Jackson Pollock's art and fractal analysis

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Can mathematics explain the art of Jackson Pollock? Can it be used to authenticate paintings of uncertain provenance? Case Western Reserve University physicists address these questions in the current issue of *Nature*.

Case physics doctoral student Katherine Jones-Smith first encountered these questions in December 2004 when preparing for a weekly astrophysics seminar. Jones-Smith performed a Google search that linked her to research by University of Oregon physicist Richard Taylor and collaborators, who claim that Jackson Pollock's famous drip paintings, are fractals. Fractals are complex geometric shapes that have been studied by mathematicians since the 1970s.

In articles that appeared in scientific journals and news magazines including *Nature*, *Physics World* and *Scientific American*, Taylor and coworkers also claim that fractal analysis can be used to distinguish Pollock's drip paintings from imitations.

Intrigued, Jones-Smith began to examine Taylor's articles, but quickly found that the work was seriously flawed. She showed that doodles that she could make in minutes using Adobe Photoshop were as fractal as any Pollock drip painting, vividly refuting Taylor's claim that Pollock was able to generate fractals by hand only because he had attained a mastery of chaotic motion.

Jones-Smith presented a pointed critique of Taylor's work to Case astrophysicists and was encouraged to write up her critique for publication. But since Taylor's original work had appeared in *Nature* five years earlier, she thought interest in the topic had waned.

That changed this February when Taylor was invited by the Pollock-Krasner Foundation to determine the authenticity of paintings recently found by Alex Matter, son of the late photographer Herbert Matter. According to Matter, a close personal friend of Pollock's, the paintings are the work of Pollock, but Taylor used fractal analysis to pronounce them inauthentic.

Convinced now that her work might still be of interest, Jones-Smith developed her critique into the article, Revisiting Pollock's Drip Paintings, co-authored with Harsh Mathur, Case professor of physics.

A key element of the paper is a painting called Untitled 5 that Jones-Smith created in a matter of minutes in Photoshop. Untitled 5 depicts a field of stars and looks like the kind of drawing the proud mother of a three-year old might stick on a refrigerator door, says Jones-Smith. But, according to the fractal authentication criteria that Taylor has made public, it is an authentic Pollock.

Jones-Smith adds, "I found I can make paintings at will in Photoshop that meet all the criteria he has made public."

A defining feature of fractals is their self-similarity: They look the same if magnified. Sometimes the self-similarity is visible to the eye, as in the famous Koch snowflake, which is composed of a hierarchy of ever smaller equilateral triangles. More often the self-similarity is statistical and can be detected only by computer analysis using a technique called box-counting.

In their Nature article, Jones-Smith and Mathur show that Pollock's works lack the range of scales needed to be considered fractal in the sense of box-counting analysis. This is because typically the smallest marks of paint are only a thousand times smaller than the entire canvas.

The researchers show that considering Pollock's paintings to be fractal actually leads to mathematical contradictions and inconsistencies. "Not only does Taylor state Pollock's paintings are fractal," said Jones-Smith, "but he goes further and says such things as this is why Pollock is such a master - that he had mastered the language of nature."

The Case researchers' findings, particularly their painting Untitled 5, do not support this contention. Jones-Smith and Mathur also note that Taylor has analyzed only 17 out of more than 180 drip paintings made by Pollock. Aside from the other problems with his analysis, the Case physicists contend that 17 paintings are too small a sample to provide an adequate basis for some of Taylor's inferences.

Adding to the unfolding drama of this research is that while Jones-Smith was preparing for her December 2004 seminar, on the other side of campus- unbeknownst to the physicists- Ellen Landau, Case professor of art history, and one of the world's foremost experts on Pollock, was studying the paintings discovered by Alex Matter. Jones-Smith and Mathur learnt about Landau's work only this February by reading about it in a newspaper article. Immediately they contacted her to tell her about their research.

"Once Harsh contacted me, I collaborated with him and Kate, providing them with in-depth information on Jackson Pollock and his working methods useful to their project," said Landau. "I am pleased they have successfully refuted Richard Taylor's thesis and that it will be published in *Nature*. Irrespective of whatever determination is ultimately made on the authenticity of the recently found Matter paintings, fractal analysis should not be considered a foolproof technique for authenticating works by Pollock. The fact that Taylor has refused to fully share his testing criteria casts further doubt on the credibility of his claims."

Jones-Smith concurs, noting that the main implication of her work for the Matter paintings is that fractal analysis should not be part of the debate regarding their authenticity.

Source: Case Western Reserve University