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The Golden Ratio: The Building Blocks of Architecture and Art

The Golden Ratio, also known as the Golden Section or the Divine Section, has been a phenomenon stunning intellectuals in a variety of fields for many centuries. The Ancient Greeks first studied the ratio, but it continues to be studied today. The ratio is used as a balancing technique and in this way is able to make certain designs or pieces of art seem more eye-catching. This ratio is a part of mathematics famous for influencing architecture and various aspects of art.

The Golden Ratio can be defined in two different ways: numerically and geometrically. Stated numerically, if we were to take the numbers in the Fibonacci Series (0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, ..) and divide the first number by the one preceding it, then we will find that the number we are descending towards is 1.618…, also known as Phi (Cox, 1997). This is the Golden Ratio. Similarly, by the geometric definition, if we use the same number in the Fibonacci Series creating squares by finding the longer side and adding another square to that side. The dimensions would start with 1x1 and go on to 2x1, 3x2, 5x3, 8x5, 13x8 and so on (examples are shown in appendix). A Golden Rectangle is formed from this definition (contained by proportions of the Fibonacci Sequence) (Cox, 1997). The Golden Rectangle is known as being the most pleasing shapes and proportions in all of geometry. Many examples are found in art masterpieces, such as Da Vinci's *Mona Lisa* and ancient architecture constructed by the Greeks. Besides the Golden Rectangle, other geometric shapes can be

created by using the Golden Ratio in the same way. An example of this is the pentagon. This is constructed by applying Fibonacci's Sequence to the line segments (see appendix).

The Golden Ratio has many applications in the "real world" but is especially found in architecture. Much of the architecture of the ancient world employed this tool in order to make their buildings better and more pleasing to the eye in general. For example, the Golden Ratio is found in the structuring of the Great Pyramid of Giza (Nathe & Hobgood, n.d.). The civilization though that applied this technique to the fullest was the Ancient Greeks. They were aware of the "aesthetic effects" that the ratio attached to the architecture. A famous example of this was in the Greek Parthenon stationed in the Acropolis in Athens. The Parthenon was built by Phidias and two other architects who used the idea of the Golden Ratio (the Golden Ratio is also known as Phi which was named after Phidias) (Nathe & Hobgood, n.d.). Starting from the outside of the building, the measurements of the front wall represent the Golden Ratio (Obara, n.d.). This is shown in appendix. Besides this, the Golden Ratio is also found in the interior of the Parthenon (Nathe & Hobgood, n.d.). Other buildings that appear to use the Golden Ratio are but are not limited to: the Notre Dame in France, the UN Building, and the CN Tower.

Besides architecture, the Golden Ratio is also found in many famous works of art. Leonardo Da Vinvi called the Golden Ratio the "divine proportion" and highlighted it in many of his works, especially when it came to body parts. Examples of this use of the Golden Ratio is found in his two drawings *An Old Man* and *The Vetruvian Man"(The Man in Action),"* as well as in his painting *Mona Lisa* (Nathe & Hobgood, n.d.). As seen in the appendix, these works of art

employ the technique of the Golden Ratio in terms of its' geometric definition. Da Vinci used the ratio when focusing on the body parts, such as Mona Lisa's eyes or the old man's facial features in *An Old Man*. Other artists that used the Golden Ratio in their work were Michelangelo, Raphael, and Rembrandt. Michelangelo created a pentagram when applying the Golden Ratio to his painting, *Holy Family.* In Raphael's *Crucifxition,* he uses a pentagram and a triangle (Cox, 1997). Rembrandt's self portrait creates a triangle when using the Golden Ratio.

The use of the Golden Ratio suggests a very interesting point when thinking about the way artists and architects create their works of art: they must understand mathematics in order to create something that is visually pleasing. This is obvious when it comes to architecture because it is a field that includes various measurements and mathematical data. However, when one thinks of art and artists, they usually don't think that any sort of math is involved, just the creative mind. In this way, it seems that with art, there is much more detail that is put into the work than meets the eye.

Bibliography

Cox, F. (1997). *The Golden Ratio.* Retrieved September 14, 2009, from <http://www.geom.uiuc.edu/~demo5337>.

Nathe, C., & Hobgood, K. (n.d.). *In order to better understand the Golden Ratio, it is helpful to have anunderstanding of the mathematical term proportion*. Retrieved September 14, 2009,from <http://jwilson.coe.uga.edu/EMAT6680Fa06/Hobgood/Kate_files/Golden20Ratio/GR2Arch.html>.

Obara, S. (n.d.). *Golden Ratio in Art and Architecture*. Retrieved September 14, 2009, from <http://jwilson.coe.uga.edu/EMT668/EMAT6680.2000/Obara/Emat6690/Golden%20Raio/golden.html>.

