

Abstract

Morris Louis's painting technique was examined by painting reproductions of equal size. Pouring paint onto a stretched, upright canvas reproduced Louis's 'Stripe' paintings, but for the 'Unfurled' paintings, unstretched canvas was anchored at a slope. The reproductions were used to evaluate two alternative cleaning procedures. The efficacy of non-ionic hydrogels for cleaning accumulated dirt and grime was compared to breadcrumbs; no significant differences were observed. A dry ice snow was applied to the reproductions to determine if it damaged either the unprimed canvas or paint; none was detected. The dry ice snow may provide an alternative to water-based cleaning strategies for cleaning large-scale paintings.

Keywords

Louis, Stripe, Unfurled, hydrogels, dry ice

Reproducing Morris Louis paintings to evaluate conservation strategies

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Introduction

The American colour-field painter Morris Louis (1912–1962) allowed no one to observe his mature painting technique. Therefore, it is not known how Louis was able to execute paintings greater than 2.7 m × 7.3 m, within his 4.3 m × 3.7 m working space. For this study conducted at Harvard University Art Museums, Gates reproduced two series of Louis's paintings, the 'Stripe' series and the 'Unfurled' series, at a scale approaching the originals, within a space comparable to Louis's studio. The two reasons for doing so were to examine how Louis could have manipulated paint and canvas, and to construct test paintings for evaluating alternative cleaning procedures for large mural-sized, acrylic paintings on unprimed canvas.

Louis's monumental 'Unfurled' paintings have caused much conjecture about how they were made, so these paintings were reproduced by Gates to examine how the artist was able to control, with great precision, the flow of paint during

application. Reproductions of Louis's 'Stripe' paintings were made by Gates to determine whether paint was applied by pouring or with a tool, because earlier attempts using both approaches, conducted in 1995 by Shank and Learner at Tate, failed to replicate the even, linear appearance of Louis's 'Stripe' paintings (W. Shank, personal communication). The reproductions made by Gates were successful in reproducing many of the subtle visual characteristics achieved by Louis, specifically paint texture and bleed. As a result, the reproductions were used to evaluate nontraditional conservation strategies for large-scale paintings on unprimed canvas.

Two possible conservation methods were explored. For the removal of accumulated grime, the efficacy of breadcrumbs gently rubbed onto a surface and then vacuumed was compared to pulverized non-ionic hydrogels used in a similar fashion. The materials studied were 2,3-dihydroxypropyl methacrylate or p(2,3-DHPMA) and 2-hydroxyethyl methacrylate or p(2-HEMA). These materials are tacky if equilibrated in water and behave much like breadcrumbs. Furthermore, these materials are unaffected by most organic solvents, allowing mixed solvent systems for cleaning.

The reproductions were also exposed to a low velocity, dry ice snow to determine if this technique could be used to surface clean without damaging either the painted or unpainted surfaces. The dry ice snow spray was explored to determine if ultimately it could be used safely to remove discoloured, cellulose-based coatings applied to the original paintings during the 1970s (Brenner 1974). This approach to sensitive surface cleaning has proved effective in removing both particulate and oily contaminants from both silicon semiconductors and polymeric films. The portable, hand-held delivery devices seemed particularly suited to the conservation of large-scale paintings.

Description of Louis's 'Unfurled' and 'Stripe' paintings

For the 'Stripe' and 'Unfurled' series, Morris Louis used only dilute Magna paint applied to number 12-cotton canvas. Magna is composed of primarily poly(*n*-butyl methacrylate), and dries quickly when thinned with aromatic solvent, such as turpentine. Louis used no priming or ground, so the paint soaked into and stained the canvas. Beginning in 1960, all of Louis's paint was custom-made by Leonard Bocour (Elderfield 1986).

One of the mysteries surrounding Louis's working technique is that he worked in a very small studio space, approximately 4.3 m × 3.7 m (Upright 1985). There was little room to work on large pieces, such as the 'Unfurled' paintings, circa 1960–61, because the length of some exceeds 6 m. The central area of these paintings is blank canvas, and paint appears to cascade from both sides as flowing bands of colour. These coloured bands can be separated by less than 1 cm of blank canvas, indicating a high degree of control during paint application. The longest coloured bands have little curvature, but the shortest coloured bands curve up to 90°. The result of this change in curvature is a sense of billowing movement, similar to a flag waving in a breeze, on each side of the 'Unfurled' paintings (Elderfield 1986).

