

Life is a Fractal Abstraction

Jules Ruis, August 2010

When one sets his or her sight to the majestic beauty of nature, it is immediately obvious that the world we live in is not composed of simple and rigid geometrical shapes and forms. Rather, the natural world is a chaotic display of endlessly diverse and sporadic fragmented figures, holding to no fixed mathematical formula or law. Before the late 1800s, mathematicians tried earnestly to wash their hands of the unpredictable chaos that they saw running rampantly throughout the universe. Desperate measures were made to tame the rebellious ways of this intangible reality, but to no avail. Mathematicians finally gave the reigns to chaos, not because they lost hope but because they realized that chaos would lead them to the Holy Grail of mathematical theory they so desperately sought. This epiphany came to them in the late 1800s and was embraced in the 1960's by mathematician Benoit Mandelbrot. Mandelbrot discovered a simple mathematical formula that could be plugged into a computer and literally looped and multiplied infinitely, thus creating a multi-dimensional image consisting of self-similar duplications of itself which is known today as Fractal Geometry. Nothing seems more random and chaotic than fractals, yet they evoke a sense of order and holistic unity rarely seen in nature by the naked eye. What is compelling about Fractal Geometry is not only the aesthetic beauty of the images it creates, but also its universal application. In the book 'Exploring Chaos', Mandelbrot says, "Fractal Geometry plays two roles. It is the geometry of deterministic chaos and it can also describe geometry of mountains, clouds, and galaxies." Although it is not widely known, the basic traits of a fractal can be applied to all aspects of life, because life exists in the form of a fractal abstraction.

Fractal images create nearly the same amount of awe in human beings as nature itself, yet the connection and similarity between the two is rarely seen. But despite human ignorance, the connection remains. The comforts of modern civilization are forged in simple and linear geometrical shapes and angles, but the natural world maintains its anarchic unruliness. As Mandelbrot said in his book, "Clouds are not spheres, mountains are not cones, coastlines are not circles, and bark is not smooth, nor does lightning travel in a straight line." Fractal geometry not only testifies to this but can actually reproduce fractal images of trees, mountains, and other natural landscapes, through simple computer calculations. The fact that nature is composed of irregular patterns is not enough to conclude that it is truly fractal, but the fact that all these patterns contain a self-similarity that can be observed at any level, from the microcosmic scale to cosmological scale leads further to this conclusion. Zoom into the edge of a river and it branches out into streams, which branch out into smaller waterways down into the tiny cracks and crevices in the ground, barely visible to the naked eye. A tree has limbs that extend into branches, which extend into twigs. This self-similar pattern is also apparent in veins, lungs, and even electricity. But of all the fractals present in nature, there is one that is found to be most intriguing: the mammalian brain.

It is from the Human brain, which the mathematical formula that represents fractals arose, as well as all that we have created which reflects this intrinsic property. Since the beginning of recorded history, humans have created elaborate and complex visual works of art that emphasize a holistic pattern of self-similarity. In various branches of Buddhism, Buddhists create intricately detailed paintings called Mandalas, which are used in meditation and said to represent the structure of the universe. Much of African art depicts a fractal-like nature. "While fractal geometry is often used in high-tech science, its patterns are surprisingly common in traditional African designs," said Ron Eglash, senior lecturer in comparative studies in the humanities and author of African Fractals: Modern Computing and Indigenous Design. Fractals are a mesmerizing visual art in themselves and are often incorporated into many computer graphics, which has become the latest form of artistic ingenuity.

Another form of art that holds this fractal like self-similarity is music. What distinguishes music from indiscernible noise is its rhythmic patterns consisting of complex pitches and tones, evoking a sense of familiarity in the listener. There tends to be a reoccurring theme that is constantly reiterated throughout the musical composition. What bears compelling evidence to the notion that music is fractal is the fact that a fractal image can be run through a specific computer program and each mathematical coordinate of the fractal can be transferred into sound, creating what is unmistakably a musical composition, slightly reminiscent of new age or electronic music. What is even more intriguing is that the geometrical configurations of DNA, or any other biological structure can be plugged into this same basic program and converted into a musical composition.

Within the spectrum of nature and the human representations of nature, there is an overall constant theme of self-similarity. If this theme were to begin in mathematics and end in science or even in nature world itself, Fractal Geometry would be seen as another mathematical concept amongst Calculus and Euclidean Geometry. But the phenomenon of Fractals stretches out into every branch of human expression and knowledge and leads all of it right back to what it has been created to represent: the beautiful balance between chaos and order within in all that makes up our world, our knowledge of our world, and ourselves.