Laura Kolkena¹, Louise Wijnberg², Emmy de Groot³ and Meta Chavannes²

Achrome (1960) by Piero Manzoni
An unpainted monochrome canvas: research and treatment

Introduction

The Stedelijk Museum Amsterdam (SMA) collection contains three Achromes by the Italian Zero artist, Piero Manzoni (1933-1963). Manzoni’s Achromes (meaning ‘colourless’) are monochrome and mostly white.¹ One of these Achromes, (1960), has visually disturbing stains, discolouration and tide lines, for which reasons it has not been displayed for many years (Figure 1). The object comprises a stretcher onto which two canvases are mounted (Figure 2). The front canvas, the only one visible, consists of a cotton canvas with seams forming a grid, with no finishing coat and no paint layer.³ The cotton has very fine creases, which form a characteristic element of the work. The back canvas is covered by the front one and painted white (Figure 2).

The Achromes constitute a considerable and important part of Manzoni’s multifaceted oeuvre (Figure 3). He created the Achromes beginning in 1957, using materials such as canvas with plaster, fibreglass wool and even bread rolls. During 1959-60, Manzoni made more than 50 Achromes using unpainted textiles (cotton, silk, flannel).⁴ Manzoni strived for entirely new artistic concepts that totally opposed art as expression.⁵ “For me it’s about a totally white surface (or better still, perfectly colourless, neutral), free from every pictorial phenomenon, [...] white is no polar landscape, no matter that evokes certain associations, no beautiful matter, no sensation, no symbol or something else: a white surface is a white surface [...].”⁶

The stains on the cotton are very obvious and thus form a discrepancy with Manzoni’s original intention.⁷ Achrome (1960) is an important work in the SMA collection and the museum wished to be able to display the work once more. The aim of the current treatment was also to make the conceptual value of the work clearly apparent once again.

The removal of irregularities on a monochrome work is often problematic and certainly in the case of an unpainted work. In the first instance, it was not certain that it would be possible to carry out a full treatment on Achrome. In another case of a stained Achrome, this time of cotton wool, (1962, Museo Giovanni Fattori collection), cleaning turned out to be impossible without impairing the work’s appearance and the artist’s original intention.⁸ An in-depth research into possible treatments for Achrome was necessary and this began in 2015.⁹ Achrome is composed of various materials, and hence involves multiple conservation

Figure 1. Piero Manzoni, Achrome, 1960, canvas on stretcher, 99.7 cm x 79.2 cm x 2.4 cm. Stedelijk Museum Amsterdam collection. Before treatment. © Stedelijk Museum Amsterdam. Photo: L. Kolkena.¹
disciplines. As it was made in the painting tradition, comprising a stretcher and a painted canvas (albeit concealed), it was treated in the painting conservation studio in collaboration with other disciplines.

The treatment was quite a challenge due to various difficult conservation issues. Would it be possible to remove patchiness with local treatments? Or would it only be possible to achieve an evenly monochrome surface by treating the entire surface of the front canvas?

This paper is primarily focused on the research into whether local (spot) or full cleaning would be suitable for the front canvas, the most suitable methods and materials, and the implications these might have for the work as a whole. It was finally decided to wet clean the front canvas. The treatment method was not the most obvious solution and the decision-making process is discussed here because it may be useful for treatments of similar works.

There is very little published about the full cleaning of an unpainted cotton or linen painting support. Methods and materials used in textile and paper conservation were investigated for their suitability for cleaning a textile painting support.

Comparable conservation problems are often presented by modern paintings, for instance, in the conservation of Color Field paintings. Sometimes patchiness on unpainted canvas can be treated locally, or full cleaning would be too problematic. Such as the large canvas *Shining Forth* (1961) by Barnett Newman, on which stains had formed on the unpainted canvas that were difficult to remove and ultimately treated locally.

In addition to cleaning, the retouching of unpainted canvas was researched and described in this study.

The preservation of the material authenticity of *Achrome* is one important criterion for the treatment choice. Furthermore, the historical value and normal signs of deterioration had to be kept in mind. The apparently simple concept of *Achrome* could be displayed by means of a replica. However, a replica would not possess material authenticity and historical value. The characteristics of the making process (seams, creases, stretching and the particular construction of canvasses) give it a unique appearance that must be preserved and displayed.

