Dorothy Snowden – STS 201 – Future Technology Project

Digital restoration of art

Introduction

An innovative collaboration between scientists and art historians will utilize Artificial Intelligence (AI) and 3-D technology in an effort to recreate a lost 19th century painting by the master of French Romanticism, Eugene Delacroix (1798 – 1863). The project, "Digital Delacroix," which was launched last summer, will merge science and the humanities to reveal the destroyed Delacroix painting "Peace Descending to Earth" (Rose, 2025).

The image was a commissioned mural located in the Hotel de Ville, once the City Hall of Paris. The 16th century building was burned to the ground in 1871 during "Bloody Week," a revolt of The Paris Commune against the French government in reaction to the embarrassing French defeat in the Prussian War (Macauley, 2025).

"La Philosophie, Socrate et son demon" is an example of a Delacroix mural. (Photo: Sorbonne University)

Through analysis of hundreds of archived sketches, prints, and paintings completed by the artist, AI will “learn” how Delacroix used color, brushstrokes, and designs to replicate the lost painting, which took Delacroix two years to complete. Considered the father of the Romanticism movement, Delacroix’s work emphasized feeling and content over the form and order of Classical compositions (Moore, 1993).

Hotel de Ville, Paris after burning during Blood Week. (PC: Smithsonian).

“Digital Delacroix” is one of the first projects funded through Schmidt Sciences’ Humanities and AI Virtual Institute (HAVI), the brainchild of former Google CEO Eric Schmidt and his wife Wendy. The couple pledged $10 million in philanthropic grants for research that applies science and technology to advance understanding and preservation of human history and culture. The Schmidt project will rely on a multidisciplinary team of post-doctoral researchers with an emphasis on AI applied to art history (Schmidt Sciences, 2025).

Schmidt Sciences and HAVI will work closely with Sorbonne University, Paris, and the Pigman College of Engineering at the University of Kentucky (UK), Lexington, KY. Key to bridging past and future is UK’s Dr. Brent Seales, who has been a professor of computer science for over three decades. His research to restore cultural artifacts led to the deciphering of fragile papyrus scrolls from the third century.

Dr. W. Brent Seales invented new restoration methods. (PC: UKY.edu).

Using non-invasive digital tools to rescue hidden texts, Dr. Seales and his research team created "virtual unwrapping" to read damaged artifacts without physically opening them, such as the oldest known Hebrew copy of Leviticus. Seales stated, "Our shared history is hidden in fragile artifacts, and technology allows us to bridge the gap between what is lost and what can be recovered." (Piercy, 2025).

The Sorbonne University, with support from the French Ministry of Culture, will supply a team of researchers lead by Barthelemy Jobert, a leading French historian and former president of Sorbonne University. Jobert anticipates the techniques applied in Digital Delacroix can unlock mysteries surrounding other works completed for the Parliament building Palais Bourbon (Sorbonne Universite, 2025).

Delacroix's mural at Hotel de Ville occupied the ceiling of a large room known as the Salon de la Paix or "room of peace." In addition to "Peace Descending to Earth," surrounding paintings depicting Hercules were thought to be crafted by Delacroix with the aid of understudies. Digital Delacroix may be able to differentiate and acknowledge their contributions.

A prolific artist, Delacroix created over 9,000 works in charcoal, ink, pastel, and oil mediums. As the leader of Romanticism, his emphasis on color and form was based on a nostalgic view of nature in response to increasing industrialization. Using themes of sensuality and violence, he rejected the harmony and order of Classical compositions. Initially, his art was met with scorn,

but in time viewers embraced Delacroix's powerful and dramatic landscapes. His body of work also included portraits and figurative pieces, among the best known are "Liberty Leading the Republic," and "La Philosophie, Socrate et son demon," in the National Assembly Library (Smithsonian, 2025).

"Liberty Leading the Republic" (detail), by Delacroix. (Photo: Sorbonne University)

The efforts of Digital Delacroix will lead to discoveries of more cultural heritage and improved preservation techniques, ensuring future generations can enjoy ancient humanities. Additional supporters of the project include the Smithsonian Institute, the Andrew W. Mellon Foundation, the National Endowment for the Humanities, the National Science Foundation, and the Educe Lab, a digital restoration initiative based at the University of Kentucky.

