The Scream' Is Fading. New Research Reveals Why.

The art world is increasingly turning to scientific analysis of pigments to find out how time has changed some famous paintings.

By Sophie Haigney

Feb. 7, 2020

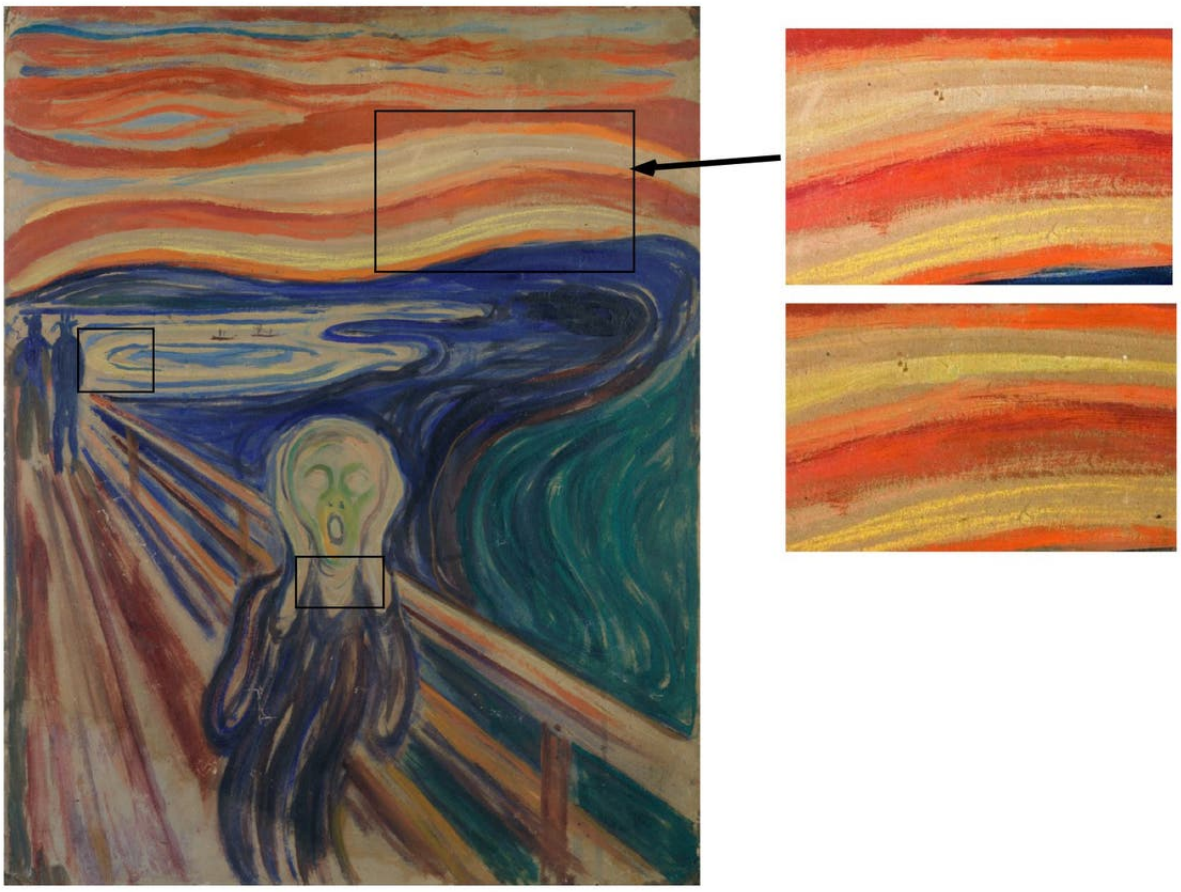
"The Scream" is fading. And tiny samples of paint from the 1910 version of Edvard Munch's famous image of angst have been under the X-ray, the laser beam and even a high-powered electron microscope, as scientists have used cutting-edge technology to try to figure out why portions of the canvas that were a brilliant orangeish-yellow are now an ivory white.

Since 2012, scientists based in New York and experts at the Munch Museum in Oslo have been working on this canvas — which was stolen in 2004 and recovered two years later — to tell a story of color. But the research also provides insight into Munch and how he worked, laying out a map for conservators to prevent further change, and helping viewers and art historians understand how one of the world's most widely recognized paintings might have originally looked.

The art world is increasingly turning to labs to understand how paintings from the late 19th and early 20th centuries are behaving. Vincent van Gogh's chrome yellows, some of which have started to brown, and his purples, some of which have turned blue, have been widely studied. But less is known about Munch's palette, and scientists, using updated technologies and tools like transmission electron microscopes, are breaking new ground.

Jennifer Mass, the president of the Scientific Analysis of Fine Art lab in Harlem, whose team is on "The Scream" research, explained the science recently in her lab. She pointed to a photograph of what looked like a set of stalagmites: It was the surface of "The Scream" seen under a microscope.

“This is really, really not what you want to be seeing,” she said. Nanocrystals are growing on the painting, held by the Munch Museum — stark evidence of the degradation near the central figure’s mouth, in the sky and in the water.



Details of the fading of Munch’s “The Scream,” from the Munch Museum, show the variation. Top right, a detail of the painting as it is today. Below right, a digital reconstruction of how it might have looked like. (The rectangles on the painting indicate areas with faded color.) Munch Museum

Conservators and researchers at the Munch Museum contacted Dr. Mass, who has been working as a fine art scientist since she was a postdoctoral fellow at the Metropolitan Museum of Art in 1995. She is also a professor at the Bard Graduate Center and has partnered with many major institutions in research.