The stains have been on *Achrome* for a long time, already before the acquisition by the SMA in 1970. The front canvas was even cleaned and bleached twice in the 1970s, but the stains are still present. These treatments have had consequences for the visible signs of ageing that form the cotton's patina. The conceptual value of *Achrome* had to be weighed against the preservation of the material authenticity and history of the canvas. This case illustrates an interesting dilemma already extensively described in 1972, but which is once again relevant for the current treatment.

2 Preliminary research methodology

To form a basis for the treatment decision-making, research was first carried out into the making, treatment history and condition of *Achrome*. This was material-technical research using the naked eye, stereo-microscopy, thread-counting and fibre identification with polarised light microscopy. Documentation photography, Reflectance Transformation Imaging...
Figure 4. Achrome under Reflectance Transformation Imaging (RTI) light. Photo: L. Kolkena and M. Wajenaar.
(RTI) and Ultraviolet Fluorescence photography was carried out with a Nikon D7000 camera with Nikor 60 mm lens, Philips TL-D 36w BLB UV lamps and 2B+85D Kodak Wratten filters for UV and colour correction. Colour temperature was adjusted in Adobe Photoshop CS6 with Camera Raw 7.4 to 10000 Kelvin and colour +35 following AIC guidelines. Photo spectrometry was performed with a Minolta Konica Photo spectrometer, with settings of m/I + E/100 T1 10°/D65, diaphragm 8 mm. Source research was carried out and reconstructions of Achrome were made.

The substances making up the stains were analysed in order to find a tailor-made cleaning method and to better understand the condition of the cotton. Sampling the stains was not possible because the fine weave of the textile would be damaged and the stains were located in a prominent place. Examination with a Hirox 3D digital high-resolution microscope (Hirox KH7700 with 2016Z lens) mounted on a MOPAS portable stand for examination of paintings (JAAP Enterprise for Art Scientific Studies Amsterdam) made the condition of the threads and fibres accessible, and it could be determined whether the stains consisted of soil particles or discolouration. Portable X-ray Fluorescence (pXRF, Bruker Tracer III with SD detector and Bruker S1 software) was performed by the Cultural Heritage Agency of the Netherlands (RCE) to detect the presence of harmful metals in the stains as well as elements in the paint layer on the back canvas. Gas Chromatography-Mass Spectrometry (GC-MS) analysis was carried out at the RCE on the materials in the paint layer on the back canvas to indicate any possible emissions of harmful gasses that could accelerate the degradation and yellowing of cellulose.

A chemical spot-test of potassium iodide solution was used on a fibre of the tacking margin to test for the presence of starch. The acidity and conductivity of the canvas were measured using an agarose gel, applied to the canvas tacking margin for 5 minutes (5% agarose in de-ionised water; Horiba Laqua Twin pH and conductivity meters).

Due to the risk of forming tide lines, it was not possible to test the stains’ solubility, nor wet cleaning methods on the object prior to treatment. As the origin of the stains was unknown, it was also impossible to reproduce these on cotton for cleaning tests.

Treatment methods and materials used and recommended for paintings with stains on cotton were collected. Literature sources and various national and international conservators and researchers in the fields of paintings, textiles and paper cleaning and retouching were consulted.

Subsequently, the discrepancy between the original appearance of the work and its current state was determined. It could then be estimated how light the canvas may become by cleaning.

All the pros and cons of the cleaning methods were considered and discussed with all involved conservators and curators in the SMA. It is important that the artist’s intention is preserved, but the object’s historical and material values should also not be lost sight of. Compromise is nearly always necessary in arriving at the most appropriate treatment for a complex conservation project.

3 How Achrome was made

“As for my current paintings, I am now using sewing machines and I am able to obtain surprising effects.” Manzoni, 1960.

The front canvas is of cotton with a grid pattern of machine stitched, double folded, horizontal and vertical seams, the seam allowances of which are on the verso (Figure 4). It is attached to the stretcher over the back canvas with staples. The back canvas has an even white primer underneath a white paint layer that the artist applied by hand in wide brush strokes. The canvas is attached with small nails to the stretcher.
The slight creases on the front canvas are already present in the earliest known photograph of 1970 (Figure 5). The reconstructions of the work made for this research show that creases only appear when deliberately formed in a dry or wet canvas. There are more Achromes with a creased surface, but this is not a standard feature in every one. It is an original characteristic of this work that must not be lost during treatment.

