

Renaissance Architecture ^[1]

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Part II - The Mathematics of Building the Dream

Renaissance architecture was a major influence on building design, and it is an era that modern architects still regularly study, as a part of their course. The creation of great churches, monuments, and buildings filtered down to even modest residences, as shown by Palladio and his villas.

Renaissance Architecture - The Mathematics of Building the Dream Part I ^[3]

Andrea Palladio ^[4] Portrait type unknown

Portrait of Andrea Palladio
(Public Domain)

Andrea Palladio

Andrea Palladio ^[4] (1508-1580) wrote four books on architecture and, due to the demand for villas by the nobility, concentrated upon that particular market and developed most of his ideas about proportion and structural strength. This architect also built the San Giorgio Maggiore church (1565) and the Il Redentore church (1576), both in Venice. Palladio was born in Padua, Italy, in 1508, and travelled extensively, studying classical structures and writing a comprehensive treatise, *I Quattro Libri dell' architettura*. In this book, he included diagrams of his own structures and those of Ancient Rome, in an attempt to show the perfect ratios that he felt should underpin architecture. His diagrams slightly deviate from the reality to prove his point, as he believed that this perfection was what the classical architects wanted, even if the implementation left much to be desired. Despite this misleading aspect, his work became a staple for Renaissance architects across Europe, also filtering into art and philosophy. The dimensions of Palladio's buildings were usually whole numbers, with every single room conforming to a whole number ratio, such as the 1:2 ratio that represented an octave in music, or 2:3 that represented a musical fifth.

Villa Pojana ^[5] Portrait type unknown

Villa Pojana by Andrea
Palladio. Drawing by Ottavio
Bertotti Scamozzi, 1778
(Public Domain)

Palladio was one of the most famous architects of his age, and his work spread far and wide, especially influencing the adoption of Renaissance ideals in England and America. He believed in the harmonic ratios of Pythagoras [5]: the Greek mathematician believed that the universe was governed by a set of numbers <1, 2, 3, 4, 8, 9, 27> divided into two sets, <1, 2, 4, 8> and <1, 3, 9, 27>. These sets were derived from musical harmonies and, according to Pythagoras; they were the key to understanding the universe. Palladio used these numbers throughout his architecture, and these numbers and their derived ratios became crucial to his work. Other ratios were more complex, but represented musical harmonies and possibly slightly more complex ratios, such as 26:15. Like many Renaissance architects, Palladio also incorporated symmetry into his design and tried to use shapes such as squares and circles for maximum effect.

The Influence of Renaissance Architecture

One area where the Renaissance changed the landscape was the increasingly ornate churches, where many of the classical themes used by Renaissance artists were developed. The main deviation from the original cruciform design, used during the earlier Gothic medieval period, was the belief that the circle was the most perfect structure and the sphere the most perfect solid, leading Renaissance architects, including Michelangelo and Da Vinci, to incorporate this principle into their work. Alongside Palladio, Serlio and Vignola also contributed to the architecture of the time, laying down mathematical rules for proportion, scale, and symmetry that would influence European architecture for centuries.

The Use of Ratios - The Golden Mean

Golden Rectangle

Image not found or type unknown

Golden Section Rectangle and
Spiral (Public Domain)

There is little doubt that the Renaissance architects used simpler ratios to develop their designs, drawing heavily upon classical architecture, mathematics and sense of proportion. Tentatively, historians suggest that they also used complex ratios, such as Palladio's musical harmonies or complex proportions such as the Golden Mean, a ratio that appears throughout nature and one that is emulated often by humans. This number is a ratio for length to width of rectangles, of 1.61803 39887 49894 84820, and it was believed to be particularly pleasing to the human eye. As with many of these proposed ratios, there are good counterarguments that the architects did not use anything other than practicality to determine ratios and that they were largely coincidental. There may be some truth in this, although the view that architects used these ratios was largely based upon the trends in Renaissance society and, if artists such as Da Vinci and Titian used such harmonies, it follows that architects were also likely to use similar processes, reflecting the overall philosophy of the time. One example of this is the Golden Mean and, while it appears throughout art and architecture, does this mean that artists used it consciously? Numbers close to this occur throughout nature, which has a habit of recycling such things, and parts of the human body and the branches of trees have ratios very

close to the Golden Mean, so there is a chance that it could also be subconscious preference as artists replicate the world around them. Often, people are so keen to prove that the Golden Mean has been used throughout history that they suffer from confirmation bias and refuse to see alternatives. For example, many mathematical historians claim that the Ancient Greek architects built the Parthenon around rectangles of the Golden Ratio, but the measurements are not supported by statistics and, indeed, many different sized rectangles exist within the temple, making it difficult to separate any trend from amongst the statistical noise: the rectangles of the Golden Ratio could also be entirely coincidental. However, Renaissance architects, usually also excellent mathematicians, would have been well aware of this ratio and certainly could have consciously incorporated it into their designs in the quest for proportion and harmonic perfection.

The Renaissance - Proportion and the Legacy of the Renaissance

Villa Pojana

Image not found or type unknown

Villa Pojana in Pojana Maggiore by Andrea Palladio ([Creative Commons](#) [6])

The Renaissance style spread from Italy across Europe, and modern architects still study the forms and styles of this crucial period, with the great buildings and structures representing the pinnacle of Renaissance art, philosophy, and science. More than anything, the architecture of this period defines the prevailing thought of the time, perhaps eclipsing even the great Renaissance artists, scholars and philosophers. Certainly, the Renaissance saw architects elevated from craftsman to artist, but most of these architects were also skilled mathematicians and geometers, applying these skills to their work.

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