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Presentation Abstract

What is the Fibonacci sequence? The Fibonacci sequence is a series of numbers where the nth Fibonacci number is the sum of the previous two numbers. Through the Fibonacci sequence, mathematicians were able to derive the Golden Ratio aka Phi, which is 1.61. From the Golden Ratio, mathematicians were able to discover the golden Angle, which is equivalent to 137.5. From that Mathematicians also discovered the golden rectangles where they were able to draw a spiral through the rectangles and discover the golden spiral. All in all, the Fibonacci Sequence follow a simple concept but a lot more comes out of this sequence of numbers than meets the eye.

While these numbers are no coincidence, they can be applied in different ways. In fact the Greek, used the Phi as a standard of beauty where most of their architecture and statues follow this ratio. On an even grander scale, these numerical values are commonly exhibited in nature. Simply they can be described as having two seedpods, five flower petals, or eight pups in a litter. More complexly, the Fibonacci sequence's appearance in nature can be described to resemble or reflect the Golden Ratio or Golden spiral. What's fascinating is that although many things in nature adhere to the Fibonacci sequence in design, this is called phyllotaxy, some exhibit symmetry while some have no symmetry at all.

Lets take the artichoke for example. Looking at it from top-down, each new petal on an artichoke is located 137.5 degrees in respect to the previous petal and so on. So, tracing the leaves of the artichoke will create a spiral path matching the Golden spiral. As for symmetry, the artichoke exhibits no mirror planes but because of the orientation of the petals, it will exhibit a rotational symmetry axis of C to the nth Fibonacci number. Furthermore, something fascinating about the artichoke is that objects exhibiting this numerical sequence will appear as if they are turning inside out when being rotated at a high enough speed.

Additionally, cauliflowers are another great example of a vegetable exhibiting the Fibonacci sequence. On a cauliflower I analyzed, I noticed that there was five spirals rotate around the cauliflower where each new piece was located 137.5 degrees from the previous piece. Similar to the artichoke, the cauliflower only has one rotational axis through the center giving it a C5 symmetry. This is because flower blooms on the cauliflower are growing in size while spiraling around the cauliflower not allowing for any mirror symmetry. Unless they were organized in a rings and growing bigger row by row, then there would be some mirror symmetry. Furthermore, there is a type of broccoli called the Romanesco that is green and spikey, often resembling a cauliflower. The Romanesco is often dubbed the Fibonacci Cauliflower where it also resembles the same spiral pattern of a normal cauliflower.

Moreover, the Fibonacci Cauliflower and the Fibonacci sequence was the basis for one professor’s interest. Professor John Edmark, a mechanical engineering professor at Stanford University inspired by the Fibonacci sequence and phi, designed a series of sculptures that exhibit the Fibonacci sequence. Looking at some of his sculptures

designed for rotation, they all exhibit a rotational axis to the nth Fibonacci number. However, his piece called the ‘Fibonacci Tiling’ exhibits no form of symmetry even though it follows the Fibonacci sequence and has the proper number or spirals placed at 137.5 degrees.

All in all, most objects in nature exhibit the Fibonacci sequence and some form of symmetry, not every object has symmetry. Scientists do not know the reason why nature tends to develop in this pattern however it’s something fascinating to observe and appreciate in our daily lives.