The front canvas is thin and slightly transparent, so that the light-coloured paint layer on the back canvas shimmers through. This effect contributes to the lightness of the work and would have been created intentionally by Manzoni, given that he applied the white paint layer to the back canvas himself.

The original degree of lightness of the canvas is unknown. It cannot be deduced from the available black and white photos. Above all, the canvas has been washed and bleached several times in previous conservation treatments.

Manzoni was assisted in the making of the Achromes by a family maid in Italy and by seamstresses in a T-shirt factory in Denmark where he made works as an artist in 1960. Perhaps they helped with sewing the seams in the fabric, but the exact part they played in the making process was not documented.

4 Treatment history and current condition

Aesthetically, Achrome is in poor condition due to the obvious dark stains. The stain at the centre of the monochrome picture catches the eye immediately and is very distracting (Figure 9). In addition, there are several visible brown tide lines and the work is discoloured to yellow-brown, which is stronger toward the edges. The darkest stains have white retouching, which slightly stands out against the discoloured cotton. The tacking margins on the front canvas show tears and holes from old rusted staples.

The work has been treated four times in the SMA since 1970 (Figure 6). The darkest stains were bleached with hydrogen peroxide and the front canvas was removed from the stretcher and rinsed in warm water in 1970. The canvas was re-stretched to remove creases. In 1972, the front canvas was treated once again, in collaboration with textile conservators and researchers at the Centraal Laboratorium in Amsterdam. It was then also investigated whether it would be possible to preserve the patina. The stains were first treated locally with a soap solution. The canvas was then bleached with hydrogen peroxide and washed with a surfactant. Measures were taken during the drying process to prevent the creases disappearing. Despite all these treatments, the stains were again visible in 1975 and subsequently retouched with white magnesium trisilicate.

The work could be displayed again after the treatments were carried out in the 1970s. Then, in 1972, it was noticed that tide lines had formed around the local treatments. These are now even more clearly visible. Due to the first treatments, the creases were apparently reduced and the colour of the canvas made lighter. Achrome’s current colour is not what one would expect from the natural ageing of cotton.

Discolouration of the canvas

Cotton consists largely of cellulose that degrades under the influence of heat, light, moisture and oxygen. With degradation, it oxidises, discoulers to yellow-brown and is subject to hydrolysis, which causes weakness. Oxidation of cellulose in-
The degradation of cellulose is the most probable cause of the yellow-brown discolouration. A chemical spot-test using potassium iodide indicated that there was no starch present to contribute to the discolouration. The colour and lightness was measured with a photo spectrometer.

**Tide lines on the canvas**

Tide lines (Figure 6) are formed when, during evaporation, a liquid transports coloured substances to the edge of a stain where they accumulate. Acidic and yellow-brown cellulose degradation products and surface soiling can be among these substances.

Tide lines and stains invisible in normal light do fluoresce under UV radiation. There seem to be tide lines and residues of local treatments present (Figure 7). A high concentration of titanium was measured with pXRF in the middle of a tide line at the upper-left corner (Figure 7). The local treatment using a soap solution could have caused this, with household soap containing titanium oxide being the possible source. This could mean that soap residues are still present. Titanium dioxide can accelerate the photochemical degradation of cellulose fibres and its small crystals can mechanically damage fibres. These residues and acidic degradation by-products can cause further damage and discolouration that only becomes visible in the future.

**Dark stains on the canvas**

The dark stains have been present for some time. Aged stains can negatively affect the condition of cotton. The presence of a metal such as iron or copper can work as a catalyst in the degradation of cellulose fibres. Stains can be acidic due to the presence of oils or mould, for example. The dark stains fluoresce red-brown under UV light (Figure 8), which can indicate the presence of iron. However, pXRF measurements of the darkest stains show that there is practically no iron present and no other metals that cause dark discolouration. The cause could be an organic substance.

The RTI images show that the dark stains form depressions in the surface (Figure 4). This suggests that the affected cotton was damaged or mechanically impacted during a treatment. Using the Hirox microscope, many broken off cotton fibres can be seen in the dark stains, again possibly due to bleaching. Therefore the surface is less ‘fluffy’ and light is less scattered (Figure 12). The volume of the threads is reduced so that the dark space between them increases, which contributes to the dark appearance of the stains. Hirox microscopy showed that the stains consist of discolouration and not soil particles that lie on the surface and between the fibres.

