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Discrete- Geometry Portfolio

Academic 1

Fibonacci’s Sequence: The Ties between Mathematics, Art, and Nature

Fibonacci’s sequence, a pattern of numbers used to solve algebraic equations has become more important and is used more than ever imagined. The sequence can be used to model and describe amazing phenomena in mathematics as well as nature, art, and science. The mathematical ideas lead to the golden ratio, spirals, and self-similar curves. These have been greatly appreciated for centuries, and are echoed in nature and art.

In Pisa, Italy in 1202, Leonardo Pisano Bigollo was a young man in his twenties, and a member of an important trading family of Pisa. While traveling throughout the Middle East, he was captivated by the mathematical ideas that had come west from India through the Arabic countries. In Pisa, he published these ideas in a book on mathematics called Liber Abaci (Bleyer, 2006, p. 710). Leonardo, who has since became known as Fibonacci, is one of the most celebrated mathematician of the Middle Ages. His book was a discourse on mathematical methods in commerce (Bleyer, 2006, p. 710).

Fibonacci brought to Europe the Hindu system for writing numbers. European tradesmen and scholars were still using of the old Roman numerals. Modern mathematics would have been impossible without this change to the Hindu system (Reich, 2012). The Hindu system is now called Arabic notation, since it came west through Arabic lands. The Liber Abaci contains a famous problem about rabbits, and the solution to this problem is now called Fibonacci’s sequence. The question he posed was: “If a pair of rabbits is placed in an enclosed area, how many rabbits will be born there if we assume that every month a pair of rabbits produces another pair, and that rabbits begin to bear young two months after their birth?” (Reich, 2012). Besides the Liber Abaci, Leonardo did not write further about it.

The sequence begins with the number 1 and 1 again, and each next number is obtained by adding the two preceding numbers together (Bleyer, 2006, p. 710). Fibonacci’s sequence is fascinating because it has been rediscovered in a variety of forms, far beyond mathematics. The appearances of Fibonacci’s numbers, and their ratios are common in nature and art displaying theories of beauty and proportion. The Fibonacci numbers are nature's numbering system (Parveen, 2014). They appear everywhere in nature, from the leaf arrangement in plants, to the pattern of the pedals on a flower, the bracts of a pinecone, or the scales of a pineapple. Fibonacci numbers are applicable to the growth of every living thing, including a single cell, a grain of wheat, a hive of bees, and even mankind (Parveen, 2014). Plants do this by growing in the most efficient ways.

Many plants show Fibonacci numbers in the arrangement of the leaves around the stem. Some pinecones also show the numbers, as well as daisies and sunflowers. Sunflowers can contain the number 89, or even 144 (Parveen, 2014). Some coniferous trees show these numbers in the bumps on their trunks and palm trees show the numbers in the rings on their trunks (Parveen, 2014). There are many instances of mathematical order involving the Fibonacci numbers themselves and the similar "Golden" elements in the natural world. In the case of tapered pinecones or pineapples, a double set of spirals are seen, one going in a clockwise direction and one in the opposite direction. When these spirals are counted, the two sets are found to be adjacent Fibonacci numbers. Sunflowers also have a Golden Spiral seed arrangement. This provides a biological advantage because it maximizes the number of seeds that can be packed into a seed head (Parveen, 2014). In art, Fibonacci’s sequence is used in spirals, proportional sections and numbers, based heavily off the patterns seen in nature.

Fibonacci’s sequence is all around us. It’s numbers and ratios create nature and art, with beauty and proportion. A question posed in 1202, has formed a method of amazing phenomena seen even in simple life and mankind. Leonardo Bigollo, who became known as Fibonacci, brought the modern Hindu numerical system to Europe. Without that the math we know today would not be possible. The seeming randomness of nature and its complexity is much more than meets the eye. Patterns and portion are intertwined with mathematics and beauty, and are all tied together in a sequence of numbers. What started with rabbits is constantly being rediscovered with endless possibilities of numbers and can be seen in a variety of forms and dimensions.

# Works Cited

Bleyer, C. (2006). *For All Practical Purposes (Seventh Edition) .* New York, NY: W.H. Freeman and Company.

Geo (Director). *Geometery: Is there a Connection between Mathmatics and Beauty in Art and Nature?* [Motion Picture].

Parveen, N. (2014). *Fibonacci in Nature*. Retrieved from http://jwilson.coe.uga.edu/emat6680/parveen/fib\_nature.htm

Reich, D. (2012). *THE FIBONACCI SEQUENCE, SPIRALS AND THE GOLDEN MEAN.* Philadelphia, PA: Temple University, Department of Mathmatics.