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The Frieze Windows of Monticello

A Surprising Palladian Adaptation

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Despite Thomas Jefferson's methodical record-keeping, many mysteries about the design of Monticello remain unsolved. One of the most interesting is the origin of the frieze windows located on the southeastern façade, which light the children's nursery room above the greenhouse.

Frieze windows, which would become popular during the Greek Revival period, appear to have no precedent in the US when Jefferson designed them for Monticello in the mid-1790s. If indeed these are the first windows of their kind in America, where did Jefferson discover the idea? In *Monticello in Measured Drawings*, William Beiswanger, at the suggestion of Pamela Scott, offered that the windows were perhaps based on Charles De Wailly and Marie-Joseph Peyre's Théâtre de l'Odéon (constructed 1778–82).[1] While the Odéon is a possible candidate, Jefferson saw at least one other example of a Doric frieze window that could have influenced his design: the Clarendon Building in Oxford, England.[2]

Southeast elevation of Monticello showing the metope windows and greenhouse
Photograph by Noah Duell

Designed by renowned Baroque architect Nicholas Hawksmoor and constructed between 1712 and 1715, the Clarendon Building is a large neoclassical printing office that was intended to act as a formal entrance to Oxford University.[3] Its façade features a monumental Doric tetrastyle portico and frieze punctuated by small, square windows set in several of its metopes. On the side elevations, the frieze windows paired with the pedimented gable ends bear more than a passing resemblance to the southeast façade of Monticello.[4]

Jefferson likely saw the Clarendon Building in April 1786 while he was on a tour of English gardens with John Adams. Although neither man left substantial notes about their visit, Jefferson recorded in his memorandum book that he paid five shillings to the doorkeepers of the colleges.[5] Visiting any number of colleges in Oxford would have brought the pair within a city block of not only the Clarendon Building, but also several other notable structures that must have made an impression, like the semi-circular Wren-designed Sheldonian Theatre, the renowned Bodleian Library, and the domed James Gibbs-designed Radcliffe Camera.

Jefferson had seen at least two kinds of frieze windows even before visiting Oxford. His first exposure probably occurred in the late-1760s, when he acquired and pored through Giacomo Leoni's 1742 English edition of Andrea Palladio's *Four Books of Architecture*.[6] In several of his villas, Palladio had designed symmetrical frieze-openings for the purpose of ventilating upper-level grain storage areas.[7] These frieze-vents were on several plates, particularly those of Villa Cornaro near Venice that Jefferson consulted for his initial design of Monticello.[8] Later, while serving in Paris as the US Minister to France,

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INSIDE

The Golden Module of Villa Forni Cerato

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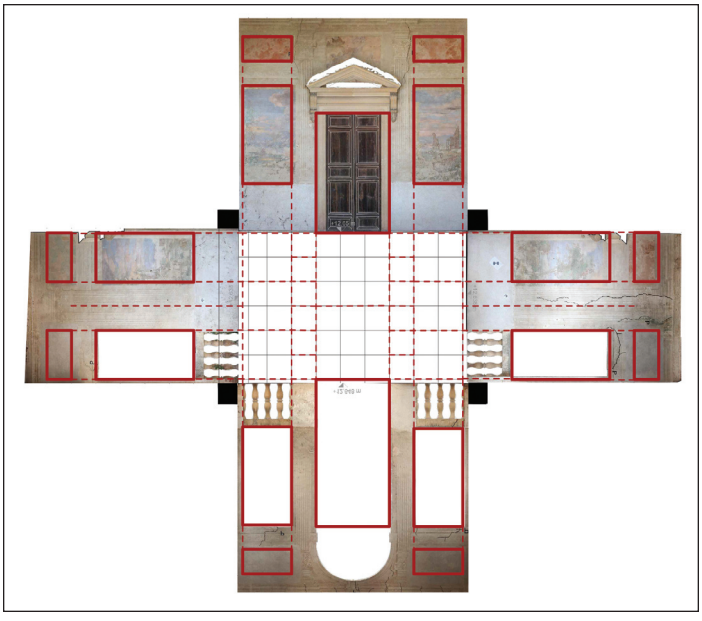
Villa Forni Cerato
Courtesy of Villa Forni Cerato Foundation

Villa Forni Cerato was built in Montecchio Precalcino, Vicenza, c1570. An UNESCO World Heritage Site, it is generally attributed to Andrea Palladio. While scholars have noted a lack of harmonious proportions, its elegance continues to fascinate and intrigue: did Palladio apply his mathematical definition of beauty in Villa Forni Cerato?[1] What were the principles in Palladio's use of proportions?