The retouches of magnesium trisilicate can cause a local difference in acidity because the substance is an antacid and thus counters acidification. This could cause differing degrees of discolouration in the future.

**5 Treatment selection criteria**

The most important aim in this treatment is to restore the authentic visual appearance. The monochrome character of the work must be brought back. As the work has already been fully cleaned a number of times, the patina has already been altered and the natural ageing is no longer intact. This simplified the choice to possibly wash the work and thus give preference for its conceptual value.

Manzoni thought it important that Achromes should stay uniformly even and he permitted interventions for maintaining the white surface. This was evident from interviews that Van de Wetering held around 1972 with artist friends of Man-
Figure 9. Dark stain on the canvas.
Manzoni ordered the overpainting or cleaning of an *Achrome* on several occasions. Henk Peeters washed a cotton *Achrome* for Manzoni in a bath; another was overpainted with a white layer by Jan Schoonhoven and, together with Peeters, Manzoni attempted to clean an *Achrome* of nylon fibre with anti-static oil.

Nevertheless, the current treatment does not aim to make the object ‘as new’, but to bring it closer to the original uniform appearance.

Another treatment aim is to make the resulting condition as stable as possible and to limit any harmful influences on the cotton so that degradation can be slowed down. The canvas’ condition is currently unstable: substances in the stains can accelerate degradation of the cotton fibres, which, in turn, weakens the stained areas. Acidification of the canvas has caused further degradation and hence discolouration of the cotton. Substances used in previous treatments (such as soap) are perhaps still present and could be reactive, thus causing discolouration, for instance.

In addition, treatment must not further weaken the cotton. Any additions, such as retouches, must be reversible.

### 6 Possible treatments

An active conservation treatment is needed to make the work visually acceptable for display. Standard treatment possibilities were evaluated on their suitability and efficacy concerning the unpainted cotton canvas of *Achrome*.

**Spot cleaning**

Spot cleaning can be carried out with a liquid, emulsion (e.g., a silicone solvent) or rigid gel (such as agarose), with or without adding a detergent, bleach or chelating agent. The amount of liquid used can be limited by using local suction or an ultrasonic mister. Even so, all local wet cleaning methods carry the risk of tide line formation. The removal of soiling with mechanical action or a laser only works on soil particles, which are not present in this case.

**Treatment of the entire front canvas**

The front canvas has to be removed from the stretcher in order to be fully cleaned. Washing would most probably reduce the natural discolouration of the fibres and the intensity of the
stains. The polar degraded elements of the fibres and residues of previous treatments are flushed away by water, which can slow down future degradation. The work would benefit visually and the condition especially would be improved for the long-term. The old retouches with magnesium trisilicate are water-soluble and so would be rinsed out with water during the treatment, ensuring that the canvas would age more evenly in the future.

The function of a detergent is to encourage release of soil, residues and degradation by-products and holding it in suspension during the washing process. A suspension agent also helps to hold soil in the washing solution to prevent soil redepositing on the object.

Full cleaning with water does have a number of possible disadvantages. Washing the entire canvas in order to lighten its colour is not reversible. The result cannot be accurately predicted and it is not possible here to test the cleaning method. There is no longer the risk of shrinkage, as Achrome has been washed numerous times, even in water at 60°C. Monitoring the drying process is crucial to preserve the creases and prevent tide line formation. The 1972 treatment that successfully preserved the creases can be taken as an example.

A full cleaning could also be carried out using solvents or with supercritical CO₂ or liquid CO₂ CO₂ as a cleaning agent has the advantage of not causing shrinkage. This is a new method originating from the industrial textile industry, but it has the disadvantage of there being little experience of using it on art objects. Besides, it is primarily used for soil particles on surfaces. Solvents are impractical for using in a bath and do not remove water-soluble substances like degradation by-products, which is an important aim of the treatment.

Bleaching with oxidation or reduction agents is often used in paper and textile conservation. However, both methods can be harmful to cotton if in a weakened condition, which is the case with the dark stained areas on Achrome (see Figure 13). Sun bleaching has been carried out on various Color Field paintings. This method is unsuitable for Achrome as it needs to be tautly stretched while wet. In addition, the size of the canvas could change and the creases be reduced. Bleaching the stains or the entire canvas could possibly reduce the stains, but the effect would be temporary.