Eva Storevik Tveit, paintings conservator at the Munch Museum, said the museum had sought out Dr. Mass because of her expertise in cadmium yellow, which she had studied in Matisse’s work, and because of the high-quality

scientific tools the lab has at its disposal. (One of Dr. Mass's colleagues, Adam Finnefrock, once took tiny samples of Cézanne's emerald green pigments to a particle accelerator at Stanford University.) And the museum, which moves to a new building later this year, needs to figure out how to best display the painting, balancing conservation concerns with viewing experience.

Munch's materials have now been more fully analyzed, and the research, due out this spring, fleshes out a more complete story about the painting. Dr. Mass's team was able to narrow down Munch's paint choices using his paint tubes, some 1,400 of which are held by the Munch Museum. Over time, with exposure, the yellow cadmium sulfide has oxidized into two white chemical compounds, cadmium sulfate and cadmium carbonate.

The analysis, Dr. Mass said, has implications for Impressionist through Expressionist paintings made between the 1880s and the 1920s painted with cadmium yellow, 20 percent of which she estimates are experiencing similar phenomena.

Dr. Mass and her team work with museums, private clients, auction houses, art fairs and artists on everything from large-scale contemporary outdoor sculpture in the Hamptons to ancient Roman sculpture. They are a part of a niche in the art world — boutique labs that operate outside of large institutions, though often in tandem with them — something that's become more common as the demand for scientific research has increased. Perhaps best known was James Martin's Orion Analytical, which was purchased by Sotheby's and became the first in-house lab of its kind at a major auction house.

Other such companies include Geneva Fine Art Analysis, based in Geneva's Free Port, and the London-based Art Analysis & Research. Often they are called in by collectors or potential buyers who are interested in questions of authenticity. "There's been a real explosion in the field," Nicholas Eastaugh, founder and chief scientist at Art Analysis & Research, said. "There are a lot more people coming in with new approaches, new ideas, and new insights."

Whether for conservation or authentication, the work often reveals something about an art object that the naked eye can't see — how old a painting really is, whether it contains drawings underneath its surface, or what factors in the environment might be causing it to deteriorate. This last question is particularly important when it comes to artists working in the same period as Munch, as research is just starting to illuminate the era.

"There tends to be an interest in the bigger-name artists, for obvious reasons," Dr. Eastaugh said. "But actually these are problems that will affect all artists of that period if they are using these materials." He said that more research would be helpful in showing "more general patterns" in the pigment degradation mechanism.

Van Gogh's "The Bedroom" (1889). Researchers have learned that many of van Gogh's blues were originally purples. Vincent van Gogh Foundation; Van Gogh Museum

A digital reconstruction of “The Bedroom” (1889). Vincent van Gogh Foundation; Van Gogh Museum

The colors of the late 19th century and early 20th century are fading especially rapidly because of changes that took place in paintmaking. Paints had been made by hand-grinding minerals extracted from the ground or using dyes made from plants and insects. The industrial revolution brought about the production of synthetic pigments like cadmium or chrome yellows, which artists would mix with oil and fillers. Artists began experimenting with these synthetic pigments, which were sometimes haphazardly prepared and untested for the purposes of longevity but were exceptionally bright — enabling the brilliant palettes of Fauvism, Post-Impressionism and modernism.

At that moment, many artists were abandoning traditional painting techniques, said Lena Stringari, deputy director and chief conservator of the Solomon R. Guggenheim Museum and Foundation, who has studied color change and

pigments in van Gogh's work. "Many artists were working in plein-air, and they were experimenting with various paints and color theories," she said. "There was this explosion of color with the rejection of the academy."

Jennifer Mass, president of the Scientific Analysis of Fine Art lab. Thomas Prior for The New York Times

That made the new pigments popular, Dr. Mass said, but they were unpredictable. "We can't say, 'Oh it's a tree, so we know that the foliage would be green,'" she explained, "because in the case of Matisse or Munch, that's not necessarily true, so we need to turn to science."

Recapturing these hues is impossible, but science can get us closer. Koen Janssens, a professor in the department of chemistry at the University of Antwerp who has studied the pigments of van Gogh, Matisse and others, said, "The idea is to try, in a sort of virtual way, to reverse time." Conservators wouldn't apply new pigments to a canvas — but digital reconstructions can gesture at the past. Dr. Mass predicts a shift toward augmented reality in reconstructions, so that you might hold up your phone to a painting and see its former color layered on the canvas.

It hasn't always been a totally easy marriage between physics, organic chemistry and the art world, said Kilian Anheuser, head scientist at Geneva Fine Art Analysis. "Until very recently, the art historian expert reigned supreme, and it was really the art historians who insisted on having the last word," he said. "And then in recent years we've had quite a number of forgery scandals where things have come to light through scientific investigation, and this has turned the tables a bit."

Ronald Varney, an independent fine art adviser, said: "There's probably a bit of resistance to the world of science in the art market. This is still a business that depends enormously on the expertise of individuals rather than machines."

The study of degradation may be increasingly important to buyers, he added, as "condition is something that's ferociously important now."

Research has certainly altered the way art historians see some of van Gogh's works. The Van Gogh Museum in Amsterdam and the Metropolitan Museum have mounted exhibitions in recent years highlighting his disappearing hues. Teio Meedendorp, an art historian and senior researcher at the Van Gogh

Museum, said: “It’s something we’ve really only realized in the last 10 years. Research that has focused specifically on the technical aspects has changed the way we think.”

Interestingly, van Gogh, among other artists, was aware of the pitfalls of the new pigments. “I’ve just checked — *all the colours that Impressionism has made fashionable are unstable*,” van Gogh wrote to his brother Theo, in 1888, “all the more reason boldly to use them too raw, time will only soften them too much.”

In a later letter, he wrote, “The paintings fade like flowers.”