



A CENTURY IN WAITING: THE TREATMENT AND TECHNICAL STUDY OF EDWARD STEICHEN'S *IN EXALTATION OF FLOWERS*

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ABSTRACT The largest commission of Edward Steichen's artistic career was his 1910–1914 *In Exaltation of Flowers* murals. These seven large-scale paintings debuted at the Knoedler Galleries, New York in 1915. After their deinstallation, the series was not shown together again for 102 years. The Art Bridges Foundation acquired the murals in 2016 and initiated a partnership with the Dallas Museum of Art (DMA). Research was carried out by the DMA curatorial team in preparation for the 2017–2021 traveling exhibition *Edward Steichen: In Exaltation of Flowers*. The DMA conservation team treated the paintings in a public-facing gallery and studied them with surface imaging techniques, non-destructive elemental analysis, and cross-section microscopy. Samples collected from two murals were later included in a multi-analytical study at the Winterthur/University of Delaware Program in Art Conservation (WUDPAC). Research carried out at the DMA and WUDPAC has revealed Steichen's choice of Lucien Lefebvre-Foinet canvases, modern oil paints, and gilding materials. Hidden away for over 100 years, the murals show a new facet of the artist's oeuvre and how his technique evolved throughout the commission.

Introduction to the artist

Edward Steichen (1879–1973) was born in Luxembourg but his family later settled in Milwaukee, Wisconsin, where Steichen began studying art. He helped establish the Milwaukee Art Students League in 1898, where he later opened his first solo exhibition. Shortly thereafter, Steichen was introduced to Alfred Stieglitz – a New York photographer and gallerist. The two men forged a collaborative working relationship and friendship that initiated the Photo Secession. Together they organized exhibitions at Stieglitz's Gallery 291, which introduced works of European modernist masters to America. It was at Gallery 291 that Steichen met and befriended Agnes Ernst (later Meyer), a fledgling reporter at the *New York Sun*, whom the two men quickly dubbed 'The Sun-Girl'. She and her friends are depicted in

Steichen's 1910–1914 *In Exaltation of Flowers* (hereafter referred to as *Flowers*) murals. *Flowers* and other paintings by Steichen have mostly remained in obscurity during the 21st century. This is partly due to the artist's decision to renounce his former career as a painter after he accepted the lucrative chief photographer position at Condé Nast Publications in 1923.¹

Introduction to the murals

The *Flowers* mural series consists of seven large canvas paintings: two measuring 10 × 8 ft (3 × 2.4 m) and five at 10 × 4½ ft (3 × 1.4 m). The murals were created by Steichen for the foyer of a townhouse at 71st Street and Park Avenue in New York City² which belonged to 'The Sun-Girl', Agnes



Figure 1 Autochrome *Portrait of Edward Steichen* by Marion Beckett, c.1915, Beinecke Rare Book Library, Alfred Stieglitz/Georgia O'Keeffe Archive; YCAL MSS 85, Box 130, Folder 2511 (photo: The Estate of Edward Steichen and Artists Rights Society (ARS), New York).

Ernst Meyer, and her financier husband Eugene Meyer Jr. They had become close friends of Steichen and likely proposed the project during their visit to the artist's Villa L'Oiseu Bleu in Voulangis, France in 1910.³

The \$15,000 commission was Steichen's primary source of income between 1910 and 1914; he began the project by creating a 1/3-scale model of the Meyers' townhouse foyer, which helped him visualize the architectural floor plan in

three dimensions.⁴ Steichen's mural design stylistically is located somewhere between Symbolism, Art Nouveau, and Art Deco, and they would have complemented the ornate spiral staircase and black marble aesthetic of the townhouse foyer.

Steichen was clearly aware of other key mural projects in Europe and the United States. He would have known of the recently-deceased French muralist Pierre Puvis de

Chavannes, who created *The Allegory of the Sorbonne* (1886–89) in Paris and *The Muses of Inspiration Hail the Spirit, The Harbinger of Light* (1895–96) in Boston. Puvis's oil-on-canvas murals combined 'idealized classicism with simple flat designs and pale colors with unsaturated and unvarnished surfaces'.⁵ There was also Steichen's contemporary Gustav Klimt, the Austrian Symbolist painter who created *Altitaliene Kunst* (1890–91), *Griechische Antike* (1890–91), and the *Beethoven Frieze* (1902) in Vienna.⁶ Likely inspired by Klimt, Steichen used silver-toned metal leaf in his easel painting *Vase of Flowers* (1907) and gold-toned metal leaf in his *Flowers* murals (1910–14).⁷

Steichen's beautifully cultivated garden at Villa L'Oiseau Bleu in France became a summer gathering destination for the Meyers and their circle of friends to socialize, perform, and create art. Inspired by Maurice Maeterlinck's essay *L'Intelligence des Fleurs* (1907), members of the group adopted various floral personas – which Steichen later incorporated into his *Flowers* mural portraits.⁸ This circle of friends included the American dancer Isadora Duncan, American painters Katharine Rhoades and Marion Beckett, and Spanish mezzo-soprano Mercedes de Cordoba.⁹

The seven paintings that make up the mural were never displayed in their intended location. Due to financial hardship during the 1914 'Wall Street debacle', the Meyers were compelled to sell their Park Avenue townhouse.¹⁰ Both the architectural blueprints of the townhouse and Steichen's 1/3-scale model have been lost.¹¹ As a result, the mural order presented in the DMA installation *Edward Steichen: In Exaltation of Flowers* was based on a 1915 exhibition checklist from the Knoedler Galleries in New York City.¹² Without existing records to identify key elements in the townhouse, or the intended display locations of the murals, any other DMA installation would have been conjecture.

In the DMA installation, the first painting is *Gloxinia–Delphinium*, which depicts Isadora Duncan naked and kneeling away from the viewer. Duncan holds gloxinias and gazes upward at long stalks of delphiniums. Gloxinias are associated with a 'proud spirit' and delphiniums were expertly cultivated in Voulangis. Steichen's photogravure *Dawn Flowers* (1903) reveals an uncanny likeness in pose to that of the kneeling figure in this mural. Although the woman is unidentified, the strong resemblance with Isadora Duncan indicates her image could have served as a visual source for the artist.