It is possible to introduce an alkaline reserve into the canvas to curb degradation of the cotton by acidification. However, this will not prevent discolouration in the long-term.
Removing a canvas from a stretcher is often not desirable. In this case, the mounting is no longer original. Removal could have a mechanical impact on the tacking margin, but it also provides the opportunity to make adjustments, for example, by adding a strip lining to relieve tension on the tacking margin.

Washing of the canvas can be carried out using a float screen method. This entails placing the object on a layer of non-woven viscose textile which lies on a screen that is in contact with water in a bath. The strong capillary action of the viscose fibers draws water, along with any soiling, out of the object.70 This method avoids having to apply any mechanical force to the textile.71 Otherwise, the canvas can be placed in a bath, supported by a sheet of Melinex so it can lie completely flat and undisturbed in a bath. The paper studio of the SMA has a large bath for this purpose.

The pros and cons were weighed up after considering all the known possibilities. The full cleaning of Achrome in a bath is preferred over spot treatment. This offers the best chance of achieving a uniform, monochrome surface. Above all, it provides advantages for the condition over the long-term. The application of bleach is undesirable because this would probably be harmful to the cotton. Bleaching was also not a good solution in previous treatments. Besides, making the canvas lighter is unnecessary. It is possible to preserve the creases with a close monitoring of the drying process.

The probable limitations of the treatment result are acknowledged. Analysis of the stains could not determine their composition, which ruled out using highly specific cleaning agents (e.g., adding a chelating agent for iron stains). The dark stains have been present for more than 45 years and are still clearly obvious despite numerous local and full treatments.
Figure 16. Achrome before treatment (with previous retouches). f/8, 1/10 sec, iso 100.
Figure 17. Achrome after washing, before retouching. f/8, 1/10 sec, iso 100.
When an old stain continues to reappear, there is only a small chance that it can be permanently removed. There is a chance that only the discolouration will disappear with ageing, but that the stains will not turn lighter. Furthermore, the differing surface structure of the affected cotton seems to have made it appear darker (as seen in the Hirox photos), on which cleaning will have no effect.

Retouching
Retouching the stains was considered and tests were carried out on cotton test strips. Reversibility is crucial, but can be problematic in regard to the porous textile, especially when a liquid is needed for the application and removal of a retouch. Paint, loose pigment and pastel are difficult to remove and hardly reversible in this case. The optical characteristics of cotton are also difficult to emulate and it would be impossible to achieve the same lustre. Retouching with micro cellulose fibre without a binder is a possibility, by which the powder attaches by catching amongst the cotton fibres. This is a method that can successfully be applied to cotton duck canvas. Unfortu-
nately, the fine weave of the canvas on Achrome does not allow this. However, applying micro cellulose fibres with water and letting it dry can attain the desired effect. It is also very compatible in colour and composition as cotton is also mostly of cellulose. However, a wet application is only advisable when the cotton is clean, thus preventing tide lines. Such a retouch can be mechanically removed. A retouch is always a temporary solution for cotton as the material discolors differently from its cotton surroundings.

7 Treatment

Washing the front canvas
Washing was carried out in a bath in the SMA conservation studios assisted by textile conservator Emmy de Groot and supported by the conservation team. 72 The canvas was first gradually wetted with tap water (Figure 15). 73 De-ionised water (with its low conductivity) could possibly cause the fibres to swell too much with a prolonged washing process. 74 A
Figure 19. Result of the treatment, after retouching.
solution of tap water and detergent was then added: pH 7.5 and T of 20°C. The work was soaked in the wash bath for 3.5 hours with short sessions of light mechanical movement to encourage the uptake of soiling by the detergent. A sponge was used to absorb the soiling from the dark stains. After the wash bath, the work was rinsed three times with tap water and once briefly with de-ionised water.

The canvas was dried face down between absorbent tissues on a thick towel. The tissues were pressed lightly to make close contact with the object, so that moisture could evaporate through the tissues to avoid tide line formation on the object itself.