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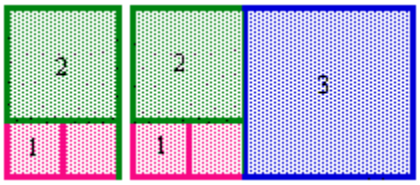
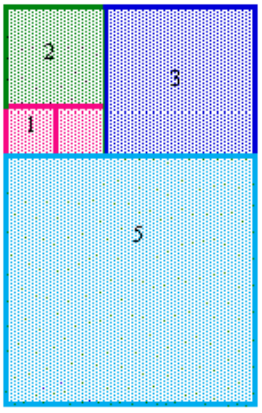
Appendix

1. Examples using the Fibonacci Sequence to understand the geometrical definition of the Golden Ratio

1x1, 2x1

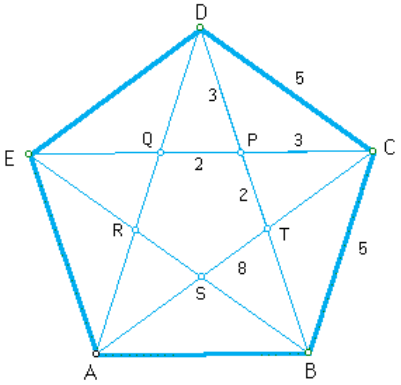


3x2, 5x3



8x5

2. Using Fibonacci's to form a pentagon



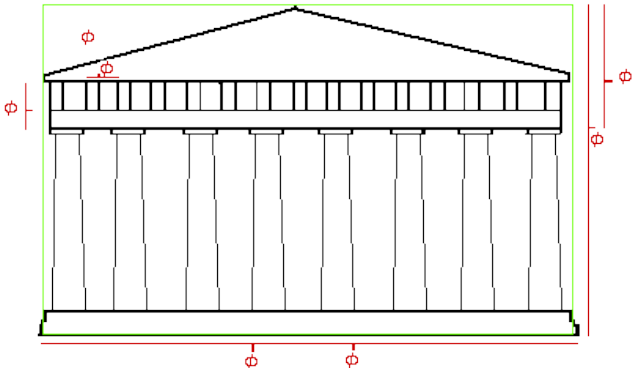
Length(Segment CA)/Length(Segment CB) = 1.618

Length(Segment PD)/Length(Segment PT) = 1.618

Length(Segment CB)/Length(Segment PC) = 1.618

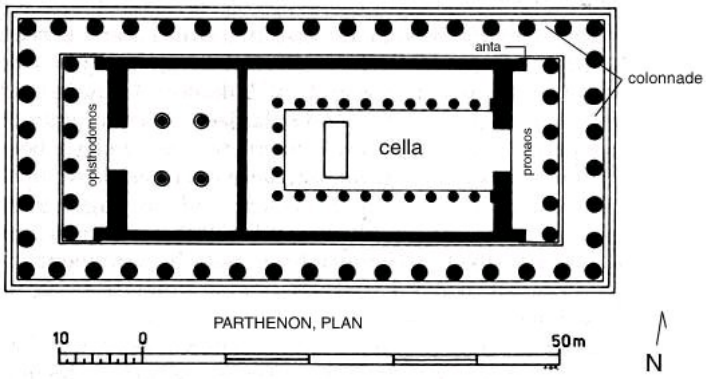
3. Parthenon and the Golden Ratio

The following diagram may provide a more clear representation of the golden ratio in the façade of the Parthenon:



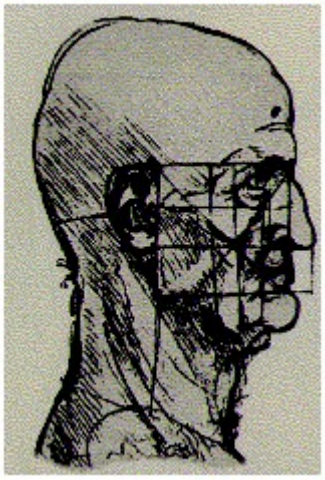
In the above figure, one can see the use of a golden rectangle that is Phi times as wide as the height of the structure.

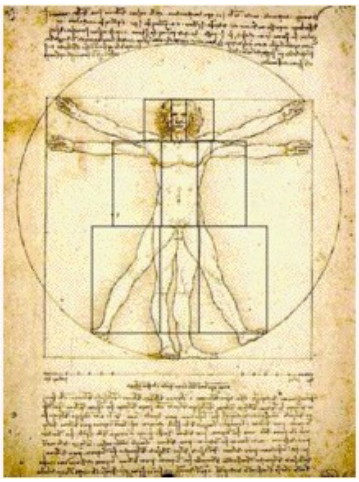
The golden ratio can also be found throughout the floor plan of the Parthenon:



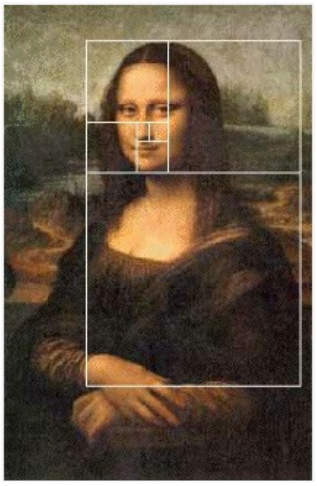
The floor plan area is a $\sqrt{5}$ rectangle: the length is $\sqrt{5}$ times as long as the width of the ancient temple.

4. Da Vinci's use of the Golden Ratio





An Old Man *The Vetruvian Man"(The Man in Action)"*


Mona Lisa

5.


Holy Family by Michelangelo


Crucifixion by Raphael

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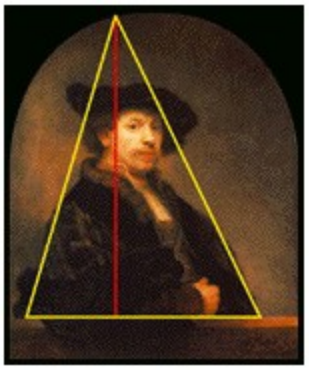
Self-portrait by Rembrandt