Clivia–Fuschia–Hilium–Henryi shows Agnes standing in front of an eclipsed sun, facing forward, and raising a bouquet of fuchsia. The eclipsed sun is significant because Agnes referred to herself as 'The Eclipsed Sun-Girl' during her second pregnancy.¹³ Meanwhile, a second figure faces left with her arms wrapped around her bent knee, her face concealed. This position highlights the woman's prominent abdomen, suggesting it is Mercedes de Cordoba, who was pregnant with her first child in 1913. *Coleus–The Florence Meyer Poppy* depicts the baby Florence Meyer sitting before an arrangement of poppies. Born in 1911, Florence was the Meyer's first child, and the poppies symbolize fruitfulness and wealth.¹⁴ Steichen had experimented

with cultivating a new species of poppy in 1911, and art historians have noted the artist hybridized a special poppy for Florence.¹⁵

Petunia–Begonia–The Freer Bronze symbolically portrays American industrialist and art patron Charles Lang Freer in the form of a Zhou dynasty bronze wine vessel.¹⁶ Freer met Agnes and acquired this vessel in 1913.¹⁷ *Rose–Geranium* features the young New York painter and photographer Katharine Rhoades, sitting before a fruit-bearing tree with roses and geraniums next to her. In the Meyers' circle, Rhoades referred to herself as 'Geraniumette' and roses are traditionally associated with love and beauty.¹⁸

Petunia–Caladium–Budleya shows Marion Beckett holding an iris, surrounded by petunias and caladiums. In the Meyers' circle, she went by 'Petunia Beckett' as petunias have soothing characteristics.¹⁹ An unidentified second figure stands in the background, grasping a budleya tree. She could represent the artist's wife Clara Steichen (1875–1952). Clara had been part of the circle at Voulangis, and she initially formed a close friendship with Beckett. That friendship was short-lived, as Clara accused Beckett of an affair with her husband in 1914.²⁰ This love triangle could explain why Beckett is recognizable, while Clara is distant and mysterious. *Golden Banded Lily–Violets* shows a female figure, which could represent either Agnes Meyer or Clara Steichen. The woman holds violets overhead, while standing behind a vase of golden-banded lilies. The lilies symbolize majesty, power, and purity.²¹

Visual examination of the seven murals

After the 1915 Knoedler Galleries exhibition, it was more than 100 years before the paintings were displayed again as a complete series. At some point, the rolled paintings were transported to the Meyers' Seven Springs Farm near Mount Kisco in Westchester County, New York.²² Following Agnes's death in 1970, her children rediscovered Steichen's murals in the basement, and they gifted the series to the Museum of Modern Art (MoMA). MoMA unrolled and assessed the paintings in 1974 (see Figure 2). *Petunia–Caladium–Budleya* was subsequently lined and re-stretched for display in the museum galleries; the other six paintings were returned to storage.

In 2017, a joint initiative between the Art Bridges Foundation and Dallas Museum of Art (DMA) brought the seven murals to Texas for a 10-week conservation project. They were uncrated and examined by a team of five DMA conservators in preparation for treatment. Due to the large-scale dimensions of the murals, they were stationed in the Cindy and Howard Rachofsky Quadrant Gallery. This setting, which was visible to the public, limited some of the normal examination and treatment processes.²³

The six unstretched paintings were first unrolled and placed face-down onto the Tyvek-covered floor. While face-down, conservators observed that each unlined, plain-weave canvas had a supplier's 'stencil mark' or 'canvas stamp' from Lucien Lefebvre-Foinet, whose shop front was