The result of washing was a clear reduction of tide lines and a more uniform lightness, which brings it closer to its original appearance (Figure 18). The surviving creases have remained clearly visible. As expected, the dark stains were not entirely removed, but certainly reduced. The white retouches were rinsed out.

The colour measurements objectively showed the difference in lightness and colour before and after washing (Table 1). The colour measurements were carried out using the L*a*b* system. The difference was calculated from the values measured before and after washing (ΔL*, Δa*, Δb* and ΔE). Discernible changes (ΔE > 5) occurred in the stains (locations D and G), tide lines (F) and an unstained area (I). As expected, the yellow-brown discoloration was particularly reduced (the values of yellow + Δb* and red + Δa* decreased). Two stains (D and G) and a tide line (F) became lighter.

A number of areas became darker (A, B, C, H and I, but only I is discernible by sight). With stains A and H, this is explained by the rinsing out of the white retouches. In general, it can be said that the canvas is less yellow due to cleaning, but not discernibly lighter (except for two stains and a tide line).

### Adjusting the stretching
A layer of Melinex was mounted over the back canvas. This forms a barrier against acidic off-gassing from the underlying stretcher and paint layer. A strip lining was applied to the front canvas tacking margins (Figure 16). A thin, plain-woven, white, 100% polyester fabric with very little elasticity was used. The fabric was attached to the canvas with running stitches to avoid using an adhesive. A double seam was made on all sides in order to evenly distribute the tension.

This way the canvas can be refitted without impacting damaged areas on the tacking margin. Before the treatment, a tracing was made of the exact position of the grid seams to ensure an accurate refitting. The current position of the seams exactly matches that before the treatment.

### Retouching
Retouching was restricted to toning down the dark stains. Powdered micro cellulose fibre was placed on the stain and spread out evenly with a porcupine quill (Figure 18). The retouch was then moistened with an ultrasonic mister (de-ionised water) and pressed down with the quill. It was possible to use a small amount of moisture because the canvas had just been washed hence there was no soiling that would form tide lines. After drying, the retouch proved to be a satisfactory coating. The micro cellulose’s lustre and transparency matched the colour of the surrounding cotton.

A minimal intervention was chosen for the retouching. A number of less obvious stains and patchiness remain visible (Figure 19).
Conclusion

This case study provided the opportunity to identify problems than can occur in the treatment of monochrome unpainted canvases. Various treatment methods were discussed and solutions formulated. The visual restoration of the Achrome concept while preserving the physical characteristics was essential for being able to show Manzoni’s intention. This was achieved by washing the front canvas and retouching the stains. The preliminary research was time-consuming, but due to lack of literature references, it was certainly necessary to be able to formulate a suitable treatment method. The examination with the Hirox microscope was an innovative and significant step with which insight was gained into the condition of the cotton bearing this kind of stain.

Standard textile conservation treatment methods were applied for washing the cotton canvas. Retouching with micro cellulose fibre is a technique often used for cotton duck fabric in Color Field paintings, for example. This method was adapted to Achrome’s fine weave in order to be able to apply a compatible and reversible retouch.

The strip lining could be attached without using adhesive, a method that also arose in collaboration with textile conservators. The barrier layer helps protect the front canvas against harmful effects caused by other materials in the object. Achrome’s treatment history has provided much insight into the issues surrounding the preservation of this type of conceptual artwork and into the dilemma that can arise when the preservation of the concept conflicts with the materials’ signs of ageing and the preservation of the historical evidence. The decision to wash the front canvas was made easier because the canvas had previously been removed from the stretcher and washed.

The treatment of Achrome was carried out successfully, whereby it can now be displayed once again. The reduction of the tide lines and application of retouches to the dark stains has resulted in a more uniform appearance. Now that the degradation by-products have been rinsed away, the condition has been improved for the long-term. The creases have been preserved and the canvas still fits its stretcher exactly. The monochrome aspect of Achrome can again be appreciated according to Manzoni’s intention.

Spot cleaning on this type of surface and artwork is not the best long-term solution. However, when a canvas cannot be removed from its support or a full cleaning is undesirable for other reasons, then spot cleaning remains a good alternative.

The collaboration and support of conservators and researchers of diverse specialities proved to be essential for formulating the correct treatment method.

The barrier layer will slow the future ageing of the work, but the process remains inevitable. Exposure to light must be restricted when the work is not on display.

