

# Preface

Modern paints offer many challenges for scientists and conservators alike, and have consequently been studied in some depth over the past two decades. *Modern Paints Uncovered*, a symposium held in 2006 at Tate Modern in London, was the first professional event devoted specifically to addressing the conservation issues of modern paints. Research presented there included advances in analytical methods, improved understanding of the physical properties and surface characteristics of modern paints, and assessments of the effects of cleaning treatments on painted surfaces. However, at that time much of the profession's attention was directed towards acrylic emulsion paints, the most widely used of all the artists' synthetic polymer paints, with relatively few studies being undertaken on modern oil paints.

Artisans and artists are known to have been using oil paints for centuries<sup>1</sup> but particularly the industrial developments in the nineteenth and especially the twentieth centuries have resulted in significant changes to that material. The modification and application of oil paints by artists have continued to evolve in the twentieth century. In addition, many paintings are unvarnished and so atmospheric influences happen directly to the paint surface. These developments make it reasonable to say that modern oil paintings have properties which are distinctly different from traditional paintings and thus provide many unique challenges for conservators and curators.

The *Issues in Contemporary Oil Paint* (ICOP) symposium, held in 2013 in Amersfoort, the Netherlands, provided a forum to discuss these challenges and to offer new information that will help conservators and curators recognise problems and interpret visual changes on paintings, which in turn may help to give a more solid basis for decisions on the treatment of these paintings. Furthermore,

---

<sup>1</sup>Raspe RE (1781) A Critical Essay on Oil-painting; proving that the art of painting in oil was known before the pretended discovery of J. and H. van Eyck; to which are added, Theophilus de Arte Pingendi, Eraclius de Artibus Romanorum, and a review of Farinator's Lumen Animæ. London, Goldney and Cadell.

interactions with paint makers and scientists were intended to provide more information on the application and stability of paints to artists who are concerned with the longevity of their artwork.

The present proceedings represent 27 long and short presentations at the ICOP symposium. The Chapters have all undergone a peer-review process and cover a range of topics. These range from developments of paint technology, working methods of individual artists, through characterisation of paints and paint surfaces, paint degradation and the factors that influence this versus long time stability, to observations of issues in collections, cleaning and other treatment issues as well as new conservation approaches.

## Research and Conservation

Chapter “[Twentieth Century Oil Paint. The Interface Between Science and Conservation and the Challenges for Modern Oil Paint Research](#)” discusses the way in which research can inform conservation by collaboration between conservators and scientists. This is done through utilisation of phenomenological and experimental methodologies to investigate the causes of optical changes in paint. Some examples of results based on case studies of paintings and the results of systematic experimental investigation of paint samples are given. This essay is corroborated by a personal account of 25 years of research, conservation treatment and display of paintings at the Stedelijk Museum in Amsterdam in chapter “[Do We See What We Know or Do We Know What We See? Conservation of Oil Paintings in the Stedelijk Museum Amsterdam](#)”. The relationship between painting technique and paint quality is discussed in relation to the works of important artists in the museum’s collection, including constructivists, Cobra artists and modern American painters from the 1950s to 1970s. Interestingly, while knowledge and appreciation of deterioration phenomena on these paintings has substantially increased in recent years, this in turn has often led to less conservation treatment.

## Developments in Paint Technology

Many new pigments were introduced in the twentieth century, especially synthetic organic pigments. In chapter “[The Delight of Modern Organic Pigment Creations](#)”, an extensive survey of their history and development in production is presented. Introduced in paints, the interaction of the organic pigments with the paint matrix can be poor which may make them vulnerable to solvents used in cleaning operations. In chapter “[Sensitivity of Modern Oil Paints to Solvents. Effects on Synthetic Organic Pigments](#)”, the sensitivity of a range of these organic pigments towards dissolution and mechanical action in conservation treatment is discussed. Chapter “[Distinction by Micro-Raman Spectroscopy and Chemometrical Analysis of Copper](#)”

Phthalocyanine Blue Polymorphs in Oil-Based and Acrylic Paint samples” describes one of the most important representatives of this group, PB15 copper phthalocyanine blue together with the characterisation of its polymorphous phases.

An overview of developments in oil paint manufacture is presented in chapter “Modern Oil Paints – Formulations, Organic Additives and Degradation: Some Case Studies” and highlighted with a range of analytical results from a number of tube paints and paintings. In chapter “Charting the Development of Oil-Based Enamel Paints Through the Correlation of Historical Paint Technology Manuals with Scientific Analysis”, an overview of developments in technology of oil-based enamel paints in the first half of the twentieth century is given; literature published in French and English is complemented by analysis of historical oil-based Ripolin enamel paint samples produced in France.