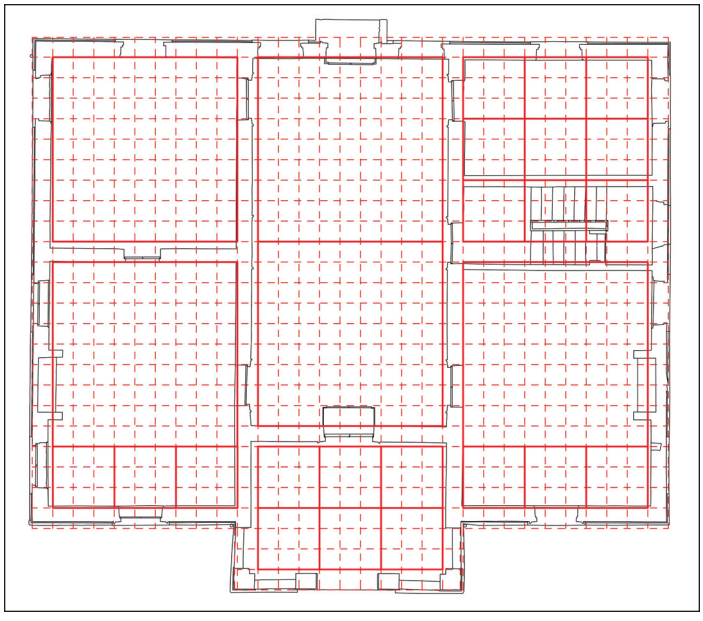
After the undervalued building had been abandoned for 50 years, the Villa Forni Cerato Foundation in 2017 decided to save it and started a comprehensive investigation, leading to the discovery of the geometric mathematical module that underlies the design of the building.

A careful study of the photogrammetric survey and observation uncovered the architectural and decorative elements in the loggia, the alignments between windows and walls paintings as well as between the main arch of the *serliana* and south portal. The study also revealed that the geometry of the building includes a grid of one-unit squares. The dimension of the square is 1 foot, 7 inches (inches used by Palladio were not the modern ones), and 2 minutes, which corresponds also to the width of the pillars of the *serliana* existing in Villa Forni Cerato.[2]

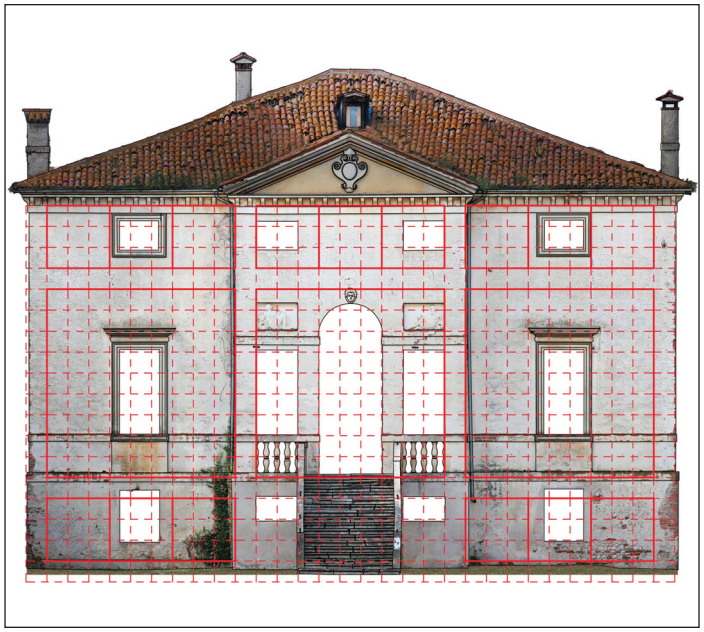
Palladio mentions the word "module" 20 times in his treatise *The Four Books of Architecture*, defining it as the diameter of the column. In Villa Forni Cerato's *serliana*, this equivalence is confirmed since the columns are replaced by pillars of the same size.



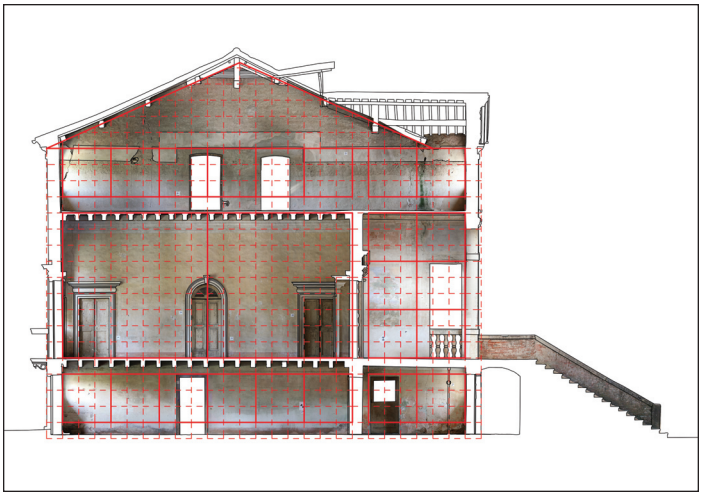
Alignments between decorative and architectural elements in the loggia of Villa Forni Cerato
Courtesy of Villa Forni Cerato Foundation



