

Klaas Jan van den Berg · Ilaria Bonaduce
Aviva Burnstock · Bronwyn Ormsby
Mikkel Scharff · Leslie Carlyle
Gunnar Heydenreich · Katrien Keune
Editors

Conservation of Modern Oil Paintings



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Preface

Modern Oil Paints

Oil paints continue to be used by contemporary artists, despite the introduction of a wide range of synthetic media. Although modern oil paints essentially consist of the same medium as paints made before the nineteenth century, the scale of production and formulation has changed significantly. A large number of additives to artists' paints may be present in modern oil paints, leading to a wide variety in their composition. These developments have in some instances led to compromises in the stability of the modern oil paints. The deterioration of works made using modern oil paints may also be due to the way the materials have been used by artists. This combination of material formulation and use and the impact on the condition of works of art is discussed by many authors in this volume.

The ageing process of oil paint has been linked to observed defects in both paintings and paint samples including water sensitivity, efflorescence, yellowing, dripping, crack formation, wrinkling, blooming, blistering, flaking and peeling.¹ Many twentieth-century paintings are particularly vulnerable since they were deliberately not varnished, and as a result, the painting surfaces may have attracted dirt preferentially and be degraded and sensitive to common methods used for cleaning.

These issues are likely to pose problems for conservators and collection keepers in the future. A deeper knowledge of these processes is important to conservation, which must consider both material preservation and aesthetics.

¹ A modern paint damage atlas and assessment tool has been developed partly within the framework of CMOP: the URL for the website will be made public in 2020 through <https://www.cultureelerfgoed.nl>.

CMOP and ICOP

This volume attempts to address the relationship between the formulation of modern oil paints and the deterioration of works made using oil media. These issues and the implication for conservation of works in modern oil media are discussed in 46 peer-reviewed chapters that were presented at the Conference on Modern Oil Paints, held in Amsterdam in 2018. This conference attracted 325 people from more than 30 countries, with a variety of backgrounds in art history, science, conservation and paint manufacture.

The conference marked the end of the Cleaning Modern Oil Paints (CMOP), a collaborative European research project, which explored the challenges associated with the conservation of the twentieth- and twenty-first-century oil paintings, paint formulation and deterioration. CMOP explored a range of topics associated with modern oil paints, including inventories of degradation phenomena and paint manufacture as well as selection and preparation of model paint samples. Also included were studies of the chemical and physical analysis of degradation of modern oil paints and paintings. Important for conservation practice were the development, testing and evaluation of cleaning systems and case study conservation treatments. CMOP was a Joint Programme Initiative Heritage Plus EU project partly funded by EU/H2020, NWO, AHRC and MIUR.²

Both the CMOP Conference and its Proceedings can be seen as a follow-up to the “Issues in Contemporary Oil Paint” Conference held in Amersfoort in 2013 and its ensuing Proceedings (van den Berg et al, 2014).

The chapters in this volume cover a wide variety of topics including aspects of oil paint manufacture, artists’ techniques and materials and degradation problems. These material aspects consider the conservation history of the works and the ethics, aesthetics and practical approaches to treatment. Where possible, the artists’ viewpoints on the display and conservation of their works are considered. Research includes experiments on model systems as well as case studies of individual paintings and collections of paintings, using analytical techniques that range from the naked eye to advanced and state-of-the-art instrumental methods.

The volume begins with two introductory chapters that are at the heart of the CMOP project. The first chapter, “Challenges in Research: Connecting Scientific Analysis with Conservation Practice”, discusses the need for conservators to evaluate scientific research to inform their conservation practice. “Evaluating Cleaning Systems for Use on Water-Sensitive Modern Oil Paints: A Comparative Study” is a keynote chapter summarising the approach and key findings of the CMOP project that relate to the practical surface cleaning of modern oil paint surfaces.

²<https://www.tate.org.uk/about-us/projects/cleaning-modern-oil-paints-0>

Paint Technology

The next six chapters discuss developments in technology of pigment and paint manufacture in the twentieth century. Chapter “Pigment Surface Treatments: Twentieth- and Twenty-First-Century Industrial Techniques and Strategies for Their Detection” presents information pigment surface modifications which have a profound influence on the production, rheology and probably ageing characteristics of paints. “Meet the Future: The Creation of New Pigments” presents the recent introduction of new pigments. The next four chapters provide insights into the paint manufacturer’s considerations on the introduction of new pigments in oil paint (“Synthetic Organic Pigments in Royal Talens Oil Paint 1920–1950”), reactivity of pigments and oil and their stability (“Zinc Oxide in Oil-Based House Paint: Insights from a Paint Chemist’s Notebook Dated 1949”), new oil-based emulsion paints (“Royal Talens’ ETA (Emulsion) Paint”) and the consequences of war-time shortage (“The House and Decorative Paint Market in Norway During World War I”).

