Winter 2014

What's Art Got to Do With Math?

Eric L. Mann
Hope College, mann@hope.edu

Eric L. Mann
Hope College
mann@hope.edu

What's Art Got to Do With Math?

The more I thought about that question the more difficult it became to separate the two subjects. In some ways math can be viewed as an art form à la George Pólya's seminal work, *The Art of Problem Solving*, or the beauty of the mathematics of the ancient Greeks constructed with just a straight edge and a compass. Or we could consider the concepts of ratio, proportion, perspective, and symmetry found in mathematics, art, or the work of a talented engineer. One might argue that mathematics and art require creativity and a willingness to ask questions, explore answers, experiment with new methods of expression, and take risks. In this issue's feature article, *The Silent A*, Ken Smith makes a strong case for the linkage of art and mathematics throughout history. We have only a brief opportunity to explore the many possibilities in this column so let's begin with one of the more well-known connections.

I remember my middle school art teacher telling us about the golden ratio and its close cousin, the golden rectangle. While Wolfram's MathWorld[1] suggests that the appearance of the golden ratio may be exaggerated in the literature, it is difficult to deny the frequent recurrence of this ratio or the aesthetically pleasing outcomes when it is applied. As a quick reminder, or a brief introduction, consider the following from Gary Meisner's blog.[2]

Suppose you were asked to take a string and cut it. Each chosen cut would result in different ratios for the length of the small piece to the large piece, and of the large piece to the entire string. There is one unique point, however, at which the ratio of the large piece to the small piece is exactly the same as the ratio of the whole string to the large piece, and at this point this Golden Ratio of both is 1.618 to 1, or Phi (Φ).

The ratio is not just 1.618 but, like another well-known ratio Pi (π), it is an irrational number: $\Phi = 1.618033\ldots$ One might wonder, why pick such a number to represent the "perfect" proportion in a rectangle or any other visual image? For me the answer lies in the Fibbonanci sequence.

Fibbonacci (Leonardo Pisano Bigollo c. 1170 – 1250) is probably best known for the sequence of numbers that carries his name: 1, 1, 2, 3, 5, 8, 13, 21, 34,…with each number in the sequence found by adding the two numbers before it 2+1=3, 2+3=5, etc). The story goes that he discovered this pattern by solving a problem in a mathematical competition common in his day. The problem was "beginning with a single pair of rabbits, if every month each productive pair bears a new pair, which becomes productive when they become a month old, how many rabbits will there be after n months?" But the story does not end there.

The Fibbonacci sequence has been called nature's numbering system with occurrences found in the arrangements of leaves on plants, the scales on a pinecone or pineapple, or the spirals of a nautilus shell. You may also recall the spiral created by drawing successive squares with side lengths using the values in the sequence. One can find numerous images with the spiral overlaid in nature and art (try searching on the Internet for images of the Fibbonacci sequence and Hurricane Sandy, the Milky Way, or the Mona Lisa).

Is there a connection between the Fibbonacci numbers, and the golden ratio, a fundamental relationship in design? When you begin to look at the ratios between each successive term in the sequence something interesting appears: 5:3 = 1.666…, 8:3 = 1.625…, 34:21 = 1.619…, 610:377 =1.618037…, 987/610 = 1.618032. As the sequence grows the ratio between the n^{th} and $n\text{-}1^{th}$ approaches the value of Φ, the Golden Ratio.

Is there a connection between art and math? I offer a poem by Benjamin Moon for you to consider as you ponder the question for yourself. **THP**

Golden

One one two, three five eight
Sounds so simple, nothing great
Thirteen, twenty-one, thirty-four
The hinges creak on an opening door
A repeating pattern of the masters hand
Signing his work, the universal plan
Learn to look, the pattern's plain to see
In the smile you flash, the dance of the honeybee
In the spirals of the pine cone and little acorn cap
In spiral arm galaxies and the ocean's wave whitecap
In the swirl of the seashell, the air vortex of a wing
The hurricane's eye and a thousand unseen things
Welcome to the mystery of the Greek letter phi
The measurement of beauty to the human eye
The golden ratio, one point six one eight
One, One, Two; Three, Five Eight[5]

References

1 http://mathworld.wolfram.com/GoldenRatio.html
2 http://www.goldennumber.net/golden-ratio/