

Preliminary programme of the conference

Tempera painting between 1800 and 1950

Experiments and innovations from the Nazarene movement to abstract art

15 March – 17 March 2018

hosted by the Doerner Institut, Bayerische Staatsgemäldesammlungen Munich
in cooperation with the Academy of Fine Arts, Munich

funded by VolkswagenStiftung and IPERION CH

Lectures

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The art theoretical discourse on oil, tempera and the diversification of painting techniques

Matthias Krüger

The paper analyses the art theoretical, art historical and art critical discussion of painting techniques during the 19th and the early 20th century. What kind of insight had art-theoreticians, art historians and art critics in the practical aspects of painting? What meaning did they attach to different painting techniques? And how did they interpret the historical shift from oil to tempera in early modern times and how did they react to the tempera revival in the 19th century. The paper is intended to give a broad survey of the debate in both the 19th and the first half of the 20th century.

Biography

Matthias Krüger, art historian, holds a lectureship at the institute for art history at the Ludwig Maximilians Universität in Munich. He has earned his doctorate with a thesis on impasto techniques in French painting in the second half of the 19th century (published as "Das Relief der Farbe"). He has taught art history at Hamburg, Munich, Bern and Bamberg. Specialised on modern and contemporary art, he has published on colour, colour theory, painting tools (badger brush, palette knife, palette), and the history of exhibitions. His habilitation focuses on the interplay of regionalism and exoticism in the late 19th and early 20th century.

Tempera: Questions of Terminology

Eva Reinkowski-Häfner

The first thing that an international group of restorers, scientists and art historians must do when discussing 19th and 20th century tempera painting is to clarify terms – the term “tempera” has been, and still is, used in different languages to describe various binders and painting techniques.

In 1847 Charles L. Eastlake summarised the meanings given to “tempera” in painting technique source texts up to 1800. Tempera was generally used to mean “binder”, in a narrower sense to mean an aqueous binder and in the narrowest sense an egg binder. Henceforth tempera came to be seen above all as a binder based on aqueous media as opposed to oil-painting.

Questions of terminology and interpretation with regard to tempera painting first arose at the start of the 19th century with the onset of research into painting technique. Whilst the English researchers Mary Merrifield, Charles L. Eastlake, the painters of the Society of Painters in Tempera and the American teacher of painting technique, Daniel Thompson, closely followed Cennini and his egg tempera, the French painter Paillot de Montabert, 1829, had known a mixture of egg yolk and resin as “peinture à l’oeuf”, which the painter Jean Vibert took up again in a modified version in 1891. In the Italian literature of painting technique the stress was placed on binders for tempera being purely aqueous. Furthermore in 1924, the painter Giorgio de Chirico named a water-miscible egg-oil-recipe, which he had taken from the professors of the Munich Academy, Ernst Berger and Max Doerner, “tempera grassa”. However, in the 6th edition of his book *The Materials of the Artist and Their Use in Painting* of 1938, Max Doerner described tempera as emulsion, whereby he included O/W as well as W/O emulsion. W/O emulsion was described as “fette Tempera”, only miscible with fatty or volatile oils. Kurt Wehlte, the Stuttgart teacher of painting technique, repeated this in 1967 when he wrote: “Tempera is in any event an emulsion regardless of whether the aqueous or the non-aqueous portion of the binder is the greater.”

The question arises as to the reason for the discrepancy between the definitions of Eastlake (1847) and Doerner (1938) and points to a peculiarly German interpretation. The definition “tempera is an emulsion” developed in Germany in the course of the 19th century, fuelled by researches into painting technique in the early 19th century with their interpretations of technical source texts, the endeavours of painters to copy the tempera painting of the Old Masters and by the efforts of paint manufacturers struggling with the difficulty of filling tubes with tempera paints as stable and durable pigment pastes. In the end just about any mixture with an aqueous and non-aqueous binder was understood to be tempera. This definition of tempera led to misinterpretations and insufficient differentiation between tempera paint and an oil paint that had been adulterated with aqueous media in order to change the consistency or the drying qualities. As soon as chemical analysis revealed a mixture of protein and oil, the discussion was of tempera, regardless of the intentions of the artist.

This paper offers as an outline a preview of what the individual conference papers will make clear: when engaged with tempera and tempera painting, the historical development of the term must be taken into consideration and a definition of tempera specific to the time and/or

the individual artist settled upon, based on research into sources, examination of painting surfaces and scientific analysis. A differentiation between tempera and oil paints must be effected by the description of physical-chemical and colloidal properties.

Biography

Dr Eva Reinkowski-Häfner, conservator and historian of art technology, obtained a MA in art history at the University of Erlangen-Nürnberg, followed by a traineeship in conservation techniques at the Institute for Art Technology and Conservation (IKK) at the Germanisches Nationalmuseum, Nürnberg. She absolved an academic traineeship at the IKK and obtained her PhD in preservation of historical monuments and restoration science from the Institute of Archaeology, Heritage Sciences and Art History (IADK) of the University of Bamberg in 2014. Since 2004 she has lectured on art technology at the Hochschule für Bildende Künste in Dresden and since 2017 at the IADK in Bamberg. In her work as a conservator she has held positions at the Amt für Denkmalpflege im Rheinland in Brauweiler, at the Restaurierungszentrum der Landeshauptstadt Düsseldorf/Stiftung Henkel and practiced as a freelance conservator in Munich.

‘Then egg, then watercolor or tempera paints, then alcohol resin’ – Paul Klee’s tempera painting techniques

Patrizia Zeppetella, Stefan Zumbühl, Nathalie Bäschlin

Various projects concerning research, conservation and restoration have been undertaken since 1998 at the Paul Klee Foundation, Kunstmuseum Bern, and later at the Zentrum Paul Klee. In conjunction with these projects Klee’s own terminology for painting techniques repeatedly became a key issue. Paul Klee used the term “tempera” for the first time in 1905 in the handwritten oeuvre catalogue of his oeuvre. He began the catalogue in 1911 and added the term to an older entry, namely for the piece *Weibl Akt, aus e. blauen Gewand heraussteigend* (Young female nude, stepping out of a blue dress). He declared his painting technique as using “lead pencil, tempera white, and watercolor”. In the 1910s, 23 artworks have “tempera” added as the medium (to half of them it was first included in 1914); in the 1920s, 22 (mostly added in 1922). The entries dated 1937 and 1939 have the largest number of works for which the artist has noted the use of “tempera”. Klee’s handwritten ‘oeuvre catalogue’ is a rich source of information about painting techniques, and it is indispensable for understanding his highly diverse art. However, these documents can only reveal specific information if we can properly comprehend the artist’s terminology. This can be seen especially in the case of the term “tempera”: Klee hardly ever used it on its own, but saw it rather as associated with a broad spectrum of techniques.

Research of the past concentrated mainly on differentiating between the terms “Tempera” or “Kleistertempera” (tempera paste) and “Kleisterfarbe” (pigment in glue), “Wasserfarbe” (water-based paint) and “Aquarell” (watercolor) or “Aquarell-Gouache” (watercolor-gouache). The specific outcomes led to the thesis that Klee saw the term “tempera” as not only embracing water-based techniques but also binding mixtures that can be combined with water (e.g. oils and gums). Therefore it remains difficult to define his use of “tempera” as

distinct from Wasserfarben (water-based paints) or Aquarell (watercolors), which is illustrated in descriptions such as 'Wasserfarben gefirnisst / Pappe', (water-based paint with varnish / cardboard) [193], for which he specified the following in 1933: "schwarzer Grund Öl, dañ Ei, dañ Aquarell bezw Temperafarben dañ Alkoholfirnis"(black primer oil, then egg, then watercolor or tempera paint, then alcohol resin). New analyses are to take up the thesis anew and adopt a reverse approach to shed light on the problem. For this purpose the art materials are currently being analyzed to precisely define the individual layers of paint as well as the material structure of a selection of his pictures. In case examples, the objective is to comprehend the materiality of the artworks by analyzing the binders and comparing the results with Klee's descriptions. The focus therein is not to be primarily directed toward defining "tempera" as distinct from other terms for painting techniques but also directed toward comprehending the similarities between them. What do the works for which Klee includes the term have in common? Is there a correspondence between specifying the use of tempera and the material components and/or the structure of the painting technique. To what degree did he target specific color effects by the way he combined materials? Was his use of terminology versatile, or did it perhaps change over time etc.? This initiative seeks to better understand Paul Klee's terminology for painting techniques and thus be able to better comprehend the wealth of context information on his artworks in the future. What is the state of conservation in the examples being analyzed and what challenges must be faced in the conservation of these artworks?

Biographies

Patrizia Zeppetella, Painting Conservator Zentrum Paul Klee Bern and responsible for the conservation of the Klee Family Collection since 1992

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'Colour and form in highest perfection'. Teaching the materials and techniques of tempera painting in the early 20th century.

Kathrin Kinseher

The revival of tempera painting in the late 19th and early 20th centuries was accompanied by an increasing knowledge in the use of tempera paints. This paper will look at the teaching of tempera painting in the early 20th century when painting techniques and materials had become a new subject in the training of artists. The paper presents an overview of teachers in London, Vienna, Berlin and Munich, where the teachers were either professional chemists or artists. How did they define and describe the term 'tempera'? What teaching methods did they use and which role models in art history did they rely on? What did they publish on tempera painting and what influence did they exert on their students?