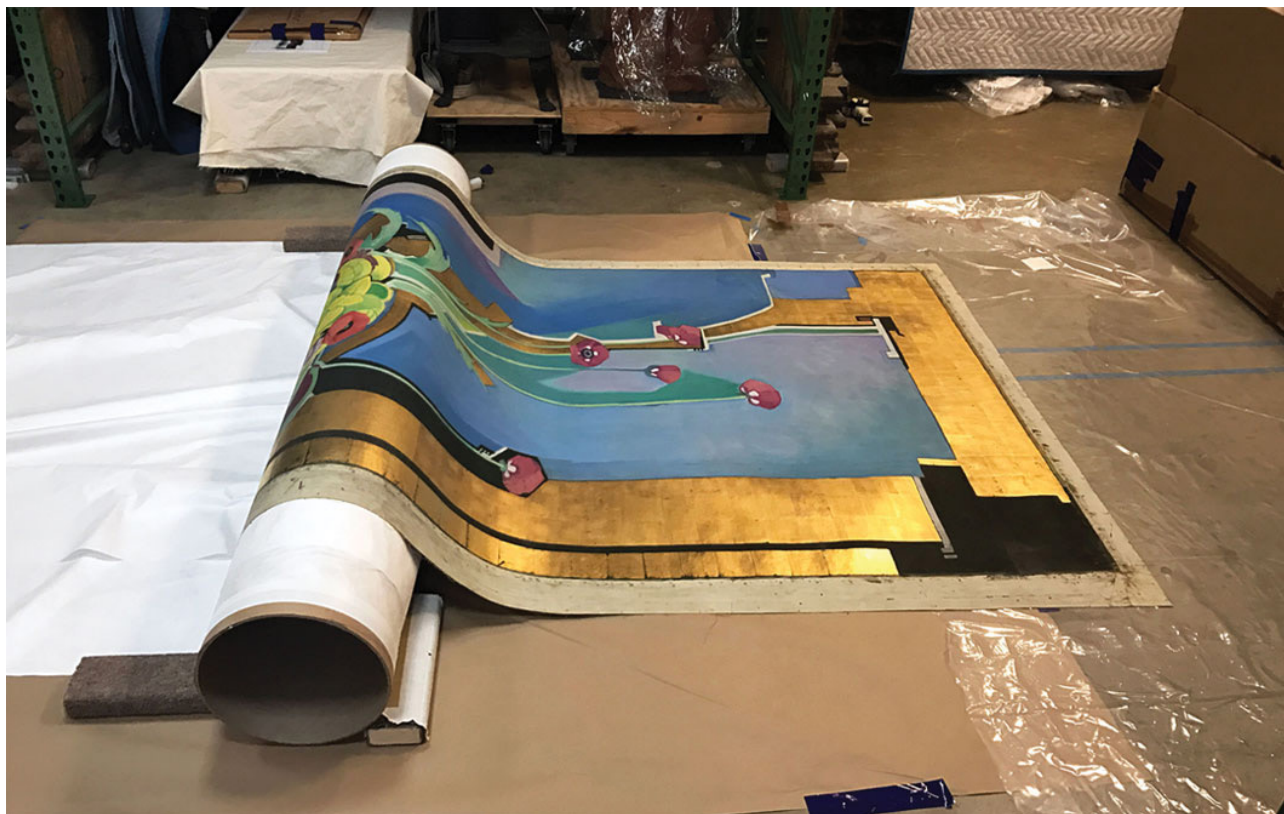


Figure 2 *Coleus–The Florence Meyer Poppy* being unrolled from its storage tube at the Dallas Museum of Art in 2017 (photo: Art Bridges and DMA).

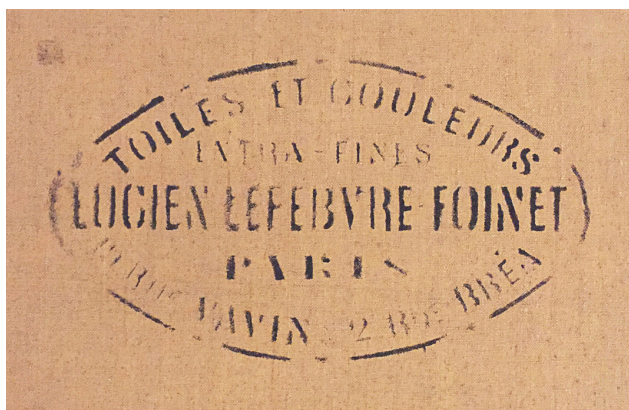


Figure 3 Colourman canvas stamp: 'Toiles et Couleurs / Extra-Fines / Lucien Lefebvre-Foinet / Paris / 19 Rue Vavin 2 Rue Bréa'. The first two lines translate to 'Canvases and Colors / Extra Fine' (photo: Art Bridges and DMA).

located at 19 Rue Vavin and 2 Rue Bréa in Montparnasse (Figure 3).²⁴ Steichen likely purchased his canvases directly from this shop, as his home in Voulangis was only 19 miles (30 km) outside of Paris.²⁵

The condition assessments determined that all six canvases were structurally stable and that the paint layers appeared generally well preserved and unvarnished.²⁶ Steichen painted his designs onto a white priming layer, which – based on the homogeneity of the ground layer and the colourman canvas stamps – appeared to be commercially primed. His palette consists of a vibrant range of colors – from warm yellows, oranges, and reds to cool greens, purples, and blues. Accents of gold-toned metal

leaf were an essential part of each painting. However, in *Clivia–Fuschia–Hilium–Henryi*, Steichen appears to have intentionally used a different metal leaf alloy to create an eclipsed sun. In *Petunia–Begonia–The Freer Bronze*, conservators noted patchy areas of metal leaf corrosion that seemed to have developed gradually from poor environmental conditions (potentially during its long-term storage in the Seven Springs Farm basement).²⁷

Steichen combined his own photography with design elements that were inspired by other murals – classic themes, pale colors, and gold leaf – to create visual contrasts. These elements, along with the figures' placement at varying heights throughout the *Flowers* murals, lead the viewer's eyes in a rhythmic dance across the entire decorative scheme.

Treatment in the Rachofsky Gallery

While the canvases were face-down on the prepared gallery floor, the versos were vacuumed and humidified.²⁸ They were then covered and flattened under gentle weight. Afterwards, the six unrolled *Flowers* canvases were edge-lined using strips of PeCap fabric trimmed with pinking shears, which extended approximately 1 inch (2.54 cm) from the turnover edges into the paintings.²⁹ Eventually, they were then placed face-up onto new Simon Liu stretchers, which had been prepared with loose linings (cotton-duck fabric). The canvases were re-stretched, pinned, and stapled (Figure 4).



Figure 4 Diana Hartman, Pamela Johnson, and Keara Teeter assess the condition of *Rose-Geranium*. Leaning against the gallery walls are $10 \times 4\frac{1}{2}$ ft (3×1.4 m) loose-lined Simon Liu stretchers (photo: Art Bridges and DMA).

Petunia-Caladium-Budleya was removed from its MoMA stretcher, which no longer provided adequate tension. Although the MoMA lining appeared stable overall, the DMA added edge-lining strips to reinforce the tacking margins before mounting the artwork onto a new Simon Liu stretcher. Once all the paintings were retensioned, the corners were expanded with wooden keys and backing boards were secured onto the verso (Figure 5).³⁰

Once the murals could be viewed upright, the painted surfaces were re-examined and cleaned.³¹ A few areas of

flaking paint required consolidation, and minor paint losses were filled.³² It was noted that the metal leaf appeared strongly attached throughout and did not require intervention. Aesthetic retouching – known as ‘inpainting’³³ – was necessary to tone the white fills and visually reintegrate areas damaged by water.³⁴ A resaturating varnish was applied only to the water-damaged black color fields, which exhibited severe blanching and uneven gloss.³⁵ Because the viewer’s experience was not significantly affected by the corroded metal leaf, these areas were



Figure 5 Pamela Johnson, Keara Teeter, and Diana Hartman secure the edge-lined *Petunia–Caladium–Budleya* onto a new stretcher (photo: Art Bridges and DMA).