## Artists’ Ideas and Working Methods: Archival Sources

Chapter “Towards Interpretation of Making, Meaning, and Change in British Twentieth Century Oil Paintings: The Relevance of an Artist’s Paint Archive” describes the archive of the artist Patrick Heron (1920–1999), as well as his paints that form a great resource for study. In chapter “Hans Hofmann’s Last Lesson: A Study of the Artist’s Materials in the Last Decade of His Career”, a technical study of a very large number of paint samples from the late-career work of the artist Hans Hofmann (1880–1966) is presented. Both studies will form a basis for a better understanding of the works of these artists and preservation of their paintings in the long term. In chapter “*Zwei Jünglinge und zwei Mädchen*, A Tempera Painting by Otto Mueller Circa 1917. Paint Analysis and Reconstruction”, materials used for the matte painting *Zwei Jünglinge und zwei Mädchen* (c.1917) by the *Brücke* artist Otto Mueller is discussed on the basis of archival research, analysis and paint reconstruction. The complex mixture of materials found in the painting indicates the use of animal glue/egg/oil tempera paints and highlights the later addition of materials in conservation procedures.

## Case Studies of Paintings: Esthetics and Conservation Issues

Three studies are presented in these proceedings describing techniques and practical conservation procedures of the works of avant-garde artists: *Théorème de Gödel* (1957) by Georges Mathieu (chapter “*Theoreme De Godel* by Georges Mathieu, 1957. Study and Restoration: Consolidation Through Cohesive Regeneration Using a Solvent”); *Cakes* (1955) by the Croatian neo-avant-garde artist Josip Vaništa (chapter “Non-traditionally Painted Oil Painting: How to Treat It Properly? Josip Vaništa’s *Cakes* (1955)”) and *Fleurs Grises* (1953) by Nicolas de Staël. For all three studies, the non-traditional techniques are an issue that required careful

consideration of the aesthetics to be achieved in the conservation procedure, the actual treatment of paint consolidation and surface cleaning, and climate conditions for further storage and display.

## Paint Degradation and Analysis

Chemical and physical changes are occurring constantly in paintings. Degradation may be local, superficial or throughout a paint system, and constituent materials can migrate through the paint, for example to its surface, causing optical effects. These can be whitening effects and are often referred to as efflorescence, or other visual disturbances, as is the case for protrusions of metal soaps. Rationalisation of degradation phenomena in paints and paint systems is discussed throughout the Proceedings. A wide range of traditional and novel, state-of-the-art analytical techniques are used and described to analyse painting materials and their degradation products. A novel technique for localising degraded materials is described in chapter [“Derivatisation Technique for Infrared Spectroscopy – Characterisation of Oxidative Ageing Products in Modern Oil Paint”](#), employing gaseous sulfur tetrafluoride SF<sub>4</sub> to modify oxidised products of paints specifically, allowing for a spatially resolved localisation of these products in paint cross sections.

Zinc white pigments became increasingly popular in the twentieth century. Chapters [“Conservation Issues in Several Twentieth-Century Canadian Oil Paintings: The Role of Zinc Carboxylate Reaction Products”](#), [“Zinc White and the Influence of Paint Composition for Stability in Oil Based Media”](#) and [“Its Surreal: Zinc-Oxide Degradation and Misperceptions in Salvador Dalí’s \*Couple with Clouds in Their Heads\*, 1936”](#) discuss the reactivity of this pigment in oil paint specifically, using a range of advanced analytical techniques. Zinc soaps are the main product of the initial reaction of zinc white with fatty acids either from the drying oil or lipidic additions. Even more pronounced is the formation of these soaps from zinc white and aluminium stearate (chapter [“Zinc White and the Influence of Paint Composition for Stability in Oil Based Media”](#)). Chapter [“Conservation Issues in Several Twentieth-Century Canadian Oil Paintings: The Role of Zinc Carboxylate Reaction Products”](#) presents more information that excessive amounts of zinc soaps may cause problems of delamination, and optically disfiguring protrusions and efflorescence. Other degradation products from zinc white, either via zinc soaps or directly, are zinc sulphide, and zinc soaps from small fatty acids, such as formate and acetate and lactate. Chapter [“Its Surreal: Zinc-Oxide Degradation and Misperceptions in Salvador Dalí’s \*Couple with Clouds in Their Heads\*, 1936”](#) discusses the formation of such products from atmospheric products in specific reaction-diffusion processes. The formation of metal soaps from others sources is described in other Chapters. For example, in chapter [“Metal Soaps and Visual Changes in a Painting by René Magritte – \*The Menaced Assassin\*, 1927”](#), protrusions or pustules on the surface of the *Menaced Assassin* (1927) by René Magritte, previously thought to be mould growth, were shown to be metal soaps. Here the metal base, possibly

calcium, zinc or lead, is still unidentified. The presence of visually disfiguring lead soap crusts and remineralised products such as lead carbonates on early twentieth century paintings are described in chapter [“An Investigation into the Viability of Removal of Lead Soap Efflorescence from Contemporary Oil Paintings”](#).

