

The vital role of proportion in architecture

[Design](#), [Architecture](#)



Proportions are understood as a cooperation of different parts in a whole. It is a commonly known term called proportion. But trying to understand the proportion in architecture turns out to be more complex due to massive amount of hidden information and theories, but those things let us understand the true meaning of proportion and their role in architecture. Proportions are considered as a combination of mathematics with art. This topic is connected with others like metaphysics, metrology, music, morphology, anthropometry, archeology etc.

Proportions, numbers and geometry are three main things in terms of architecture, which let it exist and develop. Pythagoreans had their own theory of beauty. They based it on numbers, because they thought they are everywhere. Pythagoras claimed that “ everything is a number” and wanted to show that anything can be described using numbers, fractions. He gave the God as an example of perfection and thought that He would not create something that is not as good as Him himself, so He would create only things that He considered perfect.

Plato said that everything that is good is also beautiful and beautiful things cannot exist without proper proportions. The topic of beauty became as something everyone referred to at first, because beauty is something people have been trying to reach for ages. Something was said to be beautiful when it had proper proportions and symmetry. Referring to as a whole, beauty is important, but focusing on beauty of singular objects – shapes, is a wrong way to understand proportion in architecture. Alleged beauty of different singular shapes is useless due to it being a very doubtful assumption, on which a theory of proportion could be based. Usage of those shapes in <https://assignbuster.com/the-vital-role-of-proportion-in-architecture/>

practice can only be justified as way to achieve a goal and thus it does not matter whether those shapes individually are considered beautiful or not. (schofield, p. 5)

The criteria of beauty has been along the architecture and its creation since the beginning having a vital impact on its shape and form. Alberti thought that architecture is focused on beauty. He described beauty as harmony, which is a coherent layout of parts and perfect proportions. Alberti didn't copy ancient theories, but he used them as an example. The thing that connected all of these theories was beauty. Because Alberti has based on mathematical system of harmonic proportions, as he said beauty defines harmony:

Piękno jest harmonią wszystkich części dostosowanych do siebie i będących w zgodzie i proporcji z tym dziełem, w którym się znajdują, tak, że nie można nic dodać ani ująć, ani zmienić, żeby nie zepsuć całości". He said that there are 3 perfect proportions: arithmetic, geometric and musical and all of them are pleasing to the eyes and ears and they hold true in music and architecture or even sculpture. From the general opinion of Alberti on the art two conclusions can be made: the aim of the art is beauty and the way to follow it is nature. Nature if not always perfect, was the most accurate pattern of beauty, which is the thing ancient people understood, when „stawiali sobie za cel naśladowanie natury jako największej artystki we wszelkich rodzajach kompozycji”.

Architecture, nature and geometry are in a very important relationship due to the observations of the first humans on the nature since they started

existing. Former people have started looking closer at the nature and have tried to learn from it. They have found that it has some geometric proportions in things it creates, even in the humans themselves.

Vitruvius noticed the relations between a human body and basic geometric figures like a circle and a square.

As a result of his research, Vitruvius has created his own system of human proportions. He was convinced that using rules taken from the nature of human body in architecture is a must. In the first chapter of his third book he wrote about proportions and symmetry. Symmetry comes from proportion called analogy.

The perfection of human body is shown by “ Vitruvius Man”, a work done by Leonardo Da Vinci. He was the first artist that cared about whole human autopsy. Based on his findings he created a model based on Vitruvius theories. His work had perfect proportion and symmetry. He found perfect proportion to draw a human in both square and a circle. Creating a harmony between human body and geometry was something that architecture needed and Da Vinci was the one that made it. The Diagram has many layers, so many, so if you look closer you can see geometry. Human body is referred to as something perfect and as a model of the world. Shapes used by Da Vinci are also referring to Vitruvius, because circle and square were considered perfect shapes. The next layer of meaning of diagram is architecture, main principles form, function and beauty that Leonardo applied to the Vitruvius Man connecting those three principles, which were wrong taken before as a separate things. That Man is a universal context.

The most basic role in creating the architectonic composition was left to a module. Thanks to it, the architect could create perfect proportions between different parts of the building. A piece of work created and built when following those rules was supposed to be a representation of harmony and rhythm.

In *De Divina Proportione* created by Luca Pacioli we can read: " First we're going to talk about human proportions, because out of the human body come all measurements with their names and all different kinds of proportions can be found there". So it is nothing uncommon that people have been trying to find the same numeric ratios and harmony that could bring beauty to music and architecture. If the limbs of the body are proportional to the width of the face, then their shape shall be beautiful even if the limbs alone are not beautiful, because proportions only make beauty. Wrote florentian sculptor Lorenzo Ghiberti (tatarkiewicz op. Cit. s. 73)

Research on the topic of architecture shows constantly repeating mathematical connections which could not have appeared there randomly. In RENESANS it was believed that most of beautiful rectangles are those which sides have a numerical relationship with music. More popular was the one which sides are made using the golden section

The Pythagorean tradition was able to develop the most detailed and consistent mathematical basis for musical study, the philosophy being founded on a notion of universal (numerical) harmony. A famous legend tells us about Pythagoras' discovery of the mathematical basis of musical proportion. (...)

The Pythagoreans found that the speed of vibration and the size of the sound-producing body were the factors in music that were regulated by number.

An octave scale could then be expressed as varying methods of dividing the single string of this instrument, divisions that are described in terms of mathematical proportions.