Case Studies: Artists Techniques and Materials, Degradation, Ethical Considerations and Treatment Options

This large section comprises a range of case studies of individual paintings and collections of paintings, describing with varying foci a combination of artists’ biographies, techniques, materials and degradation problems, as well as conservation history of the works, ethics, aesthetics and practical conservation approaches.

The chapter “Ellsworth Kelly: The Studio and Beyond” discusses the artist’s materials and working practices as well as his changing attitude to the conservation of his works and the consequences for their treatment and preventive conservation.

“Bocour Oil Paints and Barnett Newman”, “Pigments of Soviet Artists in the 1950s–Late 1970s”, “Alkyd-Oil Enamel Paints in Early Reliefs by Jan J. Schoonhoven”, “Aspects of Lovis Corinth’s Painting Technique in His Late Work” and “Art Materials and Techniques in Edvard Munch’s *Old Man in Warnemünde* (1907)” describe the use of pigments and materials by the artists from different periods and geographic regions in the twentieth century.

“Modern Paints and Conservation at the Clyfford Still Museum” discusses the characteristic degradation and resulting conservation issues of paintings by the artist. Another study that takes into account the artist’s voice as well as materials and techniques is “A Study of Knifer’s Oil Paintings from the 1960s”. “Preservation of Russian Abstract Art of the Second Part of the Twentieth Century” describes some issues of works of modern art that were kept under poor conditions and now pose serious conservation issues and also considers the artists’ viewpoints.

A plethora of degradation problems related to materials and techniques used by a range of artists are discussed in “Oil Paint Straight from the Tube: Paint-Specific Deterioration in Works by Alexis Mérodack-Jeaneau (1910–1913)” and “Picasso

1917: Failure Mechanisms in the Paint Layers of Four Artworks”. Mechanical failure in paint and ground layers and their causes are examined in “Delaminated Areas in a Black Oil Painting from 1960 by Pierre Soulages”, “Paint Delamination in *C'est grace à nous* by Asger Jorn” and “Use and Degradation of Zinc White in *The Woodcutters* by Bart van der Leek” as well as in “Extreme Delamination on *Beach Scene* by J.E.H. Akkeringa (1861–1942). The deterioration of paintings characterised by materials protruding through the paint surface is discussed in “The *Speckles Syndrome* Affecting the Late 1920s Oil Paintings by René Magritte”.

The degradation of paints and potential conservation solutions are discussed in “Efflorescence on Edwin Austin Abbey's *The Spirit of Light*” caused by metal soaps on the paintings' surface. “Softening and Liquefying Oil Paint on *Womanizer* by Alex Janvier” and “Deterioration and Treatment of Some Late Paintings by Paul-Émile Borduas” also discuss the effect of sometimes detrimental previous conservation treatments on the present condition.

The description of typical and conservation challenges and the way conservators may deal with the practical, aesthetic and ethical issues related to patina, surface dirt and/or degradation phenomena are discussed in “Some Considerations when Cleaning Robert Ryman's Oil Paint(ings)”, “Challenges of Surface Cleaning Paintings by Asger Jorn (1914–1973)” and “Decision-Making Processes Regarding the Treatment of Modern Oil Paintings (1950s–present) exhibiting paint dripping and oil exudates”.

