

Benoit Mandelbrot, the “Father” of Fractals

Imagine being a person who invents a new branch of mathematics in the 1980's. I mean, scholars probably thought that all branches of mathematics had been found, and now all we need to do is “clean up” the last few theorems. But the cover of Scientific American in August, 1985 changed all of that. I can remember seeing it on a magazine shelf and reading about the “picture” of a set of numbers. This confused me and I purchased the magazine to read about it. The cover featured an image created by Heinz-Otto Peitgen, called the “Mandelbrot Set”.

The Mandelbrot set is a set M made up to complex quadratic polynomials defined by:

$$P_c : z \rightarrow z^2 + c$$

This is a recursive sequence where each point “ z ” on the complex plane is worked out from the point before it using the above formula. The sequence that is generated can have four things that happen to it:

- (1) the sequence goes very slowly to infinity
- (2) the sequence goes very quickly to infinity
- (3) the sequence becomes one number
- (4) the sequence jumps between two numbers

A rectangular grid is chosen and divided into 1000^{th} s of a part in both directions, and each of the 1 000 000 numbers that is formed is tested into the equation to see which of the four scenarios above it fits into. The number is colour coded as to which scenario it fits into and the resulting picture is a Fractal.

The image that results is self-similarity in that as we “zoom” into a part of the Fractal, we still see a similar type of picture happening.

Benoit Mandelbrot is a French American mathematician born, in Poland, Nov 20, 1924. He is a Sterling Professor at Yale University. He is also an IBM Fellow at the Thomas J. Watson Research Center and a Battelle Fellow at the Pacific Northwest National Laboratory. He was born in Poland, but was educated in France where his parents moved, 1936, when he was young.

His mother was a medical doctor and he was introduced to mathematics through two uncles. His father was a clothing trader. Mandelbrot received his Ph.D. in mathematics from University of Paris in 1952. From 1949 to 1957 he was a staff member at the Centre National de la Recherche Scientifique. During this time he spent a year working with John von Neumann at the Institute for Advanced Study in Princeton, New Jersey. In 1955 he married Aliette Kagan. In 1958 he moved to the Thomas J. Watson Research Center in Yorktown Heights, New York where he remained for thirty-two years.

From 1951 onward, Mandelbrot worked on problems in information theory, economics, and fluid dynamics. He noticed that two themes, fat tails and self-similar structure were a constant theme in these areas. In 1975, Mandelbrot coined the word “fractal” to describe the types of shapes he was observing. In 1982 he published his ideas in *The Fractal Geometry of Nature*. He retired from IBM in 1987 and joined the Yale Department of Mathematics. He retired again in 2005.

I urge my readers to go to http://en.wikipedia.org/wiki/Benoît_Mandelbrot for more information on Benoit Mandelbrot and the Mandelbrot set.