Zusammenfassung


Acknowledgements

I would like to thank the following conservators and curators at the Stedelijk Museum Amsterdam for their collaboration and advice: Meta Chavannes, Louise Wijnberg, Sandra Weerdenburg, Marleen Wagenaar, Femke Segers, Soji Chou, Tessa Rietveld, Netta Kruumperman, Margriet Schavemaker and Bart Rutten. At the University of Amsterdam I would like to thank Kate Seymour, René Lugtigheid, Bas van Velzen, Vera Blok, Rene Peschar, Emilie Froment, Sara Molinari and Stéfania Lorenzotti. At the Cultural Heritage Agency of the Netherlands, I would like to thank Jan van ’t Hof, Ineke Joosten, Henk van Keulen and Frank Ligterink. Thanks also go to Camilla Kiltgaard Laursen (HEART Museum Herning), Francesca Pola (curator), Christiane Berndes (Van Abbemuseum), Rosalia Pasqualino di Marineo (Manzoni Foundation) for their support in studying sources. I would also like to thank the following conservators and researchers for sharing their knowledge: Lydia Beerksens (modern art conservator/SRAL), Jay Krueger (National Gallery Washington), Markus Gross (Foundation Beyeler), Alan Phenix (Getty Conservation Institute), Ellen Davis (Museum of Modern Art New York), Anne Getts and Patricia O’Regan (Fine Arts Museum San Francisco) James Bernstein (conservator of paintings and mixed media), Jos van Och (SRAL) and Luisa Mensi. Many thanks go to art historian Ernst van de Wetering and textile conservator Carin van Nes for sharing their knowledge and experiences during the treatment of Achrome in 1972. Finally, I would like to thank Jaap Boon (JAAP Enterprise for Art Scientific Studies Amsterdam) for translating this article.

Notes

1. Photographs by L. Kolkena, unless stated otherwise.
3. Fibres were identified as cotton using polarized light microscopy by B. van Velzen.
9. This research was conducted as part of a graduation project for the Conservation and Restoration of Cultural Heritage programme at the University of Amsterdam.
10. Literature on the treatment of canvas supports is focussed mainly on their structural function as a paint support, while visual aspects are often neglected. There is more literature dealing with spot cleaning (see 4). Watherston (1972) is an exception. The Getty Conservation Institute has been conducting research on the full cleaning and bleaching of partially unpainted paintings. To be published: Soldano, et al. A., Phenix, A., Michal Lukomski. 2017. Ripping yarns: the effect of aqueous washing and bleaching treatments on the colour and tensile strength of cotton duck canvas. Preprints of ICOM-CC 18th triennial meeting, Copenhagen, September 2017. Paris: ICOM.
14. This was discussed with SMA curators and external experts, Francesca Pola and Rosalia Pasqualino di Marineo.
15. See Figure 12 from 1970.
17. Van de Wetering described Achrome’s patina as a ‘normal’ result of ageing, which did not include the staining. Van de Wetering, 1973.
18. Described by Ernst van de Wetering, who was involved in the 1972 treatment of this Achrome.
21. 97.27 ml water, 2.6 g potassium and 0.13 g iodine.
22. See acknowledgements.
23. See acknowledgements.
27. Analysis with pXRF and GC-MS showed that the ground layer contained white titanium and a modified linseed oil glycerol alkyd resin. The paint layer contained drying linseed oil with a large amount of pine resin. Analysis showed an unexpectedly large amount of glycerol, the reason for which is unknown. From: Keulen and Joosten, 2015. The Manzoni’s signature on the canvas verso proves that the back canvas is an original element of this work.
28. This is also the case with other Achromes of this type. Luisa Mensi, personal communication, summer 2015.
29. Three reconstructions of Achrome were carried out according to
Manzoni’s methods and materials. Dry creased canvas, wet creased canvas and smooth canvas straight from the roll were used. The reconstruction using the dry creased canvas was the most similar to Achrome.