Model Studies

Six chapters focus on analytical approaches to the study of the chemical and physical degradation of oil paint and the effects of conservation treatment. Chapter “Investigations into the Mechanical Properties of Commercial Artists' Oil Paint by Dynamic Mechanical (Thermal) Analysis (DMA), Nanoindentation (UNHT) and Dynamic Vapour Sorption (DVS)” examines physical/mechanical properties of small oil paint samples with a range of state-of-the-art techniques. “A Preliminary Investigation into the Behaviour of Modern Artists' Oil Paints in a Hot and Humid Climate” presents information on the influence of tropical and moderate climates on paints, while the influence of high temperatures on curing and ageing of oil paints is studied in “Inside the Forger's Oven: Identification of Drying Products in Oil Paints During and After Accelerated Drying with Increased Temperatures”. Chapter “The Influence of Metal Stearates on the Water Sensitivity of Modern Oil Paints” describes some of the influence of metal stearate additives on the polymeric/ionomeric network of the oil paints and related solvent sensitivity of oil paints. Chapter “The Rate of Solvent Action on Modern Oil Paint” discusses fundamental aspects of solvent interaction with modern oil paint model systems.

Conservation Treatment

Amongst the most challenging practical conservation interventions is surface cleaning of solvent-sensitive paint surfaces. “Water Sensitivity in Modern Oil Paintings: Trends in Phenomena and Treatment Options” and “Modern Oil Paintings in Tate’s Collection: A Review of Analytical Findings and Reflections on Water Sensitivity” summarise the results of studies of the extent of water sensitivity of modern paintings to water and possible options for treatment. Potential alternative solutions are presented in chapters “Analytical Study to Monitor the Effectiveness of a Combined Liquid-Dispensing and Micro-aspiration System for the Cleaning of Modern Oil Paintings”, “Analysis of Cleaning Efficacy and Clearance of Silicone-Based Pickering-Type Emulsions Used in the Cleaning of Water-Miscible Oil Paints”, “Improving the Surface Cleaning of Water-Sensitive Oil Paint by Use of Alternative Application Methods” and “Designing Mock-Up Paintings for a Study of Novel Surface Cleaning Techniques for Munch’s Unvarnished Aula Paintings”. Chapter “Ketone Resins Varnishes on Canvas Paintings from the Collection of the Munch Museum” presents work on paintings by Munch, while “Evolon® CR Microfibre Cloth as a Tool for Varnish Removal” reviews a method for varnish removal without mechanical action with a novel microfibre cloth. Finally, chapter “Can Cellulose Beads Save the *Circling of the Planets*? Cellulose-Based Consolidating Filler to Stabilise Lifted Brittle Flakes on a Large Painting” presents a new filler composition to consolidate a fragile, extensively flaking painting by Giacometti.

This volume aims to combine technical evidence and the conservators’ perspective on the challenges related to conservation of modern oil paintings and to provide a basis for decisions related to treatment, storage and presentation of paintings in oil media.

We thank all our colleagues who contributed to this volume. We are grateful for the national agencies involved in the JPI Heritage Plus EU for funding the CMOP project and the Rijksmuseum for hosting the Conference on Modern Oil Paints. NWO, Rijksmuseum, AKZO Nobel and the Cultural Heritage Agency of the Netherlands are gratefully acknowledged for financially supporting the Conference on Modern Oil Paints and its Proceedings.

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Chapter 1

Challenges in Research: Connecting Scientific Analysis with Conservation Practice



Aviva Burnstock, Klaas Jan van den Berg, Judith Lee, and Bronwyn Ormsby

1.1 Introduction

One of the key aims of the CMOP research program is to inform conservation practice for the treatment and display of modern oil paintings. The focus of research has been on the causes of water sensitivity based on molecular level studies of the curing and chemical changes on ageing of modern oil paints, and the removal of dirt from water sensitive unvarnished paintings. These studies have involved analysis of the composition and chemistry of manufactured modern oil paints and samples from paintings and testing some novel practical approaches to treatment. This paper aims to provide an introduction for conservators who are required to evaluate scientific research to inform their conservation practice. The range of methods and approaches to research in selected recent studies is highlighted together with suggestions about how the results of molecular level material studies may be used by conservators to guide more specific and appropriate treatment choices.

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1.2 Material Characterisation of Paintings

Fundamental research that aims to provide guidelines for conservation is challenged by the material complexity of paintings. The variety of materials, techniques and physical histories of works of art have a pronounced influence on their condition. Therefore, molecular characterisation of materials from paintings requires consideration of the presence of combinations of materials and their interactions, ageing properties and past and present chemical and physical environment. Despite these issues of interpretation of complex data, combined methods for technical research has led to significant advances in understanding a range of deterioration phenomena in paintings, notably the characterisation of metal soaps, salts and fatty acid efflorescence in oil paintings.

