



## Fractalism

Architecture of the 21<sup>st</sup> Century  
By Douglas Boldt, AIA, 2008

### Modernism?

Having ventured eight years beyond the brink of a new century, are we still living in Architecture's Modern era? CGI, computer graphics, movies, video games, automobiles, and even athletic shoes suggest a new geometry creeping into popular design. Computer aided design and manufacturing processes have changed not only the way things are made, but what is made and how it looks. In a very brief span of time the rise of computers has radically transformed the practice of architecture.

During much of the 20<sup>th</sup> century the underlying geometry that defined the basic shapes of modern architecture was seldom questioned. The geometry of a building was taken for granted and that geometry was Euclidian: squares, rectangles, triangles, circles, rays, grids, cubes, spheres, cones, cylinders, etc. Since its discovery in the mid-1970s, fractal geometry, whether architects realized it or not, began to gradually to supplant Euclidian geometry as the guiding principle of contemporary architecture. With the turn of the century, Modern Architecture has become a historical style and Fractal Architecture has firmly taken root.

### Fractals in nature

The infinite variety of shapes and patterns of nature have always fascinated and inspired humans, but not until 1975 did the French born mathematician Mandelbrot coin the word *fractal* to describe natural geometry. Finding traditional Euclidian geometry unsuited to the task, Mandelbrot devised relatively simple algorithmic formulas to describe seemingly complex natural structures. "Clouds are not spheres, mountains are not cones, coastlines are not circles, bark is not smooth, nor does lightning travel in a straight line", said Mandelbrot.

Fractals are objects or patterns that are self-similar at successive scales in space or time. A mountain exposed to wind, rain and gravity over time causes it to erode into a series of ridges and valleys protruding outward and downward from the main ridge. Secondary ridges are interrupted at various angles by lesser ridges and valleys, thus the pattern repeats itself at decreasing scales until the material properties of its composition causes iteration to cease and a new fractal appears.

Popular exposure to fractals is generally limited to the colorful computer generated images of intricate, infinitely repeating mathematical functions, such as the Mandelbrot or Julia Sets. Repeated magnification of any portion of the image reveals that each segment is made up of smaller similar variations on the same theme. The popularity of these images has contributed to a common misconception: *A fractal must be self-similar at an infinite range of scales.* However, natural objects rarely if ever replicate themselves at infinite scales of size. If we accept Mandelbrot's theory that "Fractals are the geometry of nature", it follows that fractals may be infinite or finite.

### How is a building fractal?

A building that is fractal does not replicate itself at infinitely smaller scales, The shapes, volumes, and details of a fractal building may be finitely or singularly scaled. A fractal building may be based on a single iteration of a fundamental shape or the shape may re-iterate itself at smaller scales in the building's spaces or details. A fractal building may be an expression of motion and the forces that cause things to grow, erode, and mutate. A building could be fractal in its response to the movement of the sun, the contours or context of its site, or the rushing of wind and water over its surfaces. A fractal building might reflect the structure of a rock formation or the logic of a living organism (thus organic architecture is fractal, but fractal architecture is not limited to mimicking living organisms). It may be domed, vaulted, round, curved, faceted, or even straight and square, but not restricted to the rigid 90-degree angles that dominated Modern Architecture. Its shapes and patterns may be facsimiles or abstractions of things found in nature, or the natural processes that shape and reproduce them in endless variety.

### What's in a name?

Architects are very reluctant, understandably, to be pigeonholed or labeled. They learned hard lessons from the past having been boxed in by the harsh precepts of Modernism. But the architecture of our time will be named, either by us or by those that follow. I propose Fractal Architecture as a name that best describes the new architecture that is sprouting up around the world, encompassing elements of Sustainable, Organic, Green, Ecological, Leeds and Bio-Mimicry, movements that have risen out of necessity to help resuscitate our troubled planet. Fractal Architecture is not a rigid and static style, but a path of many branches leading to forms and realms as yet unimagined.

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