Painting by numbers: Fractal art produces pictures worth 1,000 equations

by Scott LaFee

Fractals are like metaphysical Legos, building blocks that connect the worlds of number and shape. But unlike the plastic toy bricks, you can't see fractals, which are essentially algorithms or mathematical rules. Instead, you see the patterns they produce, which are fundamentally distinctive, to say the least.

All fractal patterns share a few common traits.

FRACTAL ART - â€œWarm Glowâ€• is the product of a Mandelbrot set, perhaps the most famous fractal. Coloration is based upon how many times each pixel in the image was â€œvisitedâ€• during repeating equations. CNS Photo courtesy of Kerry Mitchell.

Each is self-similar. That is, the whole and the parts of the whole share a resemblance, regardless of scale. This rule isn't always obvious. Sometimes fractals can be self-similar only in a statistical sense.

Each is recursive: the underlying math repeats again and again.

Each evokes a sense of nature. Indeed, nature abounds with examples of fractals: branching rivers and blood vessels, swirling cloud systems, the repeating patterns of mountain ranges and the rocks that comprise them.

People have long looked at these patterns and been fascinated, but it was not until the 1960s, when computers became sufficiently powerful, that mathematicians, scientists and engineers began to create and investigate fractals in their infinite detail.

It's been a fruitful endeavor. Fractal science allows researchers to perceive order in apparent disorder. Fractal concepts have been used to analyze the distribution of galaxies in the universe, the frequencies of economic cycle indices and the probabilities of earthquakes and wildfires.

Along the way, fractals became art as well. Early efforts were colorful but relatively crude: a psychedelic paisley of spikes, spirals and zigzags. Today's art, like the math, has progressed. Powerful off-the-shelf software programs can now create remarkably exquisite fractal images on home computers.

Many employ a basic technique: Every pixel or point on the screen is assigned a unique number. Each number is inserted into a mathematical formula to produce a result. Each result is reinserted into the same formula to produce a new result. This is done again and again, a process called iteration. Pixels are then colored based on the mathematical results, whether numbers got bigger or smaller.

The computer, of course, is critical. A small fractal image may contain 300,000 points, with each point processed through a fractal formula 1,000 times. That's 300 million calculations. A poster-sized image could require 1 trillion calculations.

Massive number crunching doesn't guarantee a work of art. Indeed, fractal calculations often produce more white noise than mathematical masterpieces. That's where the artist comes in. To be successful, as these examples from some of today's finest fractal practitioners show, requires an understanding of both form and function.

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