The comparatively smaller 'Stripe' paintings, circa 1961–62, are approximately one-third the size of the 'Unfurleds', and consist of parallel, adjacent bands of colour framed by blank canvas; there are two variations in form, vertical and horizontal. The vertical 'Stripe' paintings are cropped at the bottom and thin trails or drips of paint sometimes appear at the top. In the horizontal 'Stripe' paintings, the two ends of each colour band are regularly shaped – appearing either curved or flattened. It has been suggested that the regularity of the endpoints in the horizontal 'Stripe' series could have been produced if the paint were applied with a tool, such as a swab stick used on a flat canvas (Crook and Learner 2000). Most importantly, there is a mottled texture to the paint evident in some 'Stripe' paintings, and prior to this study, it was not possible to determine if this appearance was the result of paint loss or the fabrication process.

The 'Stripe' reproductions

Magna paint is no longer commercially available, so for all the reproductions, paints were made by mixing 30 ml of Golden MSA paint with 700 ml Acryloid F-10, (50 per cent solution of poly[*n*-butyl methacrylate] in Stoddard solvent) and diluted with turpentine. The Golden pigments used in this study were ones used by Louis. As a support, only number 12-weight cotton canvas was used without priming or ground.

To reproduce the 'Stripe' paintings, paint was poured directly from one-litre jars onto unprimed canvas tautly stapled to a 61 cm × 152 cm stretcher positioned vertically. For each coloured band, the start of the paint pour was directed to the corner formed by the front of the canvas and the top-edge of the stretcher bar. On occasion, paint pooled on top of the stretcher bar and dripped onto the excess, unstretched canvas extending behind the stretcher; this created the trails of paint observed in Louis's vertical 'Stripe' paintings.

The width of each colour band was determined by the amount of turpentine: more solvent resulted in the wider colour bands characteristic of the vertical 'Stripe' paintings; less solvent, resulted in a paint of slightly higher viscosity and was used for the horizontal 'Stripe' reproductions. The texture of the reproduced paint surface was mottled, duplicating the appearance of Louis's original paint, suggesting the mottled texture of the paint was a result of the method of paint application and not a result of flaking paint. The well-defined start and end points that are characteristic of the horizontal 'Stripe' paintings were obtained by tilting the canvas forward just before the paint would flow off of the stretched canvas. This was sufficient to prevent paint from spreading along the bottom of the stretcher, and so, Louis's neat, horizontal bands of colour could be achieved (Figure 1).

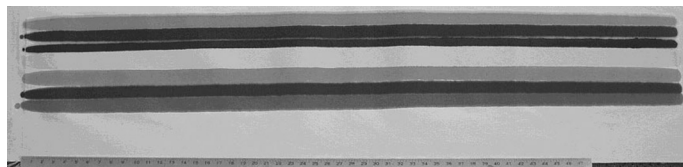


Figure 1. A reproduction by Gates of Louis's horizontal 'Stripe' painting, with a yardstick to indicate the size

The 'Unfurled' reproductions

To reproduce Louis's 'Unfurled' paintings, a 2.7 m × 4.8 m piece of canvas was positioned at a shallow angle to the floor, circa 30°, by stapling the top four corners of the two painted sides chest-high to a wall (Figure 2). The bottom of the canvas was pulled tightly away from the wall, but only the inside corner of each painted side was stapled to the floor. The two painted sides could be

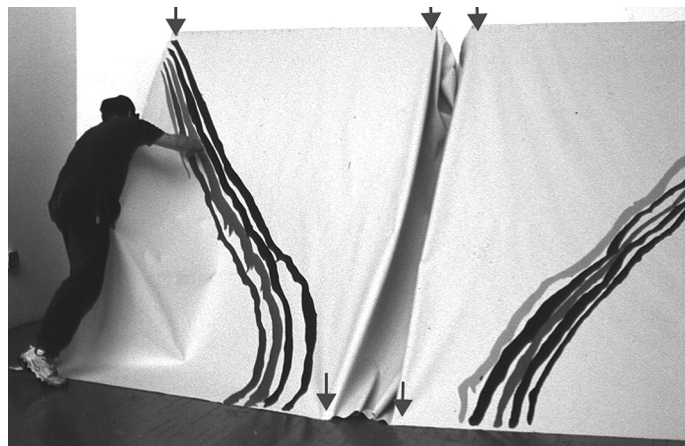


Figure 2. Gates reproducing Louis's 'Unfurled' paintings with poured paint; the arrows indicate points where the canvas was anchored to the wall and floor

positioned flush to each other, so that the unpainted central section draped freely between, demonstrating that there was sufficient space in Louis's studio to alternately paint on both sides of the canvas.