The investigation reveals the artists' knowledge of tempera in the early 20th century and presents different practices and ideas of tempera painting. Individual points of view on tempera, and as well interrelations will be discussed in relation to the following teachers: the artists Ernst Berger, Walter Crane, Max Doerner, Kurt Wehlte, Albertus Wirth; the chemists A.H. Church, Alexander Eibner, A.P. Laurie, Friedrich Linke and Ernst Täuber.

Biography

Dr Kathrin Kinseher is a researcher in the field of technical art history and head of the studio for painting techniques and materials at the Academy of Fine Arts in Munich. She received her diploma in painting conservation at the Cologne Institute of Conservation Sciences and holds a PhD from the Technical University of Munich. Her research interests have focused on painting materials and artistic painting practices, manufacturing of art materials, the history of art technological research and scholars in this field such as Adolf Wilhelm Keim and Ernst Berger.

The Tempera Revival at the Yale School of Art and the collection of Early Italian Paintings at the Yale University Art Gallery: a source of inspiration, knowledge and comprehension

Irma Passeri

Between 1926 and 1933, Daniel V. Thompson was assistant professor of art and an instrumental figure at the Yale School of Fine Art. During his appointment, he taught tempera painting and introduced Yale students to the materials and techniques of Medieval and Renaissance art, as well as how they could be applied in modern painting practice. In 1933, he published an English translation of Cennino Cennini's *Libro dell'Arte* under the title *The Craftsman's Handbook*. This, and his other publications focused on the practice of tempera, had a vast impact on the way in which artists, art historians, and art conservators perceived, understood, and studied Early Italian paintings. In 1933, Thompson left Yale to become a professor of history of art technology at the Courtauld Institute in London. Lewis Edwin York, one of Thompson's most gifted students, who illustrated Thompson's book, *The Practice of Tempera Painting*, in 1936, continued to teach tempera at Yale until the 1950. York's departure in 1950 coincided with new faculty appointments including that of Josef Albers, who changed the school's methodologies and introduced new ways of thinking about painting and creative artistic processes.

Thompson and York's legacies were reflected at the Yale Art Gallery, where an interest in the conservation of Early Italian paintings and in Cennino Cennini's treatise inspired several exhibitions, including *Rediscovered Italian Paintings* in 1952, in which artists' materials were displayed side by side with recently treated Early Italian paintings from the collection. The comparison was intended to help the viewer understand the style and techniques of the artist, as well as endorse the treatment of the whole collection. This extensive conservation campaign was inspired by a one-dimensional view of the Italian painting techniques and practice, prompted by a search for direct parallels between the treatises' texts and the artistic works. Petryn graduated from the Yale School of Fine Arts in 1948 and studied with York, Eugene Savage and Robert Vickrey, all avid promoters of the tempera technique at

Yale. The teaching, dissemination and interpretation through courses and new publications on the tempera technique, combined with the direct study of Medieval and early Renaissance paintings, was a source of inspiration for modern artists seeking a new artistic language through the use of tempera. But this knowledge also fed into the understanding of Old Master paintings and placed the seeds for a technical approach to art history.

This paper will examine the instrumental work that Daniel V. Thompson and his mentors, colleagues and students had in the development of a practical knowledge of the tempera technique of Early Italian paintings, and the impacts it made on both art students and conservators. Their practical courses and direct examination of the works of art offered new tools to the field of art history, art practice and aided the development of a modern approach to restoration. Archival research in the Yale University Library, Yale School of Art, and the Conservation Archive of the Yale Art Gallery will help to elucidate the contributions of Professors Daniel V. Thompson and Lewis Edwin York during their time at Yale.

Biography

Irma Passeri is Senior Paintings Conservator at the Yale University Art Gallery. She received her degree in the Conservation of Easel Paintings from the Conservation School of the Opificio delle Pietre Dure, in Florence in 1998. Prior to working for the Yale Art Gallery, she worked at the Opificio delle Pietre Dure and at the Philadelphia Art Museum. She has published articles on materials and techniques of Early Italian paintings and on Italian approaches to the restoration treatment of loss compensation. She lectures in a course titled Technical Examination of Art in the Department of the History of Art at the Yale University.

What is the difference between tempera and oil paint(ing)s? – On the physical-chemical properties of tempera systems

Patrick Dietemann

What is tempera? Many people believe that “tempera” and “oil” name materials, but labels such as “oil on canvas” in museums clearly denote a visual category that is based on the looks of a painting and not material analysis. There is evidence that many paintings labelled “oil on canvas” are actually tempera paintings. Hence, what is the meaning of “oil” in “oil on canvas”, if it is not a material? How can we distinguish between oil and tempera paintings when paint manufacturers advertised their tempera products (e.g. Syntonosfarben) by saying that paintings made with them could not be distinguished from oil paintings? The paper deals with the physical-chemical properties of paints in order to correlate materials with properties and the visual appearance of paintings made with these paints.

For a long time mixtures of oleaginous (oils, resins) and aqueous binders were described with the formation of oil-in-water (O/W) or water-in-oil (W/O) emulsions, depending on their ratios. This hypothesis was later called “symmetric emulsion theory”. However, colloid chemistry will be used to explain why this hypothesis is wrong and sometimes in complete contradiction to the observed properties of such systems. How are emulsions formed and what are their rheological (i.e. flow) properties? Why does an oil paint become very stiff as

soon as a small amount of water or egg is mixed in with a brush on the palette? What models should be used to describe such systems other than emulsions?

The lecture will demonstrate the significance of colloid chemistry for paints, especially tempera paints, and give examples how principles of colloid chemistry can be applied to explain the paints' properties. It will be shown that colloidal systems are determined by interfaces, a thought that has not been considered in art technological discussions so far. Formation of impasto can be explained by gel formation, mainly by the pigment particles in a (still) liquid binder. It is probably the kind of gel formation that determines, whether paints can be mixed wet-in-wet, one of the most important aspects of oil paints. However, this was also achieved by tempera paints since the beginning of the 20th century the latest. Gel formation can be dominated by minor compounds such as surfactants or solvents (water), e.g. by interaction with pigments. Such effects of colloid chemistry are in direct opposition to traditional art technological models. Often the rheological properties of paints are equated with the properties of the bulk binder, and minor compounds are neglected, although it is rather straightforward to prove that this view is not realistic. This colloidal view raises important questions on how "tempera" and "oil" correlate with materials or not and to what extent chemical analysis can help in distinguishing between the two. Are we able to detect all the relevant minor components or are we focussing too much on the major components?

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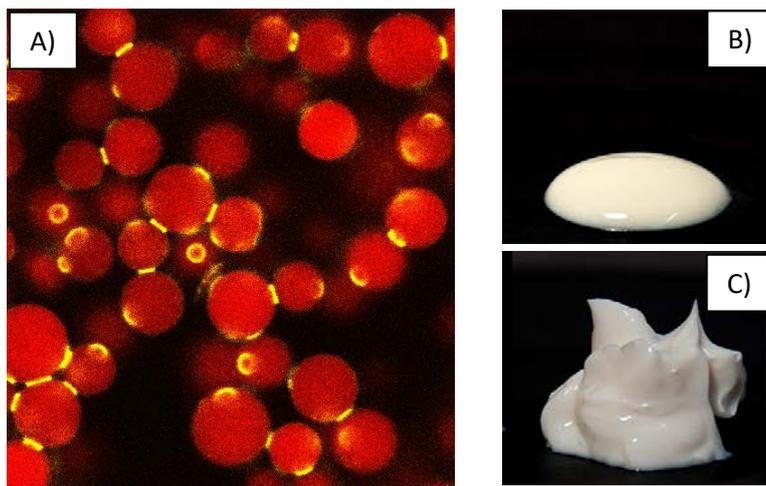
Biography

Dr Patrick Dietemann studied chemistry at the Swiss Federal Institute of Technology (ETH), Zurich, where he obtained a PhD in analytical chemistry with his thesis on the aging of natural resin varnishes on paintings. From 2003 he held a scientific position at the Zentrallabor of the Bavarian State Office of Historic Monuments, where he was responsible for the analysis of organic materials. In 2007 he was appointed as the head of organic analysis at the Doerner Institut in Munich. His research interests include numerous studies on aspects of the binding media of paintings and other objects of art and cultural heritage.

Flow Behavior and Microstructure of Complex, Multiphase Fluids

Norbert Willenbacher

Tempera paints can be complex mixtures of water, oil and pigments and egg, including amphiphilic surfactants and film forming proteins. Their consistency and flow properties are not just determined by the concentration of the individual ingredients but strongly depend on the microstructure of the composition which in turn depends on the size and shape of the pigments, the interfacial properties of the different ingredients as well as on the paint preparation process. This contribution will focus on rheological phenomena occurring in such type of complex fluids like yield stress, shear thinning, thixotropy and viscoelasticity. It will be demonstrated how these phenomena control the surface texture and appearance of a painted or coated layer depending on the shear forces acting during application of the paint. The effect of particle size distribution and particle shape on the flow behavior of suspensions will be addressed. Different microstructures which can be formed in systems including two immiscible liquid and a solid phase, e.g. Pickering emulsions, bi-gels or capillary suspensions will be introduced and their impact on flow behavior will be discussed.



