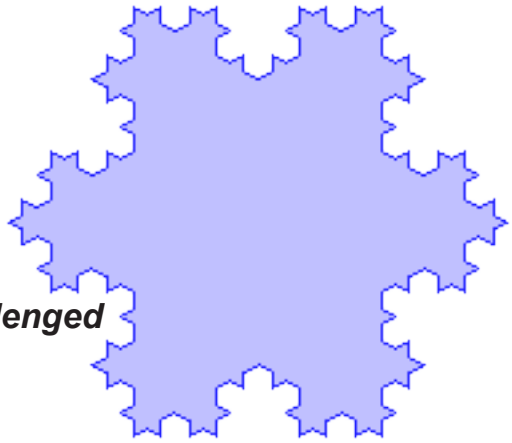
FRACTAL OR FAKE?



Novel art-authentication method is challenged

By Julie J. Rehmeyer

Jackson Pollock couldn't possibly have been thinking of fractals when he started flinging and dripping paint from a stick onto canvas. After all, mathematicians didn't develop the idea of a fractal until a couple of decades later. But if one physicist is right, Pollock ended up painting fractals anyway. And that mathematical quality may explain why Pollock's seemingly chaotic streams of paint come together into an ordered, beautiful whole, and why the technique brought Pollock acclaim as a master of American abstract painting.

A fractal is a geometric structure in which the shapes at a large scale reflect the shapes at a small scale, forming an interlocking set of patterns that nest inside each other like Russian dolls. Approximations of fractal structures have been noticed throughout nature. For example, the overall crystal structure of a snowflake looks remarkably like the structure in a single arm. And the ridges of a mountain range jut into the sky, forming patterns similar to the crags thrusting out from a single peak.

In the same way, the web of large streaks of paint across a whole Pollock painting resembles the finer network covering a small section, Richard Taylor of the University of Oregon in Corvallis reported 8 years ago. He recently used these observations to investigate whether newly discovered paintings are really by Pollock,

and hence worth millions of dollars, or whether they're destined for a garage sale. He proposes that the fractal nature of the paintings illuminates what made Pollock a genius rather than a mere slinger of paint.

Sexy results indeed-to some researchers, too sexy. Two scientists at Case Western Reserve University in Cleveland say that Taylor is stretching the mathematics too far to get his results. No fractals are lurking within the Pollock paintings, they say.

When Katherine Jones-Smith made some doodles on a page-"pretty ugly" ones, she says-she found that they shared the qualities of a Pollock, according to an analysis that follows Taylor's approach. "Either Taylor is wrong, or Kate's drawings are worth $40 million," says Jones-Smith's collaborator Harsh Mathur. "We'd be happy either way."

The attack by Jones-Smith and Mathur has sparked debate within the field and prompted a defense by the father of fractals, Benoît Mandelbrot, a professor emeritus at Yale University. "I have extraordinary experience of these structures," Mandelbrot says. Drawing on that experience, "I do believe that Pollocks are fractal," he concludes.

Geometrical Fractals

ALTHOUGH IT WASN'T until 1975 that Mandelbrot developed the notion of a fractal, mathematicians were unknowingly stumbling upon fractals in the early 20th century. Helge von Koch, a Swedish mathematician, developed a curve that had some remarkable properties for calculus and was later recognized as a fractal. If you zoom in on any section of the curve, it looks precisely like the bigger section that contains it.

The Plus, as so often seems to be the case with fractals, the Koch curve is visually attractive, in a way that brings to mind objects from nature. When three sections of the Koch curve are put together into a rough circle, the pattern looks much like a snowflake.

Mandelbrot came upon fractals in 1961 when he was studying fluctuations in the cotton market. He noticed a surprising regularity: A plot of the seemingly random price variations over the course of a month looked just like a plot of the variations over a decade.

Soon, he was seeing such a pattern in remarkably many seemingly unrelated situations. The graph of the rise and fall of the Nile over a week resembled the graph over a century. The bumps and dips of the coast of Britain roughly resembled the irregular edge of a single cove. He dubbed objects with this pattern of self-similarity at different scales "fractal," from the Latin word for "broken" or "irregular."

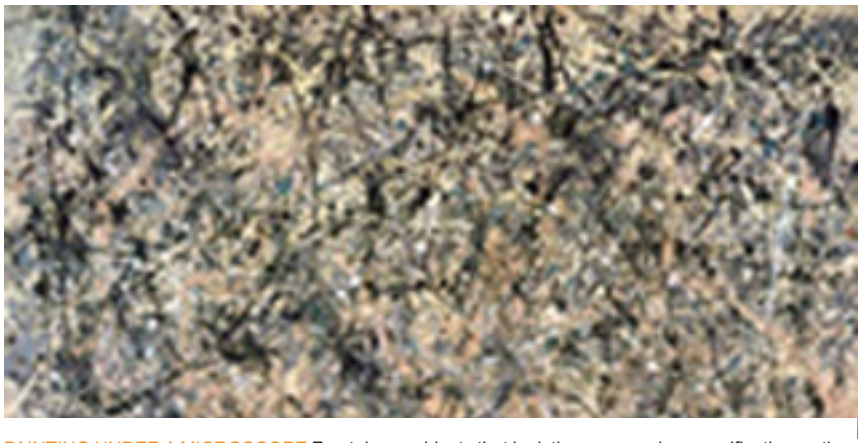
Years later, the combination of visual beauty and geometrical precision of many fractals attracted Taylor, who had long been torn between physics and art. Alongside his career in physics, he created abstract art, even leaving physics for a time to study painting at the Manchester School of Art in England.

During that period, Taylor studied Pollock's paintings. The chaotic streams of paint seem far from the orderly precision of a Koch curve, but whenever Taylor looked at a small section of a Pollock painting, it looked similar to the overall structure of the whole.

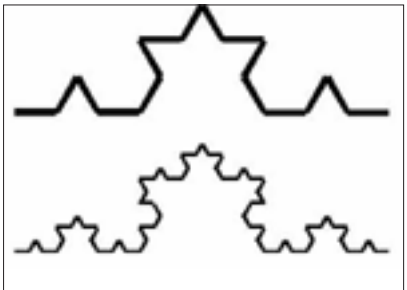
The paintings didn't show the perfect self-similarity of a geometrical fractal like the Koch curve, but natural objects never do. Nature tends to improvise, provide variations on a theme, rather than repeat patterns exactly. A mountain range doesn't have precisely the same shape as the crags on a single mountain, but the two are similar. Taylor saw the same kinds of similarities in the Pollock paintings.

Taylor thought that the observation might help explain particular qualities. "Pollock's paintings are frequently described as appearing 'organic' and 'natural,'" Taylor says. "Pollock himself said that 'My concerns are with the rhythms of nature' and that 'I am nature.'" Was it the fractal feature of Pollock's paintings that created that organic quality?

Taylor pursued his idea by computing a statistic called the "fractal dimension," which mathematicians had developed to understand some of fractals' odd qualities. Ordinary lines with no breadth are said to have one dimension,



PAINTING UNDER A MICROSCOPE Fractals are objects that look the same under magnification as they do as a whole. One researcher says that Jackson Pollock paintings have that property. *Pollock, Jackson, Number 1, 1950 (Lavender Mist), Ailsa Mellon Bruce Fund, image (c) Board of Trustees, National Gallery of Art, Washington.*



THE KOCH CURVE was one of the first fractals discovered. To create one, start with a line segment, and then replace the middle third with a triangle. Then repeat, replacing the middle third of the resulting line segments with a tinier triangle.