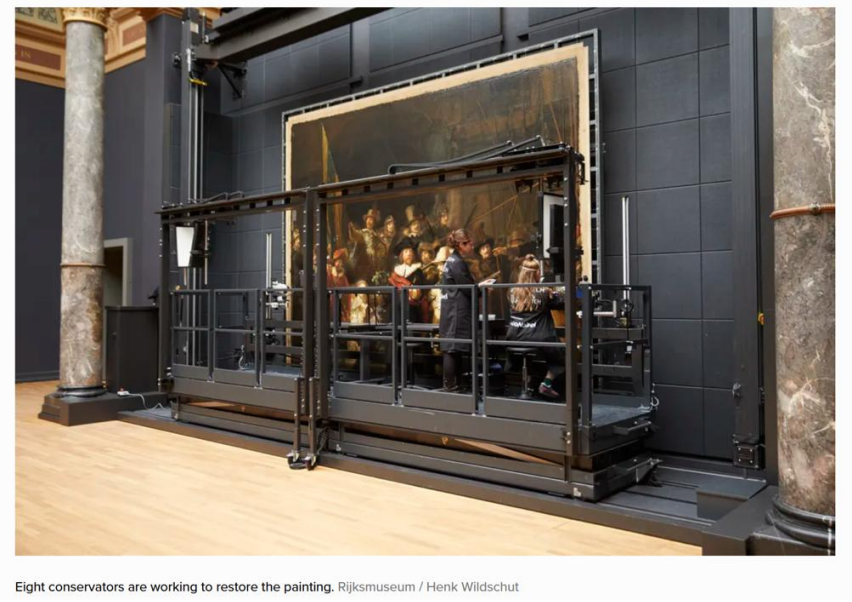
Modern-day Hotel de Ville has been restored, with the wings which suffered the least damage still displaying recovered ceiling murals created by a variety of French artists. These period murals, along with archived Delacroix drawings and paintings housed in The Louve, the state museum of France, will be used to infer links for generative A.I. algorithms (Rose, 2025).

Modern-day Hotel de Ville ceiling mural from the Romantic period (PC: Paris Trippers, 2025).

Ethical Considerations

Art restoration can be broken into two stages, with the first being analysis of the cause of damage and necessary intervention methods to suspend further deterioration. Historical artwork may have suffered a wide range of harmful environmental conditions, such as fluctuations in temperature, humidity, and ultra-violet light exposure causing fading. Art methods employed, available materials, and paint pigments are among the contributing factors to the longevity of historical works over extended timeframes. During the analysis stage, determinations of restoration methods to be employed and the cost become major considerations.

The second stage of actual restoration entails delicate hand cleaning of damaged surfaces, inpainting of areas missing paint, and varnishing. This is accomplished in repeated cycles of analysis and restoration, which is labor intensive, expensive, and requires skilled workers. Restorers have to balance the artwork's legibility while respecting the original creation and the artist's intent (Tan, n.d.).



Eight conservators are working to restore the painting. Rijksmuseum / Henk Wildschut

Pictured are restorers at work on a Rembrandt painting (PC: Rijksmuseum, Amsterdam).

Applying A.I. to art restoration requires an accurate and large dataset comprised of thousands of photographs of works created by the artist in order to "teach" the A.I. how to interpret the artist's style and color palette. Often this volume of data is unavailable, leaving room for subjectivity, calling for human intervention to choose colors which make sense, as well as the sharpness of edges, shading transitions, and brushstrokes. A.I. algorithms called generative adversarial networks (GANs), generate images and discriminate to predict if an image is real or synthetic. The software competes to produce an accurate replication but cannot substitute human ability to interpret subtilties of original artwork, therefore, A.I. must be benchmarked against existing work of the artist. As A.I. software advances, the margins of error for accuracy will decrease, but will not serve to replace traditional restoration, but rather complement human efforts (Preservation Craft, 2025).

Not all restoration efforts are considered ethical by art critics and curators. Among the often cited botched recreations are attempts to recolor or repaint images, such as a trio of Gustav Klimt panels at the Belvedere Museum. Critics claimed the A.I. results looked "cartoonish" and according to Jane Kallir, Kallir Research Institute, New York, "lack the nuanced tonal transitions Klimt is known for." Others pointed to a depiction of colors never previously attributed to the

artist. However, Klimt expert Dr. Franz Smola and Emil Wallner of the Google Arts and Culture Team stand by their restoration and A. I. results (Aspuru, 2022).

Perhaps the most infamous restoration was executed in Borja, Spain, where a 19th century fresco referred to as “Ecce Homo” resulted in the disfigurement of Jesus, angering art and religious communities. When an aged parishioner of the church, Cecilia Gimenez took it upon herself to fix the peeling image, the end result was a version of Christ critics compared to a hairy ape-man in a tight sweater. Over time, the community became a destination on account of the flopped restoration and residents have accepted the good intentions of Gimenez (Keats, 2012).

Elías García Martínez, *Ecce Homo* (1930), and Cecilia Giménez's infamous 2012 restoration attempt.

The botched restoration of Ecce Homo. (PC: Art Net, 2012).

Consideration of the financial and environmental costs of A.I. applied to art restoration follows the core questions A. I. poses for society, especially the expansive infrastructure and energy demands required to support A.I. projects. How it is applied to cultural and historical efforts has

yet to be fully understood, but in the future, A.I. will likely play an important role in the salvation of important, priceless works, in concert with human-based restoration skills and interpretations.

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