Fluorescence microscopy image (A) of a three phase fluid including solid particles (dyed red) and two liquid phases. The minority liquid phase (dyed yellow) forms capillary bridges between solid particles. The main liquid phase is immiscible.

The change in consistency of the paste due to the addition of the secondary fluid is obvious from comparing images B) and C). The freely flowing paint in B) does not include a second liquid phase, the paste in C) includes 0.5 vol% of a secondary immiscible fluid at otherwise similar composition.

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Biography

Prof Dr Norbert Willenbacher (KIT) is head of the Institute of Mechanical Process Engineering and Mechanics at Karlsruhe Institute of Technology (KIT) since 2004. He received his diploma degree in Physics and his PhD from the University of Mainz. After his dissertation at the Max-Planck-Institute for Polymer Research he joined BASF SE as a research associate in the fields of rheology of complex fluids and adhesion of soft polymers for 15 years. Prof. Willenbacher is president of the German Society of Rheology, assigned member of the ProcessNet Technical Committee on Rheology, and member of the Editorial Board of *Rheologica Acta*.

Historically Accurate Reconstructions: possibilities and limitations

Leslie Carlyle

This paper will explore the practical aspects of attempting to achieve a degree of historical accuracy in the production of reconstructions of past materials and practices.

Based on its development during the HART Project (Historically Accurate Reconstruction Techniques) from 2002 to 2005, which was part of the De Mayerne Programme in the Netherlands, the research model consists of three parts: analysis of documentary evidence in the form of historic recipes and instructions; chemical analysis of the materials in historic artworks; and the production of reconstructions with historically appropriate materials and methods.

Reconstructions serve a wide variety of purposes in the field of cultural heritage: to explore technical aspects of material production and processing; to re-create visual effects, for example in paint, due to specific application techniques; and to understand the impact of the binder on the appearance and behaviour of paint. Depending on the goal the degree of historic accuracy sought or required can be highly variable.

The HART project evolved out of a desire to produce oil paint and ground reconstructions which could serve as visual, chemical and physical reference materials for current and future study. Since the aim was to produce highly characterised reconstructions (HCRs) an important component was to explore the degree of historical accuracy possible. It is axiomatic that a moment in time cannot be reproduced, therefore the term accuracy in this model represents an aspiration- the search for accuracy in this sense then leads to new discoveries about materials and their processing and production both in the present and in the past.

The HART model calls for “representative” recipes, which entails collecting large quantities of documentary evidence of past practices and procedures, comparing and evaluating the information in chronological order, and choosing a recipe or procedure that best models what could have been used in the time of interest. A single recipe may be selected as a representative of a wide range of recipes and be followed literally, or a model recipe may be used to “represent” a series of recipes with similar ingredients and processing.

The HART model also incorporates chemical analysis from works of art to identify ingredients present (eg. SEM-EDS elemental analysis of cross sections from Van Gogh's

grounds) and to guide the interpretation of the historic recipes. Completed reconstructions are also subject to chemical analysis to serve as calibration standards for comparison with materials in works of art, and to establish the detection limits of current analytical techniques (eg. detecting the elusive presence of copal oil varnish in oil paint).

Examples which demonstrate the need to achieve at least a degree of historical accuracy will be presented, for example: the consequence of using unprocessed chalk versus modern chalk treated with undisclosed “anti-clogging agents”; the need for a single seed lot and controlled conditions for oil pressing; the use of appropriate raw materials for producing glue size, etc.

The limitations of what can be achieved and the many questions raised in this work will also be discussed.

Biography

Leslie Carlyle is a paintings conservator and materials historian. Her PhD was awarded in 1991 from the Department of Conservation and Technology at the Courtauld Institute of Art, London. It was published by Archetype, London in 2001 as *The Artist's Assistant: Oil Painting Instruction Manuals and Handbooks in Britain, 1800-1900. With Reference to Selected Eighteenth-century Sources*. From 1980 to 2005 she was a conservator/researcher at the Canadian Conservation Institute (CCI) in Ottawa Canada, and between 2005-2009 she was Head of Conservation at Tate in London. Since 2009 she has been an Associate Professor at the New University of Lisbon (Universidade NOVA), where she continues her specialism in the development of Historically Accurate Reconstruction Techniques for oil paintings; originally the HART Project within De Mayerne Programme in Amsterdam funded by the Netherlands Organisation for Scientific Research (NWO). Between 2002 and 2005 Dr Carlyle was seconded from CCI to be principal investigator for the HART Project as well as for the initial project to realise the Winsor & Newton Archive Database (work on the archive database continued in the UK with Dr Mark Clarke on a grant from the Arts and Humanities Research Council (AHRC)).

The Spiritual from the Material: An Exploration of Henry Ossawa Tanner's Complex Tempera Systems in his Later Visionary Paintings

Brian Baade, Amber Kerr, Dr. Kristin deGhetaldi, and Jennifer Giaccai

The majority of the mid and late career paintings of American artist Henry Ossawa Tanner were executed using unconventional paint media and complex layering systems. These include both materials common to paintings of the era and unique, idiosyncratic tempera paints formulated by the artist. Tanner recorded his experimental paint recipes in his journals as well as on handwritten notes he left tucked behind or written directly on the reverse of stretcher bars of select paintings. Tanner's paints are complex mixtures of drying oils, mastic resin in turpentine, parchment glue, aqueous flax seed extraction, and lanolin. The resulting paint appears to straddle the inversion point between oil-in-water and water-in-oil emulsions. Tanner's journals and notes housed in the Archives of American Art and in

the collection of the Smithsonian American Art Museum in Washington, DC have enabled reconstruction of the Tanner's paints from his original recipes.

Reconstruction of the recipes allowed a greater understanding of their handling, application, and optical qualities. Archival sources and early experimental results suggest that Tanner often preheated his tempera to facilitate painting although he may have created particular effects using the medium cold. Instrumental and cross-sectional analysis corroborated Tanner's selective use of interlayered, isolating coats of natural resins, his tempera medium, or animal glue to facilitate and create his unique paint quality. Reconstructions suggest that the artist selected and interspersed these coating materials within the paint stratigraphy based on the way in which they would influence the superimposed tempera layers and achieve particular optical effects.

Preliminary findings were briefly mentioned in the technical article on Tanner published in the 2012 exhibition and catalog *Henry Ossawa Tanner: Modern Spirit*. Expanded research since 2012 includes a greater exploration of Tanner's medium and layering strategies, the analysis of new samples from his works, and follow up analysis to confirm the materials in his paint. The goal is to enhance our understanding of the optical effects and handling properties of his complex paint systems and to better understand the aging properties and preservation challenges associated with Tanner's paintings. Examination and analytical techniques have expanded to include cross-sectional microscopy, IRR, FORS, RTI, X-radiography, XRF, SEM-EDS, FTIR, GC-MS, Pyro-GC/MS, and ToF-SIMS. This paper continues the exploration of Tanner's recipes and application/layering strategies and documents additional analysis of Tanner's paintings and the reconstructions.

Biographies

Brian Baade received an MS in art conservation from the Winterthur/University of Delaware Program in Art Conservation where he specialized in painting conservation. He has participated in numerous technical studies including a major project documenting the techniques of Henry Ossawa Tanner, art materials research, and technical art history initiatives. A large part of his work over the last decade has been the research and creation of historically representative reconstructions of Old Master paintings and techniques to be used as educational didactics and the creation of the a website sponsored by the Kress Foundation to disseminate this work to a larger audience. He and his partner Dr. Kristin deGhetaldi have recently created a website and online forum hosted by the University of Delaware to field questions from artists about issues of sound practice and the preservation of their artwork. Brian is currently an assistant professor in the art conservation program at the University of Delaware.

Amber Kerr is paintings conservator at the Smithsonian American Art Museum Lunder Conservation Center, an innovative conservation facility with floor to ceiling glass walls that permit the visiting public to view on going conservation treatments and a facility that promotes public awareness about conservation topics. She received her Master of Science from the Winterthur/University of Delaware Program in Art Conservation and is a dedicated advocate for raising professional and public awareness in conservation, preservation, and technical art history. Beyond her role as paintings conservator, Ms. Kerr is a Fellow of the International Institute of Conservation where she serves on council in addition to her

contributing roles as Social Network Editor for the IIC Facebook, Linked In, and Twitter pages and servers as a Coordinator for the IIC Point of the Matter Dialogue Series. Ms. Kerr also serves on the governing board for the Society of Winterthur Fellows and as a co-chair for the ICOM-CC Education and Training Committee.

Kristin deGhetaldi obtained her M.S. in Art Conservation from the Winterthur/University of Delaware in 2008 after receiving a Bachelor's degree in Chemistry and a Post-Baccalaureate Certificate in Conservation at the SACI Program based in Florence. Since then she has participated in numerous internships and contract positions including the RISD Museum, the J. Paul Getty Museum, the Rijksmuseum, the Smithsonian and the National Gallery of Art in Washington. Recently she has helped to launch the Kress Technical Art History Website, completed the conservation of a 12 by 20 ft 17th-c painting at Villanova University. In 2016, Kristin was awarded her PhD in Preservation Studies, from the University of Delaware where she focused on binding media analysis of 15th c Italian paintings at the University of Delaware.