Paint was poured along the length of each coloured band, starting at the upper corner of the canvas. With the bottom of each painted side anchored at only the inside corner, the side-edge of the canvas could be raised and lowered to direct paint flow. Manipulation of the canvas was most limited at the top of the canvas. Consequently, the longest colour bands have little change in the direction of paint flow whereas the shortest colour bands have the greatest curvature, as observed in Louis's paintings. The longest colour bands could not be painted without interrupting the paint application to reposition the body, although no evidence of this pause remained after the paint dried. Since the canvas was slanted, paint could be applied beneath, but very close to, an adjacent colour band and gravity would draw the paint downward. This suggests the angled canvas was integral to Louis's visual statement of painting colour bands separated by less than 1 cm of blank canvas. Suggestions that gathering the canvas, or supporting the canvas with objects underneath to create channels, or directing the paint flow with a swab stick, all proved unnecessary and too time-consuming.

Discussion of the 'Stripe' and 'Unfurled' reproductions

Reproduction of the characteristic visual features evident in Louis's vertical and horizontal 'Stripe' paintings, strongly suggests the artist created these works only by pouring paint onto the fabric. Neither folding nor masking of the canvas was necessary to obtain the regularly sized, parallel colour bands that are characteristic of the 'Stripe' paintings, however, the precise dilution of the paint was critical. Manipulation of the paint with a tool, such as a swab stick, was probably not used by Louis because this would have eliminated the mottled paint texture.

In the narrow band 'Unfurled' paintings by Louis, a visual dialogue exists between the two painted sides, with colours and distinctive forms on one side of the painting complementing the opposite side (Fried 1971). The reproductions demonstrated this was not a consequence of space limitations forcing the artist to complete one side before painting the opposite side. The closeness of adjacent coloured bands could have been achieved by pouring paint onto unstretched canvas anchored at a shallow angle; changing the tilt of a stretched canvas proved unmanageable and the use of a swab stick to guide paint flow was unnecessary. Finally, the increasing curvature of colour bands from top to bottom in the reproductions was a consequence of the canvas affixed at a slope, since the freedom to manipulate the side edge of the canvas increased top to bottom.

Hydrogel cleaning tests

Using the 'Stripe' and 'Unfurled' reproductions, two commercially available, non-ionic hydrogels manufactured for contact lenses, 2,3-dihydroxypropyl methacrylate or p(2,3-DHPMA) and 2-hydroxyethyl methacrylate or p(2-HEMA) were examined to qualitatively assess cleaning efficacy compared with breadcrumbs for the removal of accumulated dust and grime. These cross-linked hydrogels were examined as a substitute for breadcrumbs because bread of consistent character can be difficult to make. These two hydrogels were not excessively tacky such that cotton fibers were removed from the surface. A direct comparison with breadcrumbs was made, as this approach is one of the most effective ways of removing surface grime without damaging the canvas. Currently available alternatives to breadcrumbs include erasures or sponges, which can remove Magna paint or abrade the canvas, and gels made by conservators, which can be difficult to synthesize and may contain contaminating chemical precursors.

When crushed and hydrated, the p(2,3-DHPMA) and p(2-HEMA) hydrogels were tacky and had irregular surfaces capable of removing deposits from the interstices of woven canvas, if used in the same manner as the traditional approach of using breadcrumbs gently rubbed onto a surface followed by vacuuming. However, after visual inspection by conservators, no significant

differences were observed in the cleaning efficiency of these hydrogels compared with breadcrumbs. The most significant benefit of the hydrogels was their compatibility with other solvents besides water, including xylene, ethanol and acetone. Despite their efficacy and varied uses, the p(2,3-DHPMA) and p(2-HEMA) hydrogels were too expensive and too difficult to obtain to justify this application. Therefore, cheaper hydrogels are currently being investigated, specifically ionic hydrogels based on p(2-HEMA) with random copolymerization of 1–2.5 per cent methacrylic acid.