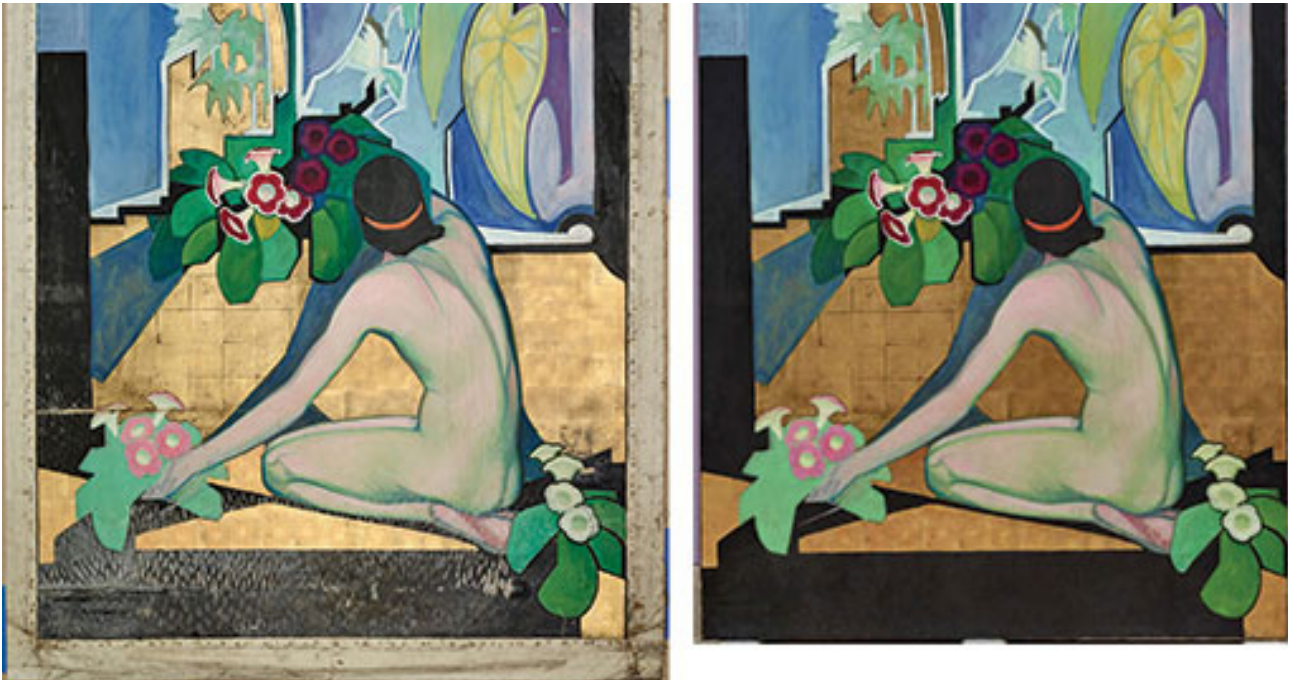


Figure 6 Before and after treatment comparison of *Gloxinia–Delphinium* (lower half of composition). The tacking margins are visible before treatment (photos: Art Bridges and DMA; © Artists Rights Society (ARS), New York).

left in their current state. Following the conservation treatment, the paintings were installed into new modern-profile frames fabricated by Gill & Lagodich Gallery. The frames'

'Japan black' finish highlights Steichen's use of black color fields and the dark marble of the Meyers' foyer, where the murals were intended to hang (Figure 6).

Table 1. WUDPAC Technical Study summary of pigments in Steichen's Flowers murals

Pigment	Instruments used to suggest the presence of the pigment in <i>Rose–Geranium</i>	Instruments used to suggest the presence of the pigment in <i>Petunia–Begonia–The Freer Bronze</i>
Lead white $2\text{PbCO}_3 \cdot \text{Pb(OH)}_2$	ED–XRF, PLM, FTIR, SEM–EDS	ED–XRF, PLM, SEM–EDS
Zinc white ZnO	ED–XRF, PLM, FTIR, SEM–EDS	ED–XRF, PLM, FTIR, SEM–EDS
Cadmium yellow/orange CdS and/or CdS+CdSe	ED–XRF (yellow), PLM (orange)	ED–XRF (yellow/orange)
Chrome yellow PbCrO_4	ED–XRF, PLM, SEM–EDS ^a	ED–XRF, PLM
Alizarin crimson (red lake) $\text{C}_{14}\text{H}_8\text{O}_4$	PLM (dye), SEM–EDS (substrate)	
Light cobalt violet $\text{Co}_3(\text{AsO}_4)_2$	ED–XRF, SEM–EDS	ED–XRF, PLM
Viridian $\text{Cr}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$	ED–XRF, PLM, SEM–EDS ^a	ED–XRF, PLM, FTIR
Cerulean blue $\text{CoO} \cdot n(\text{SnO}_2)$	SEM–EDS	ED–XRF ^b
Cobalt blue $\text{CoO} \cdot \text{Al}_2\text{O}_3$	ED–XRF ^b , PLM	ED–XRF ^b , PLM
Prussian blue $\text{Fe}_4[\text{Fe(CN)}_6]_3$	ED–XRF, PLM, SEM–EDS ^c	ED–XRF, PLM, SEM–EDS ^c
French ultramarine $\text{Na}_{6-10}\text{Al}_6\text{Si}_6\text{O}_{24}\text{S}_{2-4}$	PLM	PLM
Bone black $\text{Ca}_5(\text{OH})(\text{PO}_4)_3 + \text{CaCO}_3 + \text{C}$ and/or Mars black $\text{FeO} \cdot \text{Fe}_2\text{O}_3$	ED–XRF, PLM	ED–XRF, PLM

a Detected chromium (viridian/chrome yellow unconfirmed)

b ED–XRF detected cobalt in *Rose–Geranium*; ED–XRF detected cobalt and tin in *Petunia–Begonia–The Freer Bronze* (cerulean/cobalt blue unconfirmed)

c SEM–EDS detected iron (Prussian blue unconfirmed)

Scientific analysis of two murals

As part of a Winterthur/University of Delaware Program in Art Conservation (WUDPAC) technical study, in-depth analyses of samples from *Rose–Geranium* (1910) and *Petunia–Begonia–The Freer Bronze* (1913) were carried out. Only the two dated murals – one early and one late painting – were investigated. This technical study reviewed the DMA's non-destructive energy dispersive X-ray fluorescence (ED–XRF) elemental data,³⁶ and performed analyses of fibers, paint scrapings, and cross-sections of embedded paint samples. WUDPAC's multi-analytical approach included polarized light microscopy (PLM), Fourier transform infrared spectroscopy (FTIR), gas chromatography–mass spectrometry (GC–MS), and scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM–EDS).³⁷

