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Democracy Dies in Darkness

Feuding physicists and the bitter battle over the swirls in 'The Starry Night'

A team of scientists sparked a heated debate over whether Vincent van Gogh's "The Starry Night" depicts turbulence, a complex physical phenomenon.

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By Carolyn Y. Johnson

On this, the scientists agree: Vincent van Gogh's masterful post impressionist painting "The Starry Night" is an iconic piece of art. Its mesmerizing whirls and swirls capture the imagination.

But do the flowing brushstrokes evoke the real physical phenomenon of turbulence? Was Van Gogh channeling the fluid mechanics that causes smoke from a chimney to chaotically curl or the eddies that form in fast-moving rivers when he painted the scene? There, a fierce debate begins.

In 2024, a team of scientists from China and France published a study in the journal Physics of Fluids that detected mathematical turbulence in the complex scaling of Van Gogh's brushstrokes. The paper added to a years-long discussion that had been ping-ponging back and forth through the rarefied pages of physics journals.

James Riley, a professor emeritus of mechanical engineering at the University of Washington, learned about the new 2024 claim of turbulence in the painting when his daughter texted him a news story about the paper.

"It seemed kind of strange," said Riley, who earned his graduate degree with Stanley Corrsin, a fluid mechanics expert who made major contributions to the understanding of turbulence. "I downloaded the paper, and I read it. And I just realized the paper was nonsense — just nonsense."

A trio of analyses have now appeared from Riley and a separate group of scientists, rebutting the 2024 paper — with a harsh edge not always typical of the staid tone of scientific writing.

The Vincent van Gogh oil-on-canvas painting “The Starry Night,” from June 1889. (VCG Wilson/Corbis/ Getty Images)

“The claims of the authors would normally be rejected out of hand by researchers in turbulent flows,” Riley and Mohamed Gad-el-Hak, a fluid mechanics expert at Virginia Commonwealth University, wrote in the Journal of Turbulence.

The dispute shows science in action. Contrary to the idea that science is a set of static facts in a textbook created by dispassionate experts, it’s a human process. There are findings and conclusions, but science itself is a method for interrogating the world, subject to the limitations of the techniques being used. Disagreements are common, knowledge is refined over time, and sometimes the protagonists become intemperate, annoyed, even jealous.

“I have published numerous articles over the past 30 years, but I have never encountered such animosity from colleagues (this is their third article criticizing us in such harsh terms!),” Francois Schmitt, a physicist at the French National Centre for Scientific Research and one of the authors of the 2024 paper, wrote in an email. “Disagreements are part of the scientific method and the academic world. Why so much aggression? Usually, if we disagree, we discuss it in a well-argued article, without aggression.”

Turbulent flow is chaotic. Despite the fact that it pops up in nature constantly, it is considered one of the hardest problems in physics. It links the motion of fluids over a wide range of sizes, from large-scale swirls to smaller ones.

To find turbulence in “The Starry Night” in their 2024 paper, Schmitt and colleagues began by analyzing the individual brushstrokes in each of the 14 night-sky vortexes that animate the painting. They found the brushstrokes followed a “scaling law” put forward in the 1940s by Andrey N. Kolmogorov, a Soviet mathematician, and extended upon by two scientists, including Corrsin, Riley’s graduate adviser.

Many news organizations, including The Washington Post, wrote about the paper — a rare intersection of a study that involves complicated atmospheric phenomena with something many can relate to. The level of publicity, Riley said, made it essential to try to correct the record.

One of the new rebuttal papers, published in the Bulletin of the American Meteorological Society, used similar techniques to analyze a different painting — “A Woman Seated beside a Vase of Flowers.” Those scientists found the same mathematical patterns in the Edgar Degas painting few people, if any, would describe as turbulent — emotionally or scientifically.

Just because a painting satisfies one mathematical criteria for turbulence, it isn't sufficient to declare it turbulence, those authors argued. "The painting does not look like any recognizable, naturally occurring atmospheric process, let alone a turbulent one," an anonymous reviewer wrote of "The Starry Night."

In a written statement, Yongxiang Huang of Xiamen University, an author of the 2024 paper, rejoined: "We must point out a critical distinction regarding the subject matter: flowers are not clouds. Finding a specific spectral result on a painted image of flowers has no bearing on our study of turbulent atmospheric flow patterns in clouds."

Riley argued in the Journal of Turbulence the entire analysis was a misapplication of the theory around turbulence. He said in an interview that he believed the 2024 paper should be retracted.

In the third paper, a commentary published in Physics of Fluids, scientists from both groups teamed up to argue the 2024 paper's conclusions are unfounded.

In a reply paper that hasn't been published, Huang and his team wrote: "We fully recognize that the painting is a work of art, not a scientific experiment. Our intention was never to undermine its artistic value, but rather to demonstrate that, through rigorous analysis-and contrary to previous claims in the academic literature, the Kolmogorov-Obukhov-Corrsin scaling law can indeed be observed, even if only across a restricted range of scales."

In so many ways, this fight does not matter to the average person gazing at “The Starry Night.” Van Gogh was an artist, not a mathematician trying to represent with oil paint a statistical theory that didn’t emerge until a half century after his death. But the matter may not be completely settled.

José Luis Aragón, a physicist at the National Autonomous University of Mexico who wrote a previous paper that found evidence of turbulence in “The Starry Night,” said in an email that he was persuaded by critiques of the 2024 paper because it “rests on a fundamental conceptual mistake: they treat a painting as if it possessed the physical reality of a fluid flow. By identifying and analyzing ‘eddies’ in a static image, they implicitly assume a physical system where none exists.”

But he noted that his own analysis found turbulence by examining the brightness of the brushstrokes, using it as an analogy for velocity. His paper examined fluctuations in changes in brightness between pixels.

“The luminance contain[s] statistical signatures reminiscent of turbulence,” Aragón said. “And that they therefore *transmit the essence of turbulent motion with striking realism.*”

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James Riley
Professor Emeritus of Mechanical Engineering at the University of Washington

What readers are saying

The comments reflect a mix of skepticism and appreciation for the debate over whether Vincent van Gogh intentionally captured turbulence in "The Starry Night." Many commenters argue that the painting should be appreciated as art without overanalyzing it through a scientific lens,... Show more

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