Jennifer Giaccai is a conservation scientist at the Freer Gallery of Art and Arthur M. Sackler Gallery of the Smithsonian Institution. She has previously worked at the Smithsonian's Museum Conservation Institute and the Walters Art Museum. She has degrees in Materials Science and Chemistry from the Johns Hopkins University and Macalester College.

The exception to the rule – reconstructing Richard Wurm's 'Temperafarbe'

Wibke Neugebauer and Patrick Dietemann

The Munich paint manufacturer Richard Wurm produced tempera paints in tubes ('Temperafarben in Tubes') and the respective vehicle ('Malmittel') between c. 1877 and 1917. It was probably the first commercially produced tempera paint that was available in Germany in the late 1870ies. An extensive correspondence between the manufacturer and his clients survived in Munich archives and documents that his products – especially his tempera paints – were appreciated by many, predominately German speaking artists of that time, and were shipped from Munich to whole Germany and various European countries [1].

Wurm's tempera paints had a special characteristic that distinguished them from other, contemporaneous tempera paints: they were not water-miscible, but could be diluted with oils (or the respective vehicle). Nonetheless, according to the sources, their matt appearance as well as their short drying times resembled other contemporaneous tempera paints. It is an unsolved question how Wurm achieved these special paint properties since he never revealed his formulations. Consequently, in recent years various attempts were made to study his tempera paints in detail:

Christine Berberich transcribed in 2012 the correspondences of Richard Wurm and his clients and made first attempts to evaluate their contents in terms of working properties, consistency of the fresh paints, and drying times. Furthermore, her extensive archival research brought out further information on the composition of the respective vehicle, probably containing soft soap, lavender oil and alcohol. Ewa Kruppa technically examined several paintings of Otto Modersohn and Fritz Overbeck that – according to the written sources – were painted with Wurm's tempera paints [2]. Furthermore, tubes of Wurm's

tempera paints were analysed by the Doerner Institut [3] and in Pisa [4] by gas or liquid chromatography and mass spectrometry (GC-MS and LC-MS). Both analyses revealed only oils and fats as binders but no aqueous materials. There are strong indications that some of the oil or fat components might be present as soaps, however, it is still unclear which components.

These different methodological approaches already helped to gain more detailed information about Wurm's paints. However, they did not answer the final question: How can the analysed, single components be combined to create a paint with the special working properties that are described in the written sources and the visual characteristics that can be observed on the paintings? This study will address these issues by conducting systematic paint reconstructions that correlate all these information, leading to new conclusions on the composition of Wurm's paints. Furthermore, it will shed light on the various functions and effects that different soaps could have in tempera binding media at that time and will interpret them from an up-to-date physico-chemical point of view.

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Biographies

Dr Wibke Neugebauer obtained a diploma in the conservation and restoration of painting and sculpture at the Stuttgart Academy of Art and Design. From 2007 to 2014 she held the positions of paintings conservator and research associate at the Doerner Institut (Bayerische Staatsgemäldeausstellungen Munich) where she worked within an interdisciplinary team as part of a research project on tempera painting. These investigations formed the basis of her PhD, awarded in 2015 by the State Academy of Fine Arts in Dresden, which examines tempera techniques as used for easel painting, 1850–1914. Her research focusses on

painting materials and techniques of the 19th and early 20th century. She now works as a freelance paintings conservator in Munich.

Dr Patrick Dietemann studied chemistry at the Swiss Federal Institute of Technology (ETH), Zurich, where he obtained a PhD in analytical chemistry with his thesis on the aging of natural resin varnishes on paintings. From 2003 he held a scientific position at the Zentrallabor of the Bavarian State Office of Historic Monuments, where he was responsible for the analysis of organic materials. In 2007 he was appointed as the head of organic analysis at the Doerner Institut in Munich. His research interests include numerous studies on aspects of the binding media of paintings and other objects of art and cultural heritage.

Fresco combined with Tempera, a controversial issue

Klaus Häfner, Munich

The group of painters in Rome and Germany known as the Nazarenes made the art of fresco painting the centre of their programme, which was to exclude the use of additional binding media (tempera) on the freshly applied plaster. Detailed observations carried out on Nazarene wall paintings, for example in St. Apollinaris in Remagen, have resulted in the conclusion that the Nazarene painters practised a very special and refined painting technique. The wall paintings in Remagen, like nearly all the Nazarenes' wall paintings, while showing the characteristics of fresco painting, were executed using an extremely time-consuming painting technique, which must have greatly extended the working time needed for a fresco. There is no doubt that paintings like this had to be finished by using tempera or other organic binding media. Scientific analyses of wall paintings by the Düsseldorf Academy prove the presence of proteins in the paint layers, and confirm that the Nazarene painters must have added protein binding media to the paint layers of their wall paintings. Nevertheless, the Nazarenes were absolutely convinced that they were using pure fresco technique.

New art-technical source research casts light on the fact that the Nazarenes found their references for the use of tempera combined with the fresco technique in Cennini's 'Libro dell'arte', where the completion of fresco paintings with tempera is described. A mistake in the 1821 Tambroni edition led to the interpretation by William Dyce in 1846 that tempera paints should be used for the painting process in the fresh plaster ('tempera in fresco').

Such citations illustrate that our modern definition of fresco, which is exclusively based on the chemical reaction of the carbonation of lime, cannot describe the thinking of the Nazarenes. Dyce, for example, regarded as fresco any painting that had been begun on fresh plaster, without taking into consideration whether the painting was finished with additional binding media.

Adapting the reconstruction method of Leonetto Tintori, who carried out systematic tests on the use of tempera in medieval wall paintings ('tempera ausiliare'), I experimented on the reconstruction of Nazarene fresco paintings, aiming to produce similar paint-layer effects. All the resulting surface phenomena will be systematically described and compared by using cross-sections.

The results clearly show that the use of the tempera technique on fresco changes the behaviour of the paint, influences the wetting of the surface during the paint application, and may be responsible for optical results typical of the Nazarene painting technique. The paint layers' hygroscopicity will be influenced during and after the carbonation, thus affecting the paint layers' performance against salts. The carbonation of calcium hydroxide to calcium carbonate in the presence of organic binding media is a matter of controversy among wall-painting specialists and throws up a wide range of questions.

Biography

Klaus Häfner works since 1997 as conservator for wall paintings and stone objects in the conservation centre at the Bavarian Administration of Castles, Gardens and Lakes in Munich.

He absolved an apprenticeship as a decoration painter, followed by further professional formation during an internship at the Bavarian National Heritage (Bayerisches Landesamt für Denkmalpflege) and at the wallpaintings department of ICCROM in Rome, Italy.

He was involved in an interdisciplinary research project (Restoration of wallpaintings) at the Fachhochschule Cologne and several other research projects (f.e. Climate for Culture, a European research project).

Numerous publications on the conservation of wallpaintings and historic technologies (http://www.schloesser.bayern.de/deutsch/ueberuns/rz/service/rz_publication.htm)

'Yet another new brand of tempera, and there is no end in sight.' The tempera revival between 1800 and 1950

Karoline Beltinger

During the last decade an increased interest in the tempera revival of the nineteenth and early twentieth centuries has led to a number of new research projects. Not surprisingly for research in the field of technical art history, the topic has been approached from various angles: 1) interpretation of written sources, 2) visual examination of paintings created in tempera in the nineteenth and early twentieth centuries, 3) material analysis, and 4) reconstruction of tempera paints and painting methods. These tools of enquiry have led to important insights especially when used in parallel. Professionals involved in recent investigations are mostly conservators and conservation scientists; art historians will hopefully take a greater interest in the future.

This lecture attempts to sketch, on the basis of the results published to date, a coherent picture of the tempera revival. As far as we know today, the movement originated in Italy and the German-speaking region just after 1800, expanded – mostly within Central Europe – in the late nineteenth century and spilled over to the Americas in the twentieth.

It is widely recognised that tempera revivalists drew inspiration from ancient treatises on painting. However, as current research findings demonstrate, formulas for tempera binders were also borrowed from the contemporary practice of decorative and mural painting, where tempera had continued as a living tradition since the Middle Ages. Other formulas were –

from 1893 onwards – based on modern inventions in the field of photography. In any case, the experiments carried out in the constant search for new tempera binders could lead to surprisingly complex combinations of organic substances of both natural and – after the Second World War – synthetic origin.

It has been known for some time that paint manufacturers began to release ready-to-use artists' tempera paints from the late 1870s. A recently published listing of tempera brands commercially produced between 1875 and 1945 indicates the large number of products. In view of their sheer abundance, their discussion in the contemporary press was sometimes marked by a weariness that expressed itself through announcements such as the one quoted in the title. Impressive as the number of individual brands may be, it is not necessarily an indicator of the proliferation of tempera at the period: until the number of oil-paint products that were concurrently on sale has been quantified, no useful comparison can be made.

New information gained from recent research sheds some light on the following questions: Was it the anti-establishment avant-garde painter who felt drawn towards tempera as an alternative to oil painting, or was it rather the conservative type? Was tempera, being a fast-drying medium, chosen by fast-working, spontaneous artists, or rather by those whose long-winded working methods were made easier by a fast setting medium? Was tempera really chosen for a matt surface appearance, and therefore left unvarnished? Why did some artists return to oil painting? On the basis of an evaluation of recent findings, this keynote lecture will attempt to correct some existing misconceptions.