Support and ground

The Lefebvre-Foinet canvases were identified as 'linen' using PLM analysis, based on the fiber's narrow lumen, lack of twists, and high birefringence³⁸ supported by comparison with other case studies.³⁹ WUDPAC analyses of Steichen's canvases with ED–XRF, PLM, and FTIR provided evidence to suggest the canvases were primed with a lead white ground.⁴⁰ Steichen's choice to use non-absorbent, pre-primed linen is a significant departure from muralists' traditional practice of priming the wall or fabric themselves.⁴¹

Paint binder

During the DMA visual assessment, metal soaps had not been visually identified as a condition issue. However, WUDPAC analysis with FTIR detected zinc stearate in a red-colored paint sample extracted from an apple in *Rose–Geranium*;⁴² the presence of zinc stearate indicates the formation of zinc soaps. GC–MS chromatograms of blue-colored paint samples extracted from the skies of both *Flowers* panels reinforced this finding: they showed minor peaks for oleic acid and major peaks for azelaic acid.⁴³ The detection of oleic acid suggests that Steichen mixed zinc white into his blue oil paint.⁴⁴ The high proportion of azelaic acid indicates that the *Flowers* murals do not contain egg fats – a finding that supports the DMA's earlier suspicion that the labeling as 'tempera' paint medium had been incorrect.⁴⁵

Since metal soaps are vulnerable to environmental changes and solvent exposure, future loan travel and interventive treatment should be carefully considered. Periodic visual examination and environmental monitoring are recommended to document future metal soap degradation.

Pigments

The ED–XRF, PLM, FTIR, and SEM–EDS data strongly suggest Steichen's palette contained zinc white, lead white, cadmium yellow, cadmium orange, alizarin crimson (a red lake precipitated onto an aluminum substrate), light cobalt violet, viridian, and chrome green (Table 1). Other possible

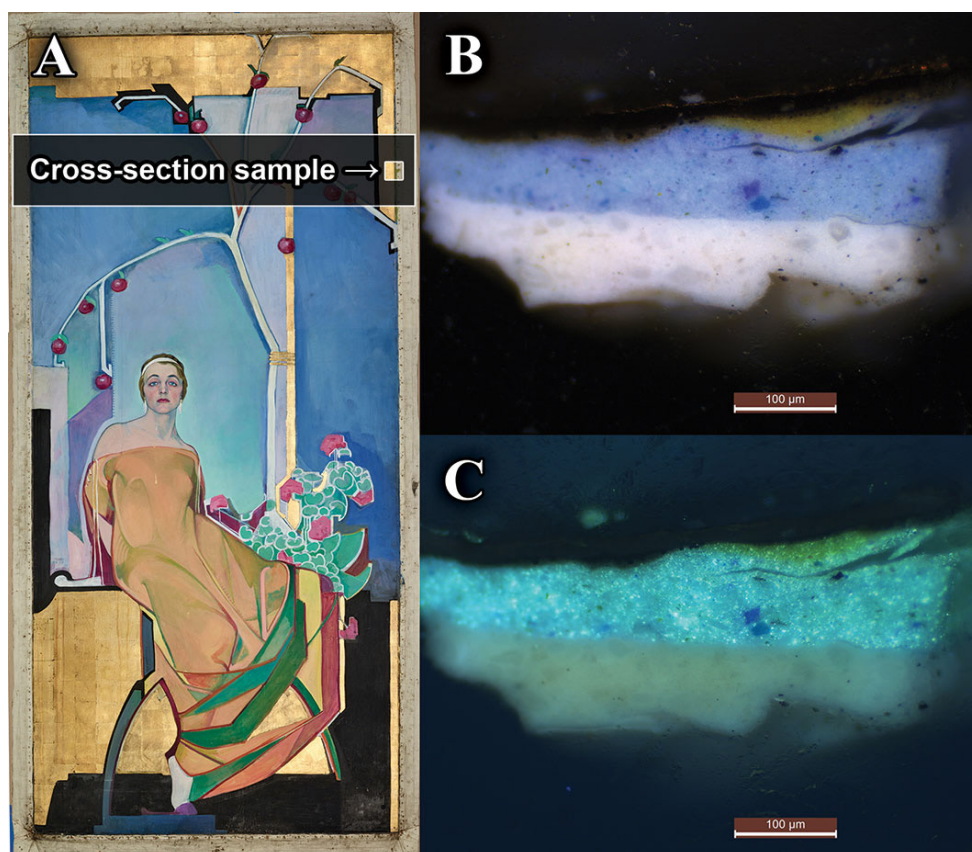


Figure 7 A: *Rose-Geranium* sample location: metal leaf collected from the tacking margin; it covered underlayers of solid black paint, blue sky, and white priming. B: 200× normal light photomicrograph captured with a Leica DM2700 showing the cross-section stratigraphy from the priming layer (bottom) to the metal leaf (top). C: 200× photomicrograph under ultraviolet radiation; the zinc white pigment (mixed in the blue sky) is autofluorescent (photos: Art Bridges and DMA).

pigments include a carbon- or iron-containing black, as well as one or more blue pigments.⁴⁶

Steichen might have chosen to use zinc white – in addition to lead white – because zinc white had widespread commercial availability; whereas, lead white was toxic, yellowed over time, and was perceived by some artists to be chemically incompatible with cadmium (Figure 7).⁴⁷ Steichen's choice of cadmium yellow, cadmium orange, alizarin crimson, and light cobalt violet demonstrates his desire to use bright, modern colors. These modern pigments were detected in other paintings by the artist as well, including his oil and tempera *Study for Le Tournesol* (1920) and opaque watercolor series *Oochens* (c.1922).⁴⁸

The authors have not located an inventory or purchasing receipts for Steichen's watercolor and oil paints. The artist could have purchased his pigments from the colourman Lefebvre-Foinet, as is documented for Picasso and other Parisian artists.⁴⁹ Watercolors that Steichen used at Voulangis included 'all the permanent prismatic colors, *vert émeraude*, rose madder, vermilion, the cadmiums, cobalt, and cerulean blue, and none of the neutral colors'.⁵⁰ Many of these modern paints were also identified in c.1909–1917 oil paintings by Henri Matisse, Pierre-Auguste Renoir, Claude-Oscar Monet, and Amedeo Modigliani.⁵¹ Steichen and his contemporaries did not seem to select oil paints based on their cost, but rather on their handling properties and aesthetic qualities. During the early 20th century, cadmium

yellow was vigintuple the price of chrome yellow, and viridian was at least triple the price of chrome green.⁵² Similarly, cobalt violet was significantly more expensive than organic dye-based violets, but it was also 'the only pure, opaque mauve artists' pigment available and was therefore a great attraction to painters ... working with floral subjects'.⁵³ Given the Meyers' generous commission, Steichen would have had adequate funding to purchase the 'best' oil paints for the *Flowers* murals.

