Splatter master Jackson Pollock avoided “coiling” when creating his paintings



Enlarge / Jackson Pollock working in his Long Island studio adjacent to his home in 1949.
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Famed abstract expressionist Jackson Pollock notoriously relied on non-traditional painting techniques to create his masterpieces. Physicists have pondered the presence of curls and coils in his work, and whether the artist deliberately exploited a well-known fluid dynamics effect to achieve them.

Now a recent paper in PLOS One is claiming the opposite: Pollock deliberately avoided so-called “coiling instabilities” as he worked.

For the last few years, Roberto Zenit, a physicist with the National Autonomous University of Mexico and Brown University, has been studying the physics of fluids at work in novel painting techniques like those used by Pollock and Mexican muralist David A. Siqueiros. Pollock, for instance, early on employed a “flying filament” or “flying catenary” technique before he perfected his dripping methods. The paint forms various viscous filaments, which are thrown against a vertical canvas. Zenit and several colleagues were able to recreate the fluid action by mounting a paint-filled brush on a rapidly rotating mechanical arm.

Pollock’s dripping technique involved laying a canvas flat on the floor and then pouring paint on top of it. Sometimes he poured it directly from a can, sometimes he used a stick, knife, or brush, and sometimes he used a syringe. The artist usually “rhythmically” moved around the canvas as he worked. His style has long fascinated physicists, such as the controversy surrounding the question of whether or not Pollock’s paintings show evidence of fractal patterns.

Most notably for this latest work, in 2011, Boston College physicist Andrzej Herczynski and Harvard mathematician Lakshminarayanan Mahadevan collaborated with art historian Claude Cernuschi on an article for *Physics Today* examining Pollock’s use of a “coiling instability” in his paintings. As Ars reported last year, this mathematically describes how a viscous fluid folds onto itself like a coiling rope—just like pouring cold maple syrup on pancakes.

The patterns that form depend on how thick the fluid is (its viscosity) and how fast it’s moving. Thick fluids form straight lines when being spread rapidly across a canvas, but they will form loops and squiggles and figure eights if poured

slowly. Herczynski *et al.* measured the thickness of lines and the radius of the coils in a Pollock painting showing this effect, and the team used that data to estimate the flow rate of the paint as the artist's hand moved across the canvas.

An intuitive physicist

According to Zenit, Pollock almost certainly relied heavily on physics as he painted, whether he did so deliberately or not. He liked to play with texture and viscosity when mixing his paints, often adding solvents to make them thicker or thinner. There's even 1950 video footage of Pollock at work, in which he asserts, "I can control the flow of paint. There is no accident." What's currently in question is whether or not the artist deliberately used coiling in his work.

- Schematic view of a small portion (lower right) of 'Number 14: Gray', by Jackson Pollock (1948).
  R. Zenit et al./PLOS One
- Schematic reproduction giving a side view of Pollock painting, while moving around the canvas.
  R. Zenit et al./PLOS One
- Schematic reproduction of Pollock painting over a transparent glass sheet.
  R. Zenit et al./PLOS One

From a fluid mechanics perspective, the artist's famous technique isn't really "dripping" at all, according to Zenit *et al*. That technical term "refers to the break up of a fluid jet onto drops, resulting from a surface tension instability," they wrote. "For the condition under which Pollock painted, the fluid filaments rarely fragmented while they were applied." The authors chose Pollock's "Number 14: Gray" to illustrate the technique, because it was painted with just one color (black enamel paint over gesso-covered paper), making it easier to track the various lines, which differ in thickness and shape.

First, Zenit *et al*. carefully analyzed video of Pollock working in his studio—taken from the 1950 footage shot by Hans Namuth—and then they measured how quickly he moved, as well as the distance from the canvas as he dropped the paint. Next the researchers built an apparatus to mimic those movements—essentially a big syringe mounted on an adjustable stand. "We can vary one thing at a time so we can decipher the key elements of the technique," Zenit said. "For example, we could vary the height from which the paint is poured and keep the speed constant to see how that changes things."

They found that the vast majority of Pollock's traces were produced because the artist actively avoided coiling instabilities, contradicting the 2011 conclusions of Herczynski *et al*. "Specifically, Pollock moved his hand at sufficient high speed, and at a low-enough height as to suppress the emergence of coiling. Like most painters, Jackson Pollock went through a long process of experimentation in order to perfect his technique," said Zenit. "What we were trying to do with this research is figure out what conclusions Pollock reached in order to execute his paintings the way he wanted. Our main finding in this paper was that Pollock's movements and the properties of his paints were such he avoided this coiling instability."

> *"Pollock's movements and the properties of his paints were such he avoided this coiling instability."*

That said, this is not the final word on the matter. Zenit *et al.* note that the low resolution of the video footage means there's uncertainty regarding the measurements they were able to make. Specifically, they were unable to get simultaneous height and hand speed measurements, and hence they were unable to correlate those two variables. While they used a paint similar to those used by Pollock (a commercial black cellulose Nitrate lacquer), the materials used by Pollock likely had a different composition and hence different degrees of viscosity and density. Also, Pollock did not typically hold the stick he

used to deposit paint vertically, often swinging it in wide arcs, although Zenit *et al*. determined this was not significant enough of an effect to alter their conclusions.

“This result could be of importance for authentication: a painting with too many coiled traces would indicate that the painting was not created by Pollock,” the authors concluded. “Furthermore, understanding the conditions for which the coiling instability can be prevented could have implications in practical applications where such an effect needs to be prevented, as in the case of ink-jet printing or the fabrication of optic fibers.”

DOI: *PLOS One*, 2019. 10.1371/journal.pone.0223706 (About DOIs).

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