Overlap of the main floor plan (*piano nobile*) to the grid of one-module squares
Courtesy of Villa Forni Cerato Foundation



South façade of Villa Forni Cerato, 2024
Courtesy of Villa Forni Cerato Foundation



North-south section
according to the module-system
Courtesy of Villa Forni Cerato Foundation

Because everything in Villa Forni Cerato is simple, which Leonardo da Vinci would have defined as "the ultimate sophistication," some scholars remain confused. What is the origin of the dimension?

Euclidian geometry had defined the golden mean or divine proportion as the ratio between two quantities where the ratio of the sum to the larger of the two is approximately equal to 1.618 and is denoted by the symbol for phi, **Φ**. In Villa Forni Cerato, the two dimensions are the width of the pillars in mathematical ratio to the length of the Vicentine foot. The ratio between the module to the Vicentine foot, equals **Φ** 1.618.

Palladio likely employed a geometric grid based on a single square module to achieve harmony in composition and visual wholeness in Villa Forni Cerato. The extraordinary discovery is that all dimensions of the Villa are multiples of this basic module, which therefore becomes the identifying element of this villa.

Starting from the module system used to design the pillars, the width of the openings equals two modules; the entrance arch, three; the internal rooms, nine modules, which also corresponds to the height of the main floor. Thus, plans, elevations, and sections are generated by multiple dimensions of the module, with slight differences due to construction of the masonry.

The building is 31 modules wide and 27 modules long. If we overlap the plan of the main floor to the whole grid, the surface of the rooms is clearly created within the grid of modules: the northwest room is a perfect square made from 9 by 9 modules (1:1). If doubled, it generates the central room, consisting of 18 by 9 modules (2:1). The south rooms are perfectly corresponding to 12 by 9 modules (4:3). In the end 9 by 6 modules form the loggia and the northeast room (3:2).

Villa Forni Cerato's ratios correspond to the ones mentioned by Palladio in Book I, among the seven types of rooms that are the most beautiful and well proportioned.[3] The same is true for the main façade and all elevations. The *serliana* itself is generated by multiple modules, and all openings originate from the grid. Thus, the discovery that all dimensions of the Villa are multiples of this basic module becomes the identifying element.

An image of the entire villa showcases the modularity. The three floors are divisible: five modules from the ground floor to the main floor, nine from the main floor to its ceiling, four modules for the attic, and another five for the roof to its highest point.

Ancient and modern scholarly research boasts an extensive literature on the conception of mathematical representation of Beauty. While the ambition of conceiving a system of mathematical

ratio was deeply rooted in the Renaissance time, Palladio never explicitly stated the mathematical basis of ratios, and consequently harmonic proportions in his projects were differently interpreted.

However, he was overtly looking for a simpler rational structure to produce harmony and integrity. Unlike other architects, Palladio, while aware of the two main mathematical systems of proportions, whole number and irrational ratios, coming from the ancients, had a more heuristic approach. He appeared willing to create a practical rule that would be mathematically usable and aesthetically perceivable.

"Palladio was either a masterful arithmetician or a serendipitous genius" stated Lionel March in 2008.[4] Considering all Palladian projects, the second definition seems to suit his approach according to the current research. As Rachel Fletcher asserted in 1990, "They [the proportional systems] are theories only, which must be translated into a dynamic language of building practice with its complex array of design and technical elements."[5] Palladio's pragmatism played an important role, without neglecting his constant pursuit of Beauty and "reserving for himself the right to break the rules."[6] ■

Rita Francesca Grandi is vice president of the Villa Forni Cerato Foundation. She studied architecture at the University of Venice. Her architectural research and working activity focus on Andrea Palladio and his work.

1 Andrea Palladio, *The Four Books of Architecture,* First Book, Chap. I Of the several particulars that ought to be consider'd and prepar'd before we begin to build. "Beauty will result from the beautiful form and from the correspondence of the whole to the parts, of the parts between each other, and of these again to the whole; so that the structures may appear an entire and complete body, wherein each member agrees with the other and all members are necessary for the accomplishment of the building."