Metal leaf

ED-XRF spectra and SEM-EDS false-color elemental maps revealed that *Rose-Geranium* had been created with pure 24k gold leaf. Conversely, *Petunia-Begonia-The Freer Bronze* contained a gold-silver alloy (detected in both areas of corroded and un tarnished metal), indicating the use of an 18k 'green' gold leaf (Figure 8).⁵⁴ Localized corrosion probably occurred after the silver had direct contact with water or prolonged exposure to high levels of ambient moisture. As a photographer, Steichen would have understood the reactive nature of silver due to the chemical processes that convert silver halides to metallic silver in gelatin silver prints. Steichen may not have intended for *Petunia-Begonia-The Freer Bronze* to corrode over time. Perhaps

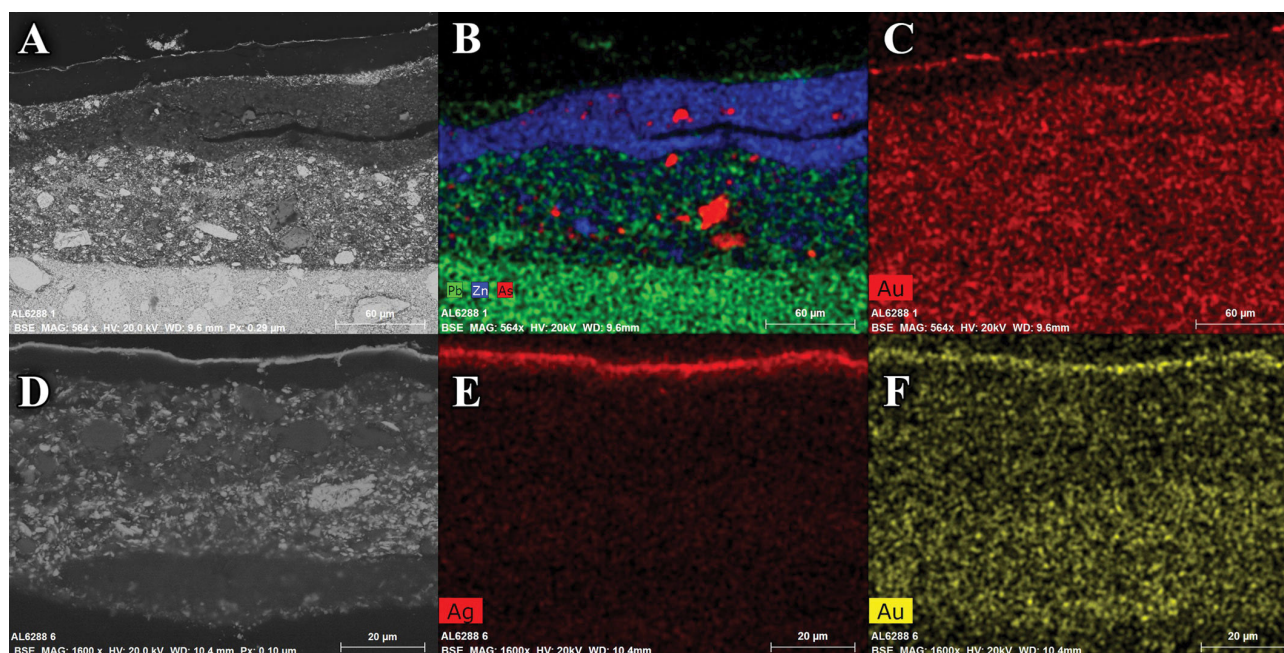


Figure 8 Backscattered electrons (BSE) and false-color mapping from the SEM-EDS analyses. The top row shows un tarnished metal leaf from *Rose-Geranium* (detail from **Figure 7**). The bottom row shows corroded metal leaf from *Petunia-Begonia-The Freer Bronze*. A–C: BSE at 564× magnification; map of lead in green, zinc in blue, and arsenic in red; map of metallic gold in red. D–F: BSE at 1600× magnification; map of metallic silver in red; map of metallic gold in yellow (photos: DMA and WUDPAC).



Figure 9 The framed murals on display in the Cindy and Howard Rachofsky Quadrant Gallery. The DMA exhibition *Edward Steichen: In Exaltation of Flowers* was on display from September 2017 to May 2018 (photo: Art Bridges and DMA; © Artists Rights Society (ARS), New York).

he unknowingly purchased booklets of imitation gold leaf before starting this panel. Alternatively, Steichen may have purchased a different metal leaf alloy to complement the color or reflectance of Freer's bronze wine vessel. Within the *Flowers* series, there is another instance where Steichen chose to impart a tarnished aesthetic: the large floating orb in the background of *Clivia-Fuschia-Hilium-Henry*⁵⁵ was created with a metal leaf that Steichen deliberately tarnished to achieve a toned 'eclipsed sun' effect.