30. Celant, 2004
31. Manzoni could have used either bleached or unbleached cotton. His choice is no longer apparent because unbleached cotton also fades over time.
32. Manzoni Archief: E-mail communication 9-6-2015 and HEART Museum Herning archives.
33. Doc. no. 2730 SMA. “Removed creases by adjusting stretching tension. Stains dabbed with hydrogen peroxide (3%).” Doc. no. 2786 SMA. “After removal from the stretcher the linen was dipped in warm water (+ 60°C); remounted after drying.” Carried out by two SMA paintings conservators.
36. Documentation no. 3198 SMA. The canvas was first bleached with sodium hydroxide (5 g/L), sodium metasilicate (20 g/L) and hydrogen peroxide (5 vol 30%) in 1 litre of water. “Separately treated were a stain that remained visible, with sodium hydrosulphite (5% sol.), and a rust stain, with oxalic acid (5% sol.).” It was then washed with the surfactants Eripon H, Geigy (1 g/L) and alkyl aryl sulphonate (2 g/L), sodium tripolyphosphate (2.5 g/L) and carboxymethylcellulose (0.2 g/L) in de-ionised water at pH 8.5. Carried out by conservators and researchers at the Centraal Laboratorium.
39. Carbonyl compounds are chromophore systems, which consist of double bonds (C=O) that absorb part of visible light and give a yellow-brown colour. Timár-Bályásy and Eastop, 1998: p. 16, 17, 26 and 30.
43. The test was not very sensitive (detects a minimum of 5%) and starch could be locally present elsewhere.
44. The colour measurements were carried out before and after treatment while the front canvas was mounted over the back canvas. The effect of the treatment on the canvas’ colour and lightness can be determined by comparing these two measurements.
45. The paint layer on the back canvas also contained titanium and was included in the measurement of the front.
46. Patents from 1935 onwards show that titanium dioxide was added to household soaps. For instance, Patent US2428317, A. Edward J. Moran, 1947.
51. The signal for iron in the stains is very weak compared with the iron oxide stains from the staples on the edges, and so could not be the source. pXRF analysis carried out by Ineke Joosten, researcher at RCE.
52. The Manzoni Foundation also holds the opinion that an intervention for the purpose of preserving the work’s conceptual value is permissible when necessary. Personal communication with Rosalia Pasqualino di Marineo, October 2015, Milan.
53. Manzoni died prematurely in 1963 and had written nothing about the conservation of his Achromes.
56. Keijser, 2009. Due to the irregular surface of Achrome, it would also be difficult to achieve adequate contact with a rigid gel.
59. It can lower the canvas’ pH level and make the whole look more uniform. Hersh, et al, 1982.
61. This was confirmed by textile conservator Emmy de Groot, who has much experience with this. 28-5-2015.
65. As also experienced by De Groot. Personal communication, 28-5-2015.
66. This is an oxidising type of bleaching. Modern Materials and Contemporary Art Newsletter, 2014: p. 15-16.
67. Personal contact with J. Krueger, March 2015.
72. In preparation for washing, the canvas was first mechanically cleaned with a soft brush and vacuum cleaner. Previous retouches were partly removed by this.
73. As recommended by conservator James Bernstein, in order to avoid forming tide lines, the canvas was gradually moistened using a handheld mister.
75. CL Universal Detergent, which consists of 5% sodium citrate, 5% triton X-100, 10% CMC and de-ionised water, diluted 1:100 with tap water. Source: Labshop, personal communication, 10-6-2015.
76. Tide lines and stains form at the area where the water finally evaporates. The layers were left to dry overnight.
77. All colour measurements were carried out on the front canvas while it was mounted over the back canvas.
78. Calculated according to CIE 1976.
79. Polyethylene terephthalate film, Melinex® type S, 12 micron.
81. System developed following the recommendations of textile conservators Netta Krumperman and Emmy De Groot.
82. Boerenbonthal, article number 130107, 100% polyester. Personal contact with supplier in Weesp, July 2015.

83. Colour temperatures for Figure 17 and Figure 18 adjusted in Adobe Photoshop CS6 with Camera Raw 7.4 from 5000K to 6600K and colour +6.

84. Following advice by conservators James Bernstein, Jay Krueger and Ellen Davis. SolkaFloc® micro cellulose fibre 300 FCC (22 micron) was used. The correct colour was achieved by heating the powder to about 200°C, rinsing it with de-ionised water and grinding it beforehand.

**Literature**


Keijser, A. 'Reiniging met een poultice van watervlekken in een textile bespanning.' Scriptie afstudeeronderzoek opleiding textielrestauratie Instituut Collectie Nederland. 2009.