Biography

Karoline Beltinger is a researcher in the field of technical art history and Head of Art Technology of the Swiss Institute for Art Research (SIK-ISEA) in Zurich. She received her diploma in painting conservation at the University of Applied Sciences in Bern, worked for the foundation Stichting Kollektief Restauratie Atelier in Amsterdam, was Head of Conservation at the Historical Museum Basel and, in 1998, accepted her current position at SIK-ISEA. She and her staff of art conservators and conservation scientists collaborate with SIK-ISEA's art historians on a regular basis, implementing research projects in the fields of technical art history and conservation science. In 2007 she launched the book series KUNSTmaterial.

Emerging from the Shadows: Christiana Herringham and the British Tempera Revival at the Turn of the Twentieth Century

Michaela Jones

This lecture will examine the artist and art writer Christiana Herringham (1852-1929); an important but heavily neglected figure of the British tempera revival at the turn of the twentieth century. According to Roger Fry, it was Herringham who corrected John Ruskin on his erroneous belief that early Italian paintings were produced mainly in oil. In 1899, Herringham published her translation of Cennino Cennini's *Il Libro dell'Arte*, complete with notes concerning her own experiments with the medium. She used Cennini's treatise to create her own paintings in tempera, and in 1901 she co-founded the Society of Painters in

Tempera. While Jill Dunkerton has claimed that the first English translation of Cennini, published by Mary Philadelphia Merrifield in 1844, had little immediate impact in publicising the possibilities of tempera, Herringham's translation had a significant and direct influence. Roger Fry credited Herringham for the diffusion of contemporary knowledge of the medium, while Walter Sickert declared that Herringham's translation was, 'The most important piece of art-criticism that has appeared in Europe in modern times.'

Despite Herringham's importance to the British tempera revival, she has largely been overlooked, and her works have received little examination. This lecture aims to address this gap in the historiography, by using Herringham's works as a case study to examine the British tempera revival in its historical and cultural context. It will utilise a primarily art historical approach to analyse the collection at Royal Holloway, University of London, which includes several tempera copies by Herringham of fifteenth-century Italian paintings. It will also discuss the results of the technical analysis which is currently being undertaken on Herringham's paintings, and what the findings reveal about Herringham's technique. This paper will look at Herringham's translation and how it impacted her work, in addition to considering the wider significance of her work on the British tempera revival.

Herringham's appreciation of tempera and copies of early Italian paintings coincided with a wider enthusiasm for the work of Italian 'primitives'. Furthermore, her copies employed modern methods of connoisseurship, as they were achieved through careful, first-hand observation of the original works. The fact that Herringham's tempera paintings were mainly copies rather than originals may explain why her work has been neglected by art historians. However, her copies are indicative of the motivations of the wider tempera revival. They demonstrate how Herringham, as well as other contemporary tempera artists, such as Joseph Southall and John Batten, looked to the past in search of inspiration, and how they sought to emulate these historical artistic methods. Additionally, Herringham's works show how the movement built upon the beliefs put forward earlier in the nineteenth century, by John Ruskin, the Pre-Raphaelite Brotherhood, and the Arts and Crafts Movement.

Restoration of Herringham to the narrative will lead to a greater understanding of the movement. By closely examining Herringham's work and its wider context, this research will shed a new light on the motivations, influences, and impact of the tempera revival in the early twentieth century.

Biography

Michaela Jones is currently a second-year PhD candidate at Royal Holloway, University of London (RHUL), undertaking a collaborative PhD with the History department and the College's Art Collections. Her research focuses on the artist and art writer Christiana Herringham (1852-1929), who led the tempera revival at the turn of the twentieth century. It centres on the Herringham works which were bequeathed to the College after her death. Michaela's thesis will include a catalogue raisonné of the Herringham collection held at RHUL, and her research will culminate in the first major Herringham exhibition in almost seventy years, opening in January 2019.

Joseph Southall and the tempera revival

George Breeze

Trained as an architect, Joseph Southall (1861-1944) found his profession as a painter at age 21 on a visit to Italy, where he became an ardent admirer of what he called the Italian Primitives and keen to study and practise the art of tempera painting. He had difficulties discovering how to paint in tempera in the 1880s but returned to the medium in 1895. Tempera fitted with the strict puritanism of his Quaker faith, a medium lending itself to what the writer Aymer Vallance called "spirituality, sincerity and purity of colour". He was an absolute pacifist, spending much of the First World War writing pacifist articles and drawing anti-war cartoons. It could be said that, in his life, Southall brought together the gathered stillness of a Quaker Meeting, the jewelled calm of tempera painting and the peace sought by pacifism.

Unlike the Pre-Raphaelite Brotherhood, Southall appreciated that a sound knowledge of early Renaissance form and technique was necessary. He ground his own colours, kept his own chickens (for the egg yolks), and developed a flat, dry, clearly articulated method which he used on a range of subjects, from large mythological and romantic scenes to portraits, landscapes, sailing ships and seaside scenes, to urban and even to some religious subjects. Southall usually designed his own frames which his wife gilded: the sparkling gold carved frames (using the egg whites in the gilding) are an essential part of his art.

Southall spent his life in Birmingham in Britain. He was a leading member of the Birmingham Group of Artist-Craftsmen, whose defining element was their devotion to the revival of tempera painting. Napier-Clavering, a critic of their first exhibition in 1907, singled out "a fine sense of surface or joy in the beauty and specific quality of materials". Southall was also a co-founder, in 1901, of The Society of Painters in Tempera whose stated objective was the "Improvement in the art of Tempera painting by the interchange of the knowledge and experience of the members". He was its leading light along with Christiana Herringham who had published her translation of the key textbook, Cennino Cennini's *Il Libro dell' Arte*, in 1899.

Southall's greatest success, however, where all his best tempera paintings were shown, was at the critically well-received exhibition at the Galeries Georges Petit, in Paris, in 1910. In the home of the European avant-garde, the distinctiveness and charm of his work did not go unappreciated. In 1925 Southall was elected an Associé of the Société Nationale des Beaux-Arts, Paris. Nearly every year he travelled to France and Italy, and particularly to Venice, to study works of art and to paint.

Privileged access to his private papers, along with the study of unpublished documents in public archives and notes on his paintings themselves, has enabled a personal and detailed study of Southall's revival of tempera painting. This study has been pursued since the 1970s and the discovery of new material continues.

Biography

George Breeze

- wrote essay "Decorative Painting" for *By Hammer and Hand – The Arts and Crafts Movement in Birmingham*, mid 1970s, published 1984
- Curated, and wrote catalogue for, exhibition *Joseph Southall 1861-1944 Artist-Craftsman* (Birmingham & London), 1980
- Director, 1981-2002, Cheltenham Art Gallery & Museum, the Arts & Crafts Movement collection of which was Designated as of National Significance, 1998
- Entry on Joseph Southall in *Oxford Dictionary of National Biography*, 2004
- Co-curated, and co-authored catalogue for, exhibition *Sixty Works by Joseph Southall from the Fortunoff Collection* (London & Cheltenham), 2005
- Paul Mellon Research Support Grant recipient for studies on Southall and tempera revival, 2009-10

Edward Steichen's Last Temperas

Abbie N. Sprague

In the early winter of 1923, Edward Steichen (1879-1973) and his gardener ransacked the house and studio in Voulangis for any remaining paintings. Lighting a match, they danced around the bonfire, while paintings melted and crackled in the flames. Only a handful of works escaped destruction. The fiery end to Steichen's painting career quickly became an art history legend.

Early in his career, Steichen experimented with a variety of media. In his thirties, his search for a distinctive style drove Steichen back to the fundamentals of materials and techniques, and with it his discovery of tempera. In 1910, Agnes and Eugene Meyer commissioned seven large-scale murals for their New York townhouse. In *Exaltation of Flowers* (1910-1914) was inspired by Steichen's love of gardening and the circle of artists and intellectuals who visited him at Voulangis. He executed the figures and flowers in a tempera and oil emulsion and set them against a gilded background. Turning away from the tonalist style of his earlier work, Steichen chose a modernist composition with large flat planes of color and distinct outlines, a style which lent itself to tempera. These are his earliest surviving tempera paintings.

In 1922, combining his passion for nature, color, and his newfound study of the golden ratio, Steichen created the iconic tempera painting *Le Tournesol*. Soon after its completion, Steichen gifted the painting to an artist friend; thereby saving it from the fateful bonfire. In time, the painting was purchased for the National Gallery of Art in Washington. A recent bequest to the museum has more than tripled the number of known tempera paintings by Steichen. The donation included two *Le Tournesol* studies and sixteen paintings for his *Oochens* series, a group of children's book illustrations he created in 1922. Steichen later reminisced, "In the small tempera paintings I made of the *Oochens*, I experienced a sense of freedom I had never experienced before." Steichen's newfound freedom extended to *Le Tournesol*, where he adopted a new color palette of vibrant greens, cobalt, cerulean blue, and vermillion. Both the *Oochens* and the sunflowers are set amongst a backdrop of diagonal lines and triangles, forms that were dominating Steichen's imagination and recent

study of geometry. Medium followed form and he chose tempera for these works. Within a few months of completing *Le Tournesol*, Steichen accepted a lucrative job offer to be Condé Nast's chief photographer, and he committed his remaining paintings to the pyre. *Le Tournesol* and the *Oochens* are his last tempera paintings.