Discussion

The collaboration between Art Bridges and the DMA provided hands-on conservation experience to emerging museum professionals, was an educational resource

for DMA visitors, and ensured the *Flowers* murals could travel to new destinations. While the 10-week conservation treatment was performed in an open gallery, the DMA team shared updates online, and the exhibition was regionally promoted by local news reporters.⁵⁶

The WUDPAC technical study analyzed two murals from the series: *Rose-Geranium* and *Petunia-Begonia-The Freer Bronze*. This research provided valuable details about Steichen's commercially-primed Lefebvre-Foinet canvases, modern oil paints, and gilding materials. After returning to France in 1908, Steichen would have been exposed to both traditional murals by Puvis and Klimt, as well as to avant-garde easel paintings – such as the figures and floral subjects of Henri Matisse.⁵⁷ This visual stimulation may have contributed to his use of bolder, more intense prismatic colors and 'abandon[ment of his] drabber early

work for the brilliance of sunlight and flowers'.⁵⁸ Steichen purchased expensive, high-quality oil paints and a mixture of metal leaf gilding materials to create his *Flowers* series. In particular, SEM-EDS analysis of cross-sections from *Petunia–Begonia–The Freer Bronze* revealed the artist gilded with a gold-silver alloy; it remains unclear whether he consciously chose to use the 18k 'green' gold leaf.

Going forward, all seven panels (Figure 9) should be kept in environmentally controlled spaces that are maintained between 40 and 60% relative humidity. The murals should be monitored to document future embrittlement of the colors mixed with zinc white, as well as photochemical degradation in the cadmium yellow, cadmium orange, and alizarin crimson pigments.⁵⁹ Routine monitoring will also help identify any new sites of corrosion within the 'green' gold leaf.

Conclusion

In September 2017, the exhibition *Edward Steichen: In Exaltation of Flowers* debuted at the DMA. From 2018 until 2021, the series traveled to multiple venues in the United States including the James A. Michener Art Museum, Orlando Museum of Art, Boca Raton Museum of Art, and Chrysler Museum of Art. All seven mural panels remain in the collection of the Art Bridges Foundation.

Steichen is widely known today as a preeminent photographer of the 20th century, but when the Meyers commissioned their *Flowers* series, this young photographer was also working as a successful painter. Compared to Steichen's photographs, significantly less technical research has been published about his small number of surviving paintings. This is partly due to the artist's 1923 decision to 'symbolically put an end to his painting career' by burning the paintings at Villa L'Oiseu Bleu, shredding paintings in his New York studio on West 40th Street, and slashing his paintings in the Meyers' garage on Amsterdam Avenue.⁶⁰

Several factors influenced Steichen's decision to abandon his former career as a painter. In the years leading up to this, Steichen had carried out aerial reconnaissance during World War I with the Photographic Section of the U.S. Air Service, he divorced Clara Steichen in 1922, he was in debt, and he suffered from depression.⁶¹ Hidden away for over 100 years, the *Flowers* murals fortunately escaped the artist's mid-career purge, and consequently reveal another facet of his early career oeuvre.

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Notes

- DePietro 2003: 4; Goley and Wolanin 1988: 3–23; Niven 1997: 500–502.
- Niven 1997: 347.
- Murphy 2009: 121; Niven 1997: 347; Pusey 1974: 85.
- Goley and Wolanin 1988: 17; Niven 1997: 353–63.
- Hensick et al. 1997: 60–67.
- Matzner 2015: 16–17.
- Goley and Wolanin 1988: 13.
- Canterbury 2017.
- Niven 1997: 306; Pyne 2007: 136–72.
- Goley and Wolanin 1988: 19; Pusey 1974: 110.
- Canterbury 2017.
- Haskell 2000: 24.
- Murphy 2009: 102. Letter from Meyer to Stieglitz on January 30, 1913. Alfred Stieglitz Archive, Beinecke Library, Yale University (ASA/YCAL).
- Canterbury 2017.
- Gedrim 2007: 354; Goley and Wolanin 1988: 32; Murphy 2009: 131.
- Goley and Wolanin 1988: 18.
- National Museum of Asian Art 2013.
- Canterbury 2017; Niven 1997: 360.
- Canterbury 2017.
- Niven 1997: 468–89.
- Canterbury 2017.
- Canterbury 2017; Kelsey 2021.
- Localized UVA-induced fluorescence could be achieved with a handheld Labino PH135 UV TrAc Light Spotlight (365 nm). X-radiographs were not captured because a portable X-ray unit could not be set up in the gallery.
- Franklin 2016: 259; Melikian 2009; Young and Katlan 2012: 135. In the early 20th century, French colourmen added canvas stamps to market their brand. The colourman Paul Foinet partnered with his son-in-law Émile 'Lucien' Lefebvre in the late 1890s under the business name Paul Foinet fils et Lefebvre. When the two men parted ways in 1904, his son-in-law established the spin-off business Lucien Lefebvre-Foinet.
- Niven 1997: 287.