Modern artists have applied paints in very experimental ways, for example by painting directly from the tube, creating very thick paint films. Depending on the type and quality of the painting materials, their application, as well as environmental conditions, this occasionally leads to major problems. One of the problems is the dripping phenomenon, where apparently dry paints liquefy and start to drip years after their applications; examples are described in chapter [“\*Theoreme De Godel\* by Georges Mathieu, 1957. Study and Restoration: Consolidation Through Cohesive Regeneration Using a Solvent”](#), [“Investigating Fluidizing Dripping Pink Commercial Paint on Van Hemert’s \*Seven-Series\* Works from 1990–1995”](#), [“Hard Dry Paint, Softening Tacky Paint, and Exuding Drips on \*Composition\* \(1952\) by Jean-Paul Riopelle”](#) and [“Set Back the Race: Treatment Strategies for Running Oil Paint”](#). The reason for this liquefaction process lies partly in the use of semi-drying oils with a relatively low iodine value (i.e. lack of double bonds). Hypotheses for the phenomenon are presented in chapter [“Investigating Fluidizing Dripping Pink Commercial Paint on Van Hemert’s \*Seven-Series\* Works from 1990 to 1995”](#); the liquefaction process and possible treatment strategies for the subsequent curing of the paint are described in chapter [“Set Back the Race: Treatment Strategies for Running Oil Paint”](#).

The problem of water sensitivity of oil paint surfaces, which offers major difficulties in the cleaning treatment of paint surfaces, is mentioned in several chapters. In chapter [“Water Sensitive Oil Paints in the Twentieth Century: A Study of the Distribution of Water-Soluble Degradation Products in Modern Oil Paint Films”](#), water sensitivity due to magnesium sulphate heptahydrate formation is explained to be largely a surface phenomenon, corroborating the evidence that this type of sensitivity is caused mainly by reaction of magnesium carbonate in the paint with atmospheric sulphurous compounds. This is further substantiated in a number of case studies of paintings from the Tate collection.

## New Conservation Approaches

In the last Chapters, actual treatment strategies for surface cleaning are proposed. Chapter [“Investigation into the Surface Conductivity of Water-Sensitive Modern Oil Paints”](#) discusses how the measurement of conductivity of an oil paint surface can be a useful indicator for water sensitivity caused by water-soluble salts. In chapter [“An Investigation into the Viability of Removal of Lead Soap Efflorescence from Contemporary Oil Paintings”](#), on efflorescence of metal soap crusts, an approach is proposed which utilises EDTA chelating agents, which provides a balance between thinning down the crust layer whilst respecting the original paint surface. Chapters [“Dry Cleaning: Research and Practice”](#), [“New Approaches to Surface Cleaning](#)

of Unvarnished Contemporary Oil Paintings – Moist Sponges and Cloths” and “Agar – A New Tool for the Surface Cleaning of Water Sensitive Oil Paint?” discuss approaches for removing dirt from solvent-sensitive paint surfaces: Chapter “Dry Cleaning: Research and Practice” discusses a range of dry cleaning materials, chapter “New Approaches to Surface Cleaning of Unvarnished Contemporary Oil Paintings – Moist Sponges and Cloths” reports the potential for using moistened sponges for paint surfaces, and in chapter “Agar – A New Tool for the Surface Cleaning of Water Sensitive Oil Paint?” agar gels that can be applied in liquid form and removed as a sol are discussed, limiting the amount of water released into the paint and reducing the mechanical action to a minimum.

We are grateful to the different institutions who supported the work that led to the organisation of the ICOP symposium and the compilation of articles for these Proceedings, especially the twentieth century oil paint research group at Cultural Heritage Agency of the Netherlands, *Object in Context* programme leader Tatja Scholte and the Agency’s management. We furthermore thank all professionals who were involved in the research that forms the basis of these Proceedings.

Amsterdam, The Netherlands  
30 June 2014

Klaas Jan van den Berg  
Aviva Burnstock  
Alberto de Tagle  
Matthijs de Keijzer  
Gunnar Heydenreich  
Jay Krueger  
Tom Learner

Issues in Contemporary Oil Paint

Burnstock, A.; de Keijzer, M.; Krueger, J.; Learner, T.; de

Tagle, A.; Heydenreich, G.; van den Berg, K.J. (Eds.)

2014, XV, 430 p. 132 illus., 102 illus. in color.,

Hardcover

ISBN: 978-3-319-10099-9