Steichen's use of tempera coincides with his adoption of a new distinct style. Steichen, like many American tempera revivalists, was reluctant to discuss his materials and techniques. However, recent archival and technical research sheds light on his working methods. By examining Steichen's last surviving temperas, this paper explores the intersection of medium and style, in the relatively unknown output of an overlooked precursor to the American Tempera Revival.

Biography

Abbie N. Sprague is an art historian specializing in nineteenth-century British Art and the British and American Tempera Revivals. Her doctoral dissertation examined tempera painters within the context of the British Arts and Crafts Movement. Subsequently, her work has included lectures and publications on Wadsworth's murals on board the RMS *Queen Mary*, the Society of Painters in Tempera, the Pre-Raphaelites use of tempera, and the work of Andrew Wyeth. For fourteen years she contributed regularly to the Society of Tempera Painters publications. Her latest research examines Edward Steichen's last tempera paintings.

Tempera Painting in Venice at the Beginning of the 20th Century

Giuseppina Perusini¹, Teresa Perusini², Giovanni Soccol³, Francesca Caterina Izzo²

Our contribution aims to illustrate the use of tempera in Venice between the late nineteenth and early twentieth century, focusing in particular on the analysis of paintings and documents left behind by the painter Gennaro Favai (1879-1958), whose archive is currently kept at the Venice home of artist Giovanni Soccol, who was his pupil and assistant.

Giovanni Soccol, a former Professor at the Academy of Fine Arts in Venice, was also able to meet Guido Cadorin (1892 – 1976) and, through Favai, had access to the works and writings of his teacher Mario de Maria (1852-1924), allowing him to learn the painting techniques of these artists based on their writings, which he partially rewrote. Some works and texts of these painters – which will also be subject to analysis – are an essential starting point for studying Favai's paintings.

Both Gennaro Favai's painting technique and his paintings are of particular interest since they are firmly embedded in the tradition of Venetian painting, and because of the various moves and contacts made by the artist during his life. Indeed, after his training in Venice, Favai lived some years in Paris, New York, Capri as well as other locations across Italy and Europe (*Gennaro Favai. Visioni e orizzonti*, Venice 2011 ed. by S. Fusco, E. Prete, C. Sant, G. Soccol)

Our contribution intends to focus in particular on skin glue and flour-based tempera, which characterises much of Favai's paintings, as well as a great deal of scenic and decorative

paintings (found also on furniture and ornaments), playing a vital role in early nineteenth century Italian painting (G. and T. Perusini, *The Use of Tempera by Painters and Restores in Italy and Latin Europe c. 1800-1870*, in *Painting in Tempera c. 1900*, ed. by C. Beltinger and J. Nadolny London, 2016)

In Favai's archive, besides the artist's numerous notes on painting technique, there are some very little-known publications that reveal the interest in tempera painting during the early decades of the twentieth century (such as that of Charles Louis Borgmeyer, *The Art of Gennaro Favai – The Venetian Process of Tempera Painting*, in "Fine Arts Journal", 1912).

In addition to the technical and historical research, this study will also conduct several scientific analyses on samples taken from Favai's paintings in order to characterise the nature of the binding-media used and their level of degradation. These investigations will be carried out by Francesca Izzo, while the painter Giovanni Soccol will perform reconstruction tests on Gennaro Favai's tempera painting as part of the Conference (March 2018).

Biographies

- 1 University of Udine
- 2 Cà Foscari University of Venice
- 3 Academy of Fine Arts, Venice

Tempera and Pastels - realizing color effects in Paul Klee's late work

Nathalie Bäschlin and Stefan Zumbühl

This contribution investigates the way the artist Paul Klee implemented painting technique in the tempera and pastel paintings of his late work. The findings and theses presented in it are based on the art technological examination of two paintings by Paul Klee, *Legende vom Nil* (*Legend of the Nile*) dated 1937 and *Flora am Felsen* (*Flora on the Rocks*) dated 1940. Our study focuses on both binding media and pigment-analysis and their contextualization within contemporary discourse on Painting technique. By adopting this approach we were able to infer that, for Paul Klee, the "chemical resistance" of the vibrant color effects was a key factor that motivated him to use this technique. Our research on the work of this artist often verified the fact that Paul Klee kept the amount of binding media to a minimum in his paintings. Paul Klee developed his technique of painting technique with pastels by following the recommendations of the chemist Wilhelm Ostwald.

Being a scientist, Ostwald considered himself a modern specialist for paint technology and photography, having conducted many scientific experiments to substantiate his knowledge in the field. His novel and astonishing guidelines for painting techniques for the time, found not only access into the academies of art but also began to play a role in the hierarchy of genres. Paul Klee was interested in Ostwald's ideas and approaches. The chemist Alexander Eibner made detailed and critical remarks on Ostwald's pastel-paint technology. He argued that Ostwald's prognosis of "chemical resistance" was only valid if the pastels were protected from mechanical stress factors and when high quality, non-fading paints were used. In the

case of painting with pastels technical application is very limited in scope. For example, they are totally unsuitable for use in combination with glazes. We know that Klee studied the "Malerbriefe" (Painters' correspondence) of the chemist Wilhelm Ostwald and also various writings of the chemist Alexander Eibner. It therefore seems perfectly logical to reason that he reflected on what he had read in his technical experiments in painting from around this time.

Legende vom Nil (Legend of the Nile) displays a thick layer of pastels in keeping with Ostwald's recommendations. Klee made his pastel crayons himself from pigments, chalk, and some kind of carbohydrate, probably gum. He worked over the pastel strokes, increasing their density, with various tools and carried out the process of "paraffining" using natural wax as advocated by Ostwald. Doing so, he obviously adapted Ostwald's recommendations to his own needs. *Flora am Felsen (Flora on the Rock*, dated 1940) also reveals a multilayered method, in this case using „Öl= und Tempera=Farben"¹ (oil and tempera paints) The technical application of the paint and its effects exhibit obvious overlaps with *Legende vom Nil (Legend of the Nile)*. Thus we argue that the vibrancy of the color effects, the intensity of color, and the prospect of "chemical resistance" were also in the case of this painting the key motivation behind the choice of painting technique, which the artist modified and refined over many years.

By combining modern Analytical methods for the research and analyses (FPA-Imaging) of artworks with literature research and history of reception, we are making new discoveries in an area that is currently highly relevant in research: the fact that Paul Klee considered it just as worthwhile to strive for "chemical resistance" as to implement fragile and risky materials that promoted uttermost precision in art in the realization of his artworks – goals of a seemingly incompatible nature.

Biographies

Nathalie Bäschlin, Chief Conservator, Museum of Fine Arts Bern, Lecturer at the Painting Conservation Department, Bern University of the Arts

Dr. Stefan Zumbühl, Conservation Scientist, Researcher, and Lecturer, Art technological laboratory, Bern University of the Arts

'I explored every means of painting back then, namely, every tempera' – Hermann Prell's research on Tempera

Silke Beisiegel

Hermann Prell (1854–1922) occupied an important position as a monumental painter in the German Empire. During his numerous large commissions for government buildings – such as the main rooms of the town halls in Worms and Hildesheim, the throne room of the German embassy in Rome, the staircase in Dresden's Albertinum and the stateroom in Dresden's New Town Hall – he was particularly interested in the technical and artistic

¹ Paul Klees technical specification given in his hand-written Oeuvre catalogue.

realisation of a Gesamtkunstwerk. However, with the exception of the mosaics in Bremen's Cotton Exchange, none of his monumental work has been preserved.

Prell was a professor of history painting at Dresden's Royal Academy of Art from 1892 to 1914. As a teacher he also introduced students to the foundations of painting technique and involved them in the realisation of large projects. Throughout his life Hermann Prell's practical work was accompanied by an intense exploration of questions related to painting technique. He left a record of this in his extensive writings, which document his experiments dealing with painting technique and recipes. He additionally occupied himself extensively with related historical and contemporary sources, for example, the writings of Cennino Cennini, Raffaele Borghini and Ernst Berger. Prell was also engaged in a lively exchange with other artists, such as Hans von Marées, Carl Gussow, Ernst Berger, Anton von Werner and Max Klinger. His occupation with tempera's use for easel paintings as well as wall paintings played a major role in this context. Based on his experiments he used casein tempera for large-scale paintings in a method that he was constantly refining. Along with preserved receipts, Prell has provided the information about his use of commercially available artists' materials. For example, he used tempera paints from the companies Wurm and Neisch. Our view of his working process is further supplemented by historical reproductions and numerous colour studies serving to develop compositions and painting techniques. A good example is the staircase in Dresden's Albertinum where Prell used tempera on canvas and wall.