The most useful studies for conservators combine analytical characterisation of specific material deterioration based on molecular or spectral indicators linked with visual and microscopic evidence of the surface phenomena. The use of conventional light microscopy in these studies is critical for conservators who are familiar with this technique, while images of paintings or paint samples produced using Hirox, electron microscopy and other high-resolution techniques such as atomic force microscopy require more detailed interpretation of the practical implications of the results. Concomitantly, few conservators have access to resources for molecular analysis of organic materials, and thus rely on generalisations based on the results of analytical investigations that are often limited to case studies. The relationship between the results of material analysis and recommendations for treatment may influence conservation decision making and practical approaches to treatment. For example, deterioration of the paint surface that includes the accumulation of polar free fatty acids at the surface could indicate sensitivity to protic solvents [2, 8]. Alternatively, surface whitening caused by migration and aggregation of fatty acids to the paint surface that can take various forms is typically removable using solvents or if possible, dry polishing with a silk cloth [5]. Where surface crusts and whitening caused by the formation of metal soaps compromise reading of the composition, an approach may be to reduce the soaps using chelating agents with a preference for the metal to be removed and a low preference for chelation of the underlying paint [11]. Alternatively, soaps that have formed as part of the ageing of the work might be best left alone and the visual impact accepted or considered in the approach to retouching. In all these cases, molecular material characterisation has been critical for guiding treatment options, while the skill and judgment of the conservator remains key to the success of the treatment.

In relation to cleaning unvarnished paintings, fundamental analytical studies based on single case studies of paintings may provide data of limited general value, given the variation in artists' materials and technique, and the deterioration and condition of the works. Cleaning case studies typically report the use of an approach to treatment that removed unwanted surface material without removing paint, and few studies include a critical evaluation of the risks and choice of reagent and method of application that are important criteria for conservation practice.

1.3 Paint Samples and Reconstructions

Recent research on the chemistry of modern oil paints has benefitted from access to historical paint samples such as the set from the leading British brand Winsor & Newton that include paint-outs of every batch of oil paint made at the factory.¹ These samples are dated and naturally aged and provide a starting point for comparison with similar materials used in paintings. The composition and surfaces of the Winsor & Newton and other brands of manufacturers paint samples have been characterised using a combination of methods, including FTIR, GC-MS and electrospray MS and light microscopy combined with SEM-EDX for elemental analysis of the composition of oil paint and surface examination [6, 8].

The results of the analysis of manufactured paints and naturally aged paint outs has informed the production of new samples of known standardised composition, with the aim of identifying the aspects of paint formulations that affect curing, drying, changes on aging, and the cleaning of modern oil paints. As modern manufactured paints include additives to modify and homogenise the paints in a range, there are physical and chemical interactions that may contribute to their deterioration and resulting sensitivity. The interpretation of analytical studies of modern oil paints has been based on a model of oil paint that contains glycerides that oxidise and cross link to form a polymeric network, whilst in parallel, hydrolysis and oxidative scission reactions form free carboxylic acids, and saponification reactions form metal soaps [13]. These processes may be influenced by pigments that incorporate reactive or mobile metal ions, or those that do not contribute toward the formation of an ionomeric network. Based on a significant body of analytical research, this model was accepted some time ago and new analytical findings may help to refine the model.

To enable systematic study of the deterioration or the effects of different reagents on paint films, paint samples of homogeneous consistency have been produced and then artificially aged to try to mimic changes in the films that might occur under natural conditions. Some of the historical samples and experimental reconstructions of modern artists' oil paints produced for study have closely replicated the surface characteristics observed on paintings. For example, the formation of skins of medium and medium separation in ultramarine-containing paints has been consistently observed both in paintings and in experimental samples. These findings are useful to conservators together with the results of studies that medium skins may be associated with sensitivity to water and protic solvents caused by the formation of polar degradation products at the paint surface [2, 7, 8]. Some paints develop polar

¹The paint swatches/samples were donated to Tate's science department by Ian Garrett, former Technical Director of Winsor and Newton, on the closure of the W&N factory at Wealdstone in North London in 2011. They include paint-outs of every batch of oil paint made at the factory applied to canvas or card. Each patch of paint is dated and the purpose of each paint out was to test for drying time. The painted areas are approximately 5 cm x 10cm and therefore represent valuable historical records of paints made at the factory to be used intelligently and sparingly in analytical and cleaning investigations.