Dry ice spray cleaning tests

In an attempt to preserve the pristine surface of unprimed canvas, carboxymethylcellulose and hydroxypropylcellulose coatings were applied to some Louis paintings during the 1970s. Many of these coatings have yellowed with age, but removing these disfiguring coatings currently involves applying water, either with poultices, swabs or suctioning, but these strategies can be impractical considering the monumental size of the paintings. One non-aqueous treatment for coating removal that was investigated was the application of a low-velocity dry ice snow, a method currently used for cleaning semiconductor chips.

Before the efficacy of this method for cellulose-based coating removal was evaluated, however, it was necessary to determine if it damaged either the cotton canvas or the Magna paint. Using the reproductions, both paint and canvas areas were exposed to the dry ice snow when the relative humidity was 90 per cent, so significant water condensation occurred. Since water-based treatments form the basis of many accepted conservation strategies for unprimed canvas, the condensation resulting from the application of dry ice snow may not be problematic. The condensed water may partially dissolve the coatings, and allow the cotton fabric to wick some of the disfiguring coating from the surface, minimizing the yellowed appearance. Future study is required.

Scanning electron microscopy was used to compare exposed and unexposed areas after no differences were identified by visual inspection. Thorough examination at 150 \times , occasionally increased to 400 \times , revealed no detectable differences following the dry ice snow exposure (Figures 3–6). Currently, a comparison of the tensile strength and micro-hardness of the painted and unpainted areas following the dry ice exposure is underway and the results will be forthcoming.

Conclusions

The dual justification for reproducing Louis's 'Stripe' and 'Unfurled' paintings to scale was to test specific presumptions about how these paintings were created and to fabricate test materials that respond to cleaning methods in ways approximating the original art. Reproducing the subtle painted forms in Louis's paintings provided an opportunity to explore how significantly physical and material limitations impacted the artist's visual statement. The reproductions have proved extremely valuable in devising alternative cleaning methods for mural-sized paintings that have painted areas as artistically important as unpainted areas. The performance of non-ionic hydrogels for removing accumulated grime was not significantly better than traditional breadcrumbs; therefore, the use of cheaper, ionic hydrogels is being explored. The application of dry ice snow did not appear to damage either painted or canvas surfaces in the reproductions, so its efficacy for removing cellulose-based coatings is also being explored.

References

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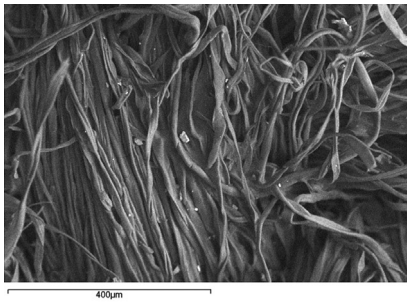


Figure 3. Cotton canvas, no dry ice exposure, photographed at 150 \times

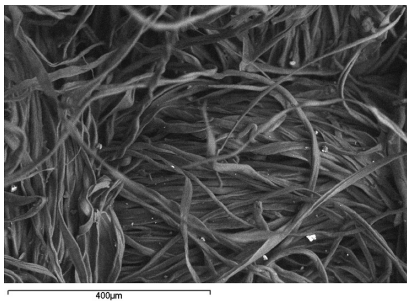


Figure 4. Cotton canvas, after dry ice exposure, photographed at 150 \times

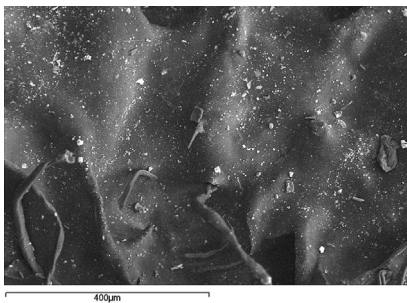


Figure 5. Mars black Magna paint from the 'Stripe' reproduction before dry ice exposure, photographed at 150 \times

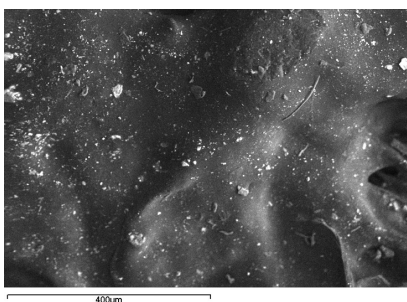


Figure 6. Mars black Magna paint from the 'Stripe' reproduction after dry ice exposure, photographed at 150 \times

Upright, D, 1985, *Morris Louis, the Complete Paintings: A Catalogue Raisonné*, New York, Abrams.

Materials

Acryloid F-10, 50 per cent solution poly(*n*-butyl methacrylate) in Stoddard solvent
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PO Box 91746
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