Biography

Since July 2013 Paintings Conservator at Old Masters Picture Gallery / New Masters Gallery, State Art Collections Dresden

Freelance Conservator, started part-time PhD at the Academy of Fine Arts Dresden concerning the painting technique of Hermann Prell

2008–2010 Assistant Conservator in the Project "Conservation and restoration of the painted linen wall covering in the mansion of Ermlitz", Academy of Fine Arts Dresden

Postgraduate Conservation Intern at Municipal Gallery Lenbachhaus in Munich

2007 Diplom after five-year study programme at the Academy of Fine Arts Dresden

Publications: book about artist questionnaire concerning painting technique c. 1900, (forthcoming) article about Otto Mueller's "Leimfarbe"

The transparent surface, tempera in the surrealist and fantastic art circle in Mexico: Juan O'Gorman, Remedios Varo and Gunther Gerzso

Sandra Zetina

A group of artists in Mexico, during the 1940s and 1950s developed an keen interest in tempera technique and Old masters painting, stimulated by the publication of the English and Spanish translation of the treatise by Max Doerner *The Materials of the Artist and Their*

Use in Painting, first published in Germany in 1921, translated to English in 1934, with several subsequent editions. The Spanish edition was published in 1942, translated from English by the engineer Pedro Reverté, political prisoner of the Spanish Civil War, who dedicated his efforts while in prison to the translation of technical and scientific books for Gustavo Gili Barcelona publishing house, before founding his own editorial.

The circle of painters that used and researched tempera in Mexico was related to fantastic art, an alternative interpretation of surrealist sensibility, mingled with primitivism, or the interest in popular imagination and naïf expressions like popular ex-votos. Most of the fantastic and surrealist painters from this circle were predominantly intimate painters, of small formats, that rarely exhibited their oeuvres.

Antonio Ruiz, called El Corcito (1892-1964) was considered the master of tempera by the generation of younger artists; he painted everyday popular scenes and imaginative self-portraits. Juan O’Gorman (1905-1982), architect and muralist followed El Corcito in his interest in tempera, he also produced small imaginary landscapes, ex-votos and portraits, in a close dialogue with his friend Frida Kahlo (1907-1953).

O’Gorman established a dialogue with the stage designer and painter Gunther Gerzso (1915-2000), the Irish surrealist painter Leonora Carrington (1917-2011) and the Spanish Remedios Varo (1908-1963), part of the surrealist circle in exile after the occupation of France during second world war.

All these artists aimed to produce pristine surface qualities kindred to the Northern European primitives, particularly in the translucency and brilliance of color achieved by some Flemish painters. Some, as Gerzso, manifested the role of technique for the transmission of emotional content. They shared an interest in Brueghel, Bosch, Bossaert and many other Old Masters. Some of them also appropriated the topics of the northern European painting tradition, as the floral or fruit still lives, and the memento mori, making equivalences with Mexican popular painting or circumscribed them to a personal imaginary.

This research will discuss the painting practices of the fantastic and surrealist circle through the study of the complex Juan O’Gorman series of lectures about tempera painting and Old Master techniques at the National Academy of Science. The notions expressed by this artist will be compared with technical analyses of some of the paintings by Juan O’Gorman, Remedios Varo and Gunther Gerzso, with imaging techniques (visible and UV imaging, IR reflectography, spectroscopic portable techniques as XRF, FORS, microscopy of surface and samples, SEM-EDX and chemical analysis GCMS) in the context of the development of surrealist painting practices as decalcomania, dreamscapes and the interest in alchemy through technique, but also their concern with degradation of oil painting and purity of color, as indicated by the notes on technique inscribed in the back of the panels.

Biography

Sandra Zetina works at the art history department of the National Laboratory for Research and Conservation of Cultural Heritage (Laboratorio Nacional de Ciencias para la Investigación y Conservación del Patrimonio, LANCIIC) Cultural from the Instituto de Investigaciones Estéticas IIE, at the National University Universidad Nacional Autónoma de México, UNAM, in Mexico City. She pursues a PhD in Art History at the same university,

where she obtained her master degree (2012). Studied Heritage Conservation at the Escuela Nacional de Conservación, Restauración y Museografía (ENCRYM-INAH) in México. Curator and professor at de degree program in technical art history at UNAM, her research is devoted to technical art history of Mexican art, involved in Modern art painting practices.

Developments in the analysis and interpretation of tempera-based paint systems

Kristin deGhetaldi

While the conservation and scientific communities have made excellent strides in pigment research, the history of media analysis in conservation should be considered when assessing the literature concerning tempera paints in traditional easel painting. The success of any given analytical technique depends on its ability to detect (and in some cases quantify) key chemical markers found in tempera paints. Instrumentation and analytical methods (such as sample preparation) have greatly improved since the early efforts of conservation scientists. Over the years massive spectral libraries representing artists' materials have been developed and organized, providing scholars direct access to searchable databases. But as with most technological improvements, unforeseen complications can arise. Contamination from restoration materials such as resin/oil-containing varnishes, proteinaceous adhesives, the migration of fatty acids, the presence of reactive pigments, and the formation of degradation products (e.g. metal soaps) are now known to affect the detection of many key chemical markers, markers that are often used in the characterization of paint binders.

These complications call for a re-evaluation of the findings reported in early technical studies. In addition, conservation scientists now have the daunting task of selecting from the various protocols that are used for sample preparation. Therefore direct comparison of analytical results generated from different laboratories may not be possible until protocols for sample preparation have been standardized. Finally, numerical references (such as fatty acid and amino acid ratios) that were once used to confirm the presence of tempera grassa, egg tempera, and various drying oils have been found to be affected by the presence of restoration materials, pigments, degradation components, and other factors, making these markers unreliable for accurate characterization in most instances. In moving forward, more research is needed to address these issues including pigment interactions with organic binders, the analysis of complex mixtures, detection limits, and the comparison of analytical protocols and instrumentation. This paper also explores the evolution of various analytical techniques used to characterize tempera-based paints in easel paintings including cross-sectional staining, thin layer chromatography, spectroscopic methods, and chromatography/mass-spectrometry.

A more accurate assessment of tempera-based paints can be accomplished if the original stratigraphy of the paint and ground layers is maintained throughout the analytical procedure. Imaging techniques combined with certain analytical methods (such as ATR-FTIR or ToF-SIMS) now allow for the characterization of inorganic and organic materials within discrete layers present in cross-section paint samples. Such methods can aid in differentiating between restoration and original materials without consuming the sample during the process, allowing the sample to remain preserved for future analysis. Recent advancements in mass spectrometry, non-destructive imaging, and other techniques may

help to avoid some of the problems associated with the more traditional analytical tools used to characterize tempera-based paint systems.

Biography

Kristin deGhetaldi obtained her M.S. in Art Conservation from the Winterthur/University of Delaware in 2008 and a Ph.D. in Preservation Studies from the University of Delaware in 2016. She has worked at a number of institutions including the RISD Museum, the J. Paul Getty Museum, the Rijksmuseum, the Smithsonian, and the National Gallery of Art in Washington. Recently she has helped to launch the Kress Technical Art History Website, completed the conservation of a 12 by 20 ft 17th-c painting at Villanova University, and has organized a new online resource (MITRA) intended to connect artists with those working in the cultural heritage sector.

The versatility of an emulsion: the Tempera Muzii and its uses for modern painting and for restoration during the first half of the twentieth century

Mattia Patti¹ and Margherita d’Ayala Valva²

Unlike the common revivalist approaches to tempera as the technique of the old masters, the “Tempera brillante Muzii” was specifically created and marketed in the years 1903-1908 for the modern purposes of Impressionist painting, although when Impressionism was on the wane. Eventually, about thirty years later and until the 1960s, the technique ended up being chosen by restorers as the first layer in a mixed-medium system.

Alfonso Muzii (1856-1946), the inventor of the Muzii tempera procedure, is a today fairly unknown painter, active in Abruzzo, in Naples and Florence, immigrated to South America in the years 1887-98, and in the early twentieth century based back in Florence. There, he experimented the formulas of mediums for oil-in-water emulsions based on Arabic gum or egg yolk, testing them on the Lefranc range of colours.

The folder of documents recently found in the Lefranc Archives (now ColArt, Le Mans) by the FUTURAHMA research group now allows to reconstruct the genesis of a product, as largely used as little known in its components. The letters, post cards and attached recipes in a multitude of variants clearly document the exchange between Muzii – whose approach was mostly experimental, since he had no scientific background – and the chemists Emile Lefranc and his partner Paul Letellier, and the feedback from the factory in Issy in the years 1903-08. After submitting the results of his researches to Italian artists such as Giovanni Fattori (1825-1908) and Plinio Nomellini (1866-1943), who first had tested the colours, Muzii reported to Lefranc their suggestions and feedback, and urged for quickly marketing the product (first sold in tubes in 1905, in a range of twenty-four colours).

The folder also conserves documentation of further controls carried out by the French company, dating back to the late 1920s and 1930s, when the Muzii colours were used by restorers in the Louvre. The joining link is Marc Havel, a chemist working for Bourgeois, very active among the laboratories of the Louvre in the 1930s and close to Jacques Maroger (1884-1962), an artist-scientist, restorer at the Louvre, and also creator of a medium, that Havel would later report as derived from the Muzii procedure for its use of Arabic gum. Havel

himself would be the major oral source for the first study attempting to locate the Muzii tempera among the restoration techniques of the 1940s-60s, Anne-Elizabeth Rouault's historical and technical-scientific study of the restoration of a painting by Simone Pignoni from the Musée des Beaux-Arts de Lyon.