Ratios are usually based on geometric sequence. The one who created a system of architecture that relied on ratios like 2: 1 and 3: 1, just like Alberti relied on those ratios in music. He was using the idea given by Timaeus of Plato who said " what is pleasing to the ear should be pleasing to the eye". In music, harmony is conceived and perceived as a pleasant unification of different sounds. Alberti refers to the number 1, 2, 3, 4 to establish the harmonious intervals of 2: 3 (fifth) 3: 4 (fourth), 1: 2 (octave) among others. Harmonic musical intervals could be expressed as pure mathematical ratios and thus could be applied to geometry. The octave falls in the harmonic form of the structure of tonality. There is a coincidental link between physical dimensions and harmonious sounds. The sound of the taut string divided in the middle corresponds exactly to the distance of an octave in the ear is able to discern with amazing precision, its accuracy of its deviation. There is a great temptation to relate these measures to vision. The words of Alberti are in strict proportion to musical analogy and nobody will dispute their quality. Inspired by the mathematical order and beauty found in nature, Alberti set out rules of distance, dimension and proportion.

Aesthetics and beauty were closely tied in mathematics. As all sciences and arts were assumed to have departed from mathematics, musical harmonies were determined by mathematical calculation. Alberti then applied the harmonic proportions used in the music of the time to the designing of his buildings resulting in proper balance and harmony with the environment

Palladio used mathematical tools as devices to aid his designs: concepts such as symmetry and proportion are key to understanding Palladio's architecture. It is generally accepted that the theory and practice of applying musical proportions to architecture during the Renaissance was a way of endowing the building with cosmic harmony.

In addition to using harmonic proportions in planning, Palladio also proposed several methods to be used when determining the height of rooms so that they are in proper proportion with the width and length. The height of rooms with flat ceilings would be equal to their width. The height of square rooms with vaulted ceilings would be one third greater than their width.

In architecture, geometry plays a role as quantitative control of the buildings harmony, so that the lack of it would make the building was vague and did not clearly defined.

Another system based on numbers is golden ratio. Golden Number is very close to a rate 5: 8 is the one used by Le Corbusier. His theories based on of the eleven-century mathematical Fibonacci, takes the credit for reducing the Golden Number to rational numbers applicable to architecture. The Modulor is a geometrical proportioning grid based on the human form. He

created a system of architecture based on the ratios 2: 1 and 3: 1 suggested by the Timaeus of Plato in ancient Greece and based on musical scale. Same from the challenge of positioning the human form within three inter connected squares, The challenge came in the placement of the third square. Le Corbusier solved the problem by using the relationship of ϕ and the introduction of a right angle. But the Modular was not very successful until now. c

Stability, harmony and dynamics have become key issues. The problem now was to find some rule that would allow to base the building on the surface. The idea of Golden Section was born. It is all about maintaining the proportions between the sides of a rectangle. Golden ratio was achieved by dividing a line into two parts so that the total length divided by a longer side's length is equal to a long side's length divided by short side's length. Many building have been based on this rule. The adaptation of this rule has been adapted in circular facades of the building.

Architecture in itself was purely mathematical and precise. It was commonly beveled that beauty was somehow linked to numbers (mathematics) - as Plato stated. Architects perceived architecture as mathematics translated into spacial units. A similar idea was developed by Greeks when they thought that music is geometry translated into sound. For architects a sense of balance is assumed to be based on visual appreciation and sight, symmetry is the most obvious known form of that balance.

symmetry can be spotted in geometric figures, in nature among plants and animals, even in the spacing of organs in the body, in construction, art,

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crafting, basically everywhere, because symmetry is a structural necessity of organisms. By using symmetry in architecture, weight can be properly spaced on more solid things with supports. In Greek art every part is a whole in itself, but at the same time is a part of something bigger, it is a rule of multiplicity in unity. Because of that even ruins of Ancient Greek seem beautiful to us. Beauty of architecture is measured by balanced, mathematically calculated proportions. Palladio thought that symmetry is necessary for harmony. In axial symmetry it is common to avoid the centre of the building. Until 18th century this type of symmetry was used only in religious constructions. Later it started to become more common to use axial symmetry in other places like houses and factories.

A symmetry can also be noticed in Gothic. Gothic Architecture mathematics is present in different ways. One of them is one of many ways of achieving the effect the architect desires, other times it can be a rule of the work and beauty. Mathematics as the 1st way appears in architecture as every kind of calculating that enables the building to be stable and strong. From the point of view of a casual person, those calculations are not important at all. They belong to the technical aspect of the object, which the author cares about. The thing that matters for the public is how it looks in the end, no matter how it was achieved.

To fulfill the aesthetic requirement of design throughout the history of architecture a system of proportion has been implemented and used. Key principles in this system were to make sure that key ratio is maintained throughout the design, the building must be able to be easily divided into

different parts and it had to be adaptable to architect's technical means.

Many known architects have been developing that system throughout the history of architecture and those were Vitruvius, Alberti and Le Corbusier.

Symmetry in gothic architecture was seen as a good way of solving projection. In elevations it was seen as an analogy to natural objects. In the projection of the building usually there is a single-axis symmetry.

Appearance of another symmetry axis is more of a later occurrence, less common and usually connected with sacred buildings and by that with symbolics. A good example are churches with cross projection. Architecture of the church, being the image of Jerusalem, is also the image of the universe, because it replicates its mathematical structure. Geometrical module ruling the proportions of gothic cathedral is the reflection of Gods order, because he created the world by using weight, numbers and measurement. The God himself is sometimes described as the Great Architect of the Universe. Number is the leading archetype of the universe. By using the number everything was created.