that the hall would be 24 × 42. This error is corrected in the book by adopting a 24 × 40 hall - i. e. in ratio 3:5, a beautiful proportion in Serlio's words - and by reducing the dimensions of the rooms along the adjacent sides. In the manuscript, one might therefore imagine

that the intention was to arrange four rooms along the axes of symmetry, respectively the vestibules and the halls, in a 1:2 ratios, which was not supported in the drawing.

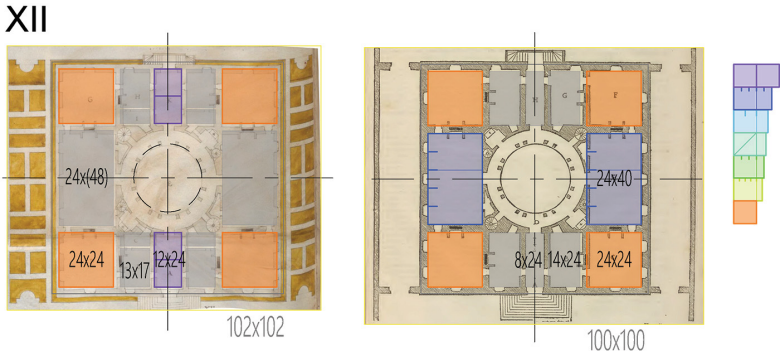

Fig. 7. Serlio, Villa XII. Sources: Wien, Österreichische Nationalbibliothek, Cod. Ser. n. 2649, fol. 44v; Serlio 1575, p. 27. Graphic overlay and ratios' analysis: R. Spallone.

The overall dimensions, assuming the walls thickness, are comparable: 102 × 102 in the manuscript and 100 × 100 in the book.

Villa XVII (Fig. 8) retains in both versions the same dimensions of the square perimeter of a house with a square barycentric courtyard. The use of this figure for the general layout of the plan is emphasized in both sources. In the passage between the manuscript and the book, the design of the plan assumes a double symmetry, longitudinal and transversal, reinforcing its image as a centralised plan, but in 8 of the 17 rooms it loses the rectangular ratios. In this case, it can be assumed that this is due to the measurement from the drawing on the plate, as could also be testified by the side of the two large halls at the side of the courtyard that is reduced to 23 feet, losing the wall alignment with the adjacent rooms.

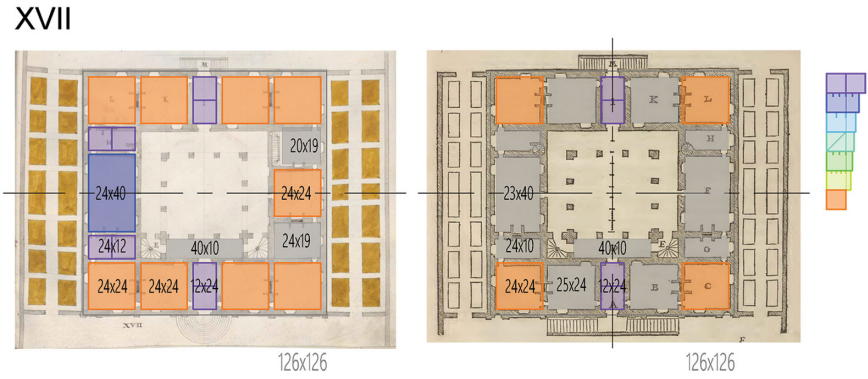

Fig. 8. Serlio, Villa XVII. Sources: Wien, Österreichische Nationalbibliothek, Cod. Ser. n. 2649, fol. 52r; Serlio 1575, p. 41. Graphic overlay and ratios' analysis: R. Spallone.

6 Conclusion

The comparison of the plans showed that the differences between the two sources do not invalidate the attention paid to the geometric and proportional characters in the plans. The research appears to be fertile with possible further developments, which, through the analysis and systematic comparison of the drawings of the 24 villas, will be able to offer new considerations on the compositional and geometric transformations of the plans and will be able to initiate the study of the relationships with the elevations, verifying the criteria for their ideation. In this sense, parametric digital models will be able to offer new keys to interpretation, validating hypotheses of three-dimensional reconstruction.

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