26. Minor damages in the canvases included fabric punctures and tears in the tacking margin, water staining, and accumulated surface dirt. Before unrolling, the DMA was concerned about the paint film condition because the paint medium was mistakenly documented as "tempera." Traditional egg tempera paint is an inflexible medium, and it would survive poorly in rolled storage. After unrolling and assessing their condition, however, only minor flaking and paint losses were noted.
27. Most of the *Flowers* murals displayed gold-toned metal leaf with minor abrasions, drip staining, and no active lifting. Patchy areas of corrosion (present only in some murals) probably developed after prolonged exposure to ambient moisture or water. *Petunia–Begonia–The Freer Bronze* was one of the last paintings in the series; Steichen could have purchased one type of metal leaf at the beginning of his commission in 1910 and another type of metal leaf three years later, when he created this panel.
28. A soft-bristle brush was used with a DeWalt DC500 2 Gallon vacuum to dry clean the canvas versos.
29. PeCap is the monofilament polyester used to create the edge-lining strips. These strips were coated with BEVA 371 film, which was reactivated between 150 and 160°F (65–70°C).
30. Before adding the wooden stretcher keys, they were coated with Multiwax W–835. Corrugated 'blue board' was the material used for the backing boards.
31. Surface cleaning was carried out with polyurethane foam sponges (dry) and polyvinyl alcohol sponges (wetted with an aqueous solution).
32. Flaking paint was set-down with an Aquazol 500 and losses were filled/leveled with Flügger acrylic spackle.
33. Inpainting was performed with Schminke Horadam Gouache, Gamblin Conservation Colors, Daniel Smith Luminescent Watercolors, and metallic dry pigments.
34. Minor water damages were documented in drip patterns, staining, or blanching. Severe water damages caused physical etching of the paint layer.
35. The resaturating varnish consisted of 10% Regalrez 1094 and 1.5% Multiwax W–445 (matting agent) in ShellSol D38.
36. Teeter and Matsen 2018: 8–11. ED–XRF data were collected in the Rachofsky Gallery using a handheld Bruker Corporation Tracer III–SD.
37. Teeter and Matsen 2018: 8–11. PLM slides were prepared with Cargille Meltmount and photomicrographed with an Eclipse E600 Pol / RTKE Spot 7.2 Color Mosaic CCD. Transmission FTIR was performed with a Nicolet 6700 FTIR spectrometer / Nicolet Continuum IR microscope. GC–MS paint scraping samples were treated with ≤100 µL of 1:2 Grace Alltech MethPrep II and heated to 140°F (60°C); the treated samples were analyzed with an Agilent 7820A GC / Agilent 5975 MSD. SEM–EDS cross-sections were embedded in Extec polyester resin (14675) and hardener (14685); the cubes were polished with 1,500–12,000 grit Micro-Mesh and coated with carbon-conductive paint. The polished and coated cubes were mounted onto ZEISS ½ inch (12.7 mm) diameter aluminum pins and analyzed with a ZEISS EVO MA15 variable-pressure SEM. An Axio Imager.M2m / AxioCam HRC photomicrographed the SEM samples under visible light and UVA-induced visible fluorescence.
38. Mayer 2012: 321–23; Teeter and Matsen 2018: 13–14.
39. Barry and Devolder 2011: 108–15; Oriola et al. 2014: 89–93. Pablo Picasso's *Female Nude* (1910) and Salvador Dalí's *Figure and Drapery in a Landscape* (1935) were also identified to be painted on Lefebvre–Foinet's fine-weave linen canvases.
40. Helou-de La Grandière et al. 2008: 191–94; Teeter and Matsen 2018: 19–53. The ED–XRF, PLM, and FTIR data were augmented by: (1) a published case study of Lefebvre–Foinet's 1959 commercially-primed lead white canvases, and (2) WUDPAC false-color SEM–EDS mapping of the *Flowers* mural cross-sections, which isolated lead to the lowest layer.
41. Hensick et al. 1997: 64. A traditional priming example was presented in the technical publication about Puvis's Boston murals. Those walls were primed by the artist's studio with a glue-based chalk ground to achieve a 'frescolike appearance in his use of oil paints'.
42. The 'red apple' paint scraping sample consists of alizarin crimson, mixed with zinc white and lead white.
43. The 'blue skies' samples consist of a cobalt-containing blue (possibly cobalt blue or cerulean) mixed with zinc white and lead white.
44. Rogala et al. 2010: 103. As oil paintings age, oleic acid cross-links to form azelaic acid. However, paintings containing zinc white may retain significant proportions of oleic acid, due to a 'lamellar matrix' that limits oxidation and contributes to paint embrittlement. In the *Flowers* murals, peaks for oleic acid were found in the 'blue sky' paint scraping samples but were not found in other pigment samples.
45. Mills and White 1987: 142; Teeter and Matsen 2018: 14–15. Zinc stearate detected in the 'red apple' paint scraping sample indicates the formation of zinc soaps from a chemical interaction between the zinc white pigment and the oil binding medium. Traditional oil paintings and egg tempera paintings each show GC–MS peaks for palmitic and stearic acids; however, only oil paintings contain 'high proportions of the dicarboxylic acid degradation products, particularly the C₉ compound azelaic acid'.
46. The WUDPAC technical study was conducted between September 2017 and May 2018. Since WUDPAC analyzed samples that had been previously collected by the DMA, some pigments were only analyzed with one analytical method. For example, French ultramarine was characterized solely from paint scrapings examined with PLM, and it was not identified within SEM–EDS cross-sections.
47. Mayer and Myers 2013: 52–3. J.G. Vibert's book *La Science de la peinture* (1891) discussed the darkening of cadmium when it was mixed with lead white.
48. Owen and Morales 2019: 189; Thoury et al. 2011: 939–51.
49. Barry and Devolder 2011: 108.
50. Niven 1997: 288.
51. D'Alessandro 2019; Keegan 2014; Roy 2007: 65–7; Burnstock et al. 2018: 323. The pigment analyses included: SEM–EDX of Matisse's *Bathers by a River* (c.1909–17); XRF, SEM–EDX, PLM of Renoir's *Seated Bather* (1914); SEM–EDX of Monet's *Irises* (c.1914–17); XRF and light microscopy of Modigliani's *Female Nude* (c.1916).
52. Fiedler and Bayard 1986: 68–9; Newman 1997: 276.
53. Douma 2008; Roy 2007: 66.
54. Brady 1963: 353; Teeter and Matsen 2018: 23–4. Since copper was not detected with ED–XRF or SEM–EDS, the gilded layer cannot contain a 14–15k 'green' gold leaf.
55. *Clivia–Fuschia–Hilium–Henryi* (c.1913) has an attribution date based on the pregnancies of Agnes Meyer and Mercedes de Cordoba.
56. A series of *Facebook Live* social media videos and *Uncreated* blog posts were shared by the DMA between 6/19/2017–7/28/2017: Behind-the-Scenes Introduction (video); A History of 'In Exaltation of Flowers' (blog); Preparing for Re-Stretching (video); Preparing Steichen's Rare Murals for Display (blog); Stretching Steichen's Murals (video); Surface Treatments (video); Studying Steichen's Technique (blog); Grime, Dust, and Drips...oh my (blog). The *Flowers* murals were also featured in local press stories by NBC 5 *Dallas–Fort Worth*, NTPB *KERA Art&Seek*, and University of Delaware *UDaily*.

57. Niven 1997: 233; Lister and Fiedler 2019. An example of one floral subject painted by Henri Matisse is *Still Life with Geranium* (1906).
58. Niven 1997: 358.
59. Van Loon et al. 2012: 220–21.
60. DePietro 2003: 4; Goley and Wolanin 1988: 3–23; Niven 1997: 502.
61. Goley 2003: 6; Haskell 2000: 24–9; Niven 1997: 501.

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