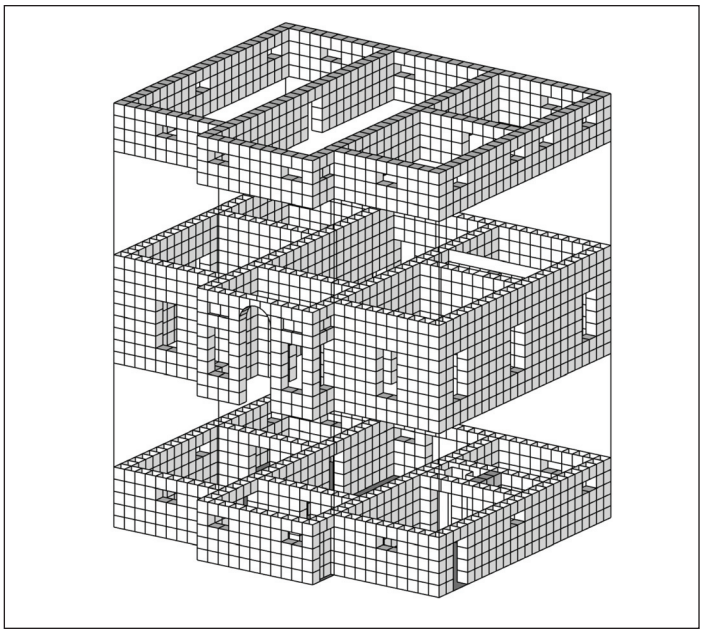
2 The Vicentine foot is divided into 12 inches and each inch into 4 minutes [*minuto*]. According to one source, "The unit of measure employed by Palladio was the ancient foot of Vicenza. After allowances are made for inaccuracies and minor variations in drawing and construction, it appears that the standard ground-floor wall thickness employed in the villas was two of these feet. Rooms almost invariably have dimensions that are small integer multiples of the unit foot." G Stiny Centre for Configurational Studies, The Open University, Milton Keynes MK7 6AA, England. W.J. Mitchell, The Martin Centre for Architectural and Urban Studies, University of Cambridge, Cambridge, England, Received 11 April 1978.

3 Andrea Palladio, *The Four Books of Architecture,* First Book, Chap XXI Of the loggias, entries, halls, rooms, and of their form. "Seven types of room that are the most beautiful and well-proportioned and turn out better: they can be made circular, though these are rare; or square; or their length will equal the diagonal of the square of the breadth; or a square and a third; or a square and a half; or a square and two-thirds; or two squares."

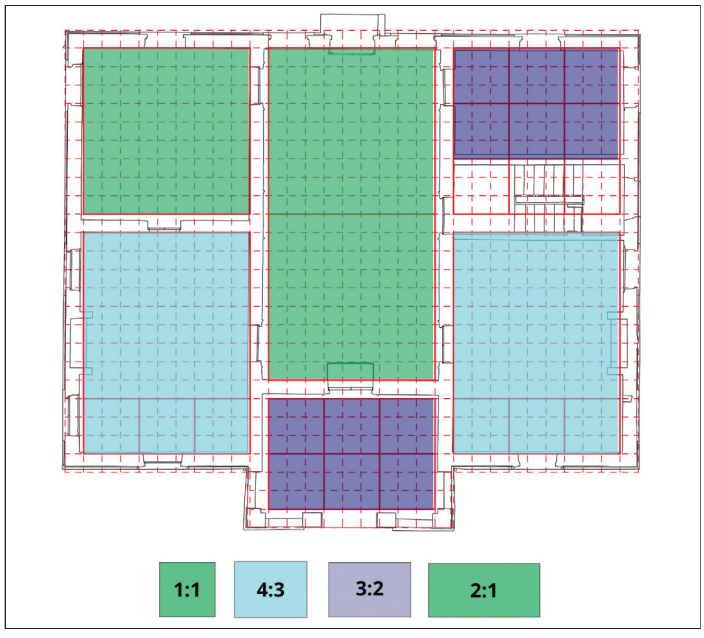
4 Lionel March, "Palladio, Pythagoreanism and Renaissance Mathematics," 2008 in Wassell, S.R., Williams, K., eds., Nexus Network Journal, vol 10:2. Birkhäuser Verlag, Basel, Switzerland.

5 Rachel Fletcher, "Proportioning Systems and the Timber Framer," *Timber Framing*, 18, December 1990, pp. 8–9.

6 Rudolf Wittkower: Principles of Palladio's Architecture: II, *Journal of the Warburg and Courtald Institutes*, Vol 8, 1945, p. 95, The Warburg Institute..



Volumetric development of the floors of Villa Forni Cerato according to the module-system
Courtesy of Villa Forni Cerato Foundation



Proportional ratios of the rooms of the main floor plan
Courtesy of Villa Forni Cerato Foundation