After a preliminary research (published in the conference proceedings of Cesmar 7, 2016), this paper will examine in depth the documents now entirely transcribed from the Muzii folder, together with further sources (sales catalogues, manuals and treatises mentioning the Muzii procedure) documenting the marketing and the purposes of the artist inventor and of the chemists producers. The actual use by both painters and restorers (mostly choosing the Muzii colours for the underpainting of oil colours) can be verified through the study of conservation treatment reports, and through analytical examination of paintings by Giovanni Fattori and Plinio Nomellini dating back to the years 1904-1905.

The aim of this paper is to measure the gap between marketing strategies, narratives of historical techniques, the use and practice of painters and the adoption by restorers.

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Biographies

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History, use and chemical aspects of Talens' tempera paints with a focus on ETA emulsion paint

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Royal Talens is a prominent artists' paints manufacturer. Founded in 1899, Talens started producing oil paints as early as 1902 [1]. While Rembrandt oil paints were and continue to be the best known range of paints, Talens also produced stationary and many other types of paints including tempera.

Talens ETA is a type of casein/oil emulsion paint that was produced by Royal Talens in Apeldoorn from as early as 1933 till 1975. Although mainly in use as a rain-water resistant decoration paint for example cinema advertisement, ETA paints were also popular among artists because of their versatility and their attractive matt finish. Artists from the COBRA artists group, among which Karel Appel, would use the paints in conjunction with oil paints.

ETA was made using casein and stand oil as the main binding medium ingredients, with a very limited number of additives which would change over the time the paint was produced. The paint was sold in tins and flacons. The propensity of the casein medium for becoming mouldy was a problem throughout the c. 25 years of its production, leading to paints that would sometimes go off in its tins even in the factory itself. This is the main reason why the production of ETA was discontinued in the 1970s. A newly developed alternative in the early 1980's, containing synthetic media (polyvinyl acetate) and called Taleta, was relatively short-lived and produced only in the first half of the 1980s.

Thanks to RCE's collaborative agreement with artists' paint manufacturer Royal Talens, new information now has become available on formulations and applications. Mainly based on new finds in the archive, the paper will deal with the history of development of tempera paints in general, with special emphasis on ETA, its formulation and application by artists.

For this study, ETA paint reconstructions were made based on historical recipes. These materials, paintings samples as well as historic ETA paints were analysed using FTIR spectroscopy, GCMS and proteomics methodology. Analytical challenges for its detection in art works, especially when mixed with oil paints, will be discussed in the paper.

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- 2 University of Amsterdam, The Netherlands
- 3 Royal Talens, Apeldoorn, The Netherlands

The production of tempera paints by Mariano Fortuny y Madrazo's in Venice between 1933 and 1949. A multi-analytical investigation from raw materials to paintings

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Mariano Fortuny y Madrazo (Granada 1871-Venice 1949), next to be a fabric designer and a theatre innovator, was also a prolific painter and a tempera manufacturer. Since 1899, the artist established his atelier in Palazzo Pesaro Orfei, an ancient Venetian building now housing the Fortuny Museum. The atelier still conserves pigments, dyes, unknown powders, raw materials for the formulation of his own tempera colours: some original paint tubes, labeled as "Tempere Fortuny" and produced by himself with a secret recipe since 1933 [1], are conserved as well. A preliminary study was presented during the 2015 conference on 'Artists' Materials. The Study of the Painter's Atelier in the Nineteenth and Twentieth Century' held at Scuola Normale Superiore di Pisa [2].

The project has then continued and, thanks to the collaboration between Ca' Foscari University of Venice, Palazzo Fortuny and Fondazione Musei Civici, the materials belonged to and used by Mariano Fortuny were identified and studied through a multi-analytical approach by the joint use of X-ray fluorescence spectrometry (XRF), Fourier Transform Infrared Spectroscopy (FT-IR), Scanning Electron Microscopy coupled with Energy Dispersive Spectrometer (SEM-EDS), Thermal analyses (TG-DSC) and Gas Chromatography coupled with Mass-Spectrometry (GC-MS). The acquired information was useful to understand not only the materials he painted with, but also the production of the "Tempere Fortuny".

The results obtained by combining several analytical techniques demonstrate Fortuny's inclination in experimenting a wide range of materials, from traditional and precious pigments like Lapislazuli blue to modern synthetic material like zinc white, passing through unusual mixtures of natural resins, oil and polysaccharidic substances used as binding media.

It is well known that the characterization of complex binder mixtures can be rather challenging, particularly when dealing with aged materials having natural origin. In this sense, a GC-MS method for lipids, natural resins, natural and mineral waxes, proteins and sugars was developed and the interpretation of data provided important pieces of information in the determination of Fortuny's secret recipe in manufacturing his own tempera paints.

Moreover, the analysis of the painting titled "The Polcenigo countess" (conserved at the International Gallery of Modern Art Ca' Pesaro, Venice) and the decoration of Fortuny's atelier confirmed the unconventional pictorial practice by Fortuny y Madrazo.

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- 1 Ca' Foscari University of Venice, Chemical Sciences for the Conservation of Cultural Heritage, Department of Environmental Sciences, Informatics and Statistics, Via Torino, 155/b Venice, Italy
- 2 Italian Chemistry Society- Diagnostics for Cultural Heritage
- 3 RCE- Cultural Heritage Agency of the Netherlands, Hobbemastraat 22, 1071 ZC, Amsterdam, The Netherlands
- 4 MUVE- Fondazione Musei Civici Venezia, Piazza San Marco 52, Venice, Italy

Analytical pyrolysis for the characterization of 20th century tempera by Maimeri

Ilaria Bonaduce¹, Sibilla Orsini¹, Anna Lluveras-Tenorio¹, Maria Perla Colombini¹, Sandro Baroni², Simona Rinaldi² and Maite Rossi²

In the course of ageing, proteins are subject to significant changes, including amino acids modifications (such as deamidation, hydroxylation and oxidation) and structural modifications (such as hydrolysis, aggregation, cross-linking and formation of strong complexes with cations). These phenomena, though not yet all well understood, may affect the analysis, interfering in several steps of the analytical procedure, and may challenge the interpretation of analytical results.

In order to overcome limitations of wet chemical methods arising from the reduced solubility of aged proteins in samples of cultural heritage, a combination of analytical pyrolysis techniques was used to characterise tempera samples from the painting collection of Fondazione Maimeri (Milan, Italy).

Maimeri, one of the very first factories to manufacture fine art materials in Italy, was established in 1923, and started the production of tempera paints by the end of the 1920s. The company was set up by the painter Gianni Maimeri and his brother Carlo, a chemist. Gianni Maimeri tested his tempera formulations in his paintings - a collection of which is now hosted at the Fondazione Maimeri - and discussed the results his unfinished text *Trattato della pittura* (*Treatise on Painting*).

In this study, evolved gas analysis mass spectrometry (EGA/MS), pyrolysis coupled with gas chromatography/mass spectrometry (Py/GC/MS) and double shot pyrolysis/gas chromatography/mass spectrometry (DSP/GC/MS) were used to characterise a selection of tempera paints by Gianni Maimeri belonging to the collection of Fondazione Maimeri. EGA/MS allowed us to investigate the thermal behaviour of proteinaceous materials alone, in mixture with pigments and in the presence of other organic materials. DSP/GC/MS was used to support the interpretation of the EGA/MS data. Both Py/GC/MS and EGA/MS were used to characterise the different proteinaceous materials and highlight changes occurring with ageing. Data clearly indicate that pure paint materials, such as casein, egg and animal glue, can be easily distinguished on the basis of pyrolytic profiles of 2,5-diketopiperazines (DKPs). DKPs are evolved by the thermal decomposition of the portions of the proteins which are less

thermally stable and are formed by cyclisation of neighbouring amino acids in a polypeptide chain. The study highlights how the formation of complexes with pigments and the interaction with oils while ageing can influence the degradation processes of proteins in a painting, and thus their thermal behaviour. As a consequence pyrolytic profiles of proteins tend to change, challenging the data interpretation.

This study contributes to our understanding of modern tempera formulations, representing a first opportunity to support the technical study of the composition of historical Maimeri paints and to evaluate the state of conservation of the paintings.

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Posters

Tempera Technique Used by Czech Landscape Painters at the End of 19th Century

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The present study is part of a three-year comprehensive project aiming above all to find out whether the differences in paint compositions—namely binding media and pigments, as well as the number of paint layers and the system of layering—could help explain why degradative processes are less pronounced in tempera techniques.

Historical sources show that, at the end of 19th century, Bohemian painters experimented with painting techniques and technologies. Of special interest to the present project is the relatively unknown syntonos tempera technique, used by the students of Mařák's plein-air landscape painting studio at the Academy of Fine Arts in Prague.

For the purposes of our research, we selected works by the most important painters from the above-mentioned school, including Antonín Slavíček, Otakar Lebeda and Antonín Hudeček, who all frequently used this tempera technique. In cooperation with the National

Gallery in Prague and private collectors, we have chosen a broad selection of paintings for both chemical analysis of paint media and conservation research.

Painting technique was investigated using optical non-invasive methods such as UV luminescence, infrared reflectography (IRR), and X-radiography. In cooperation with the Chemical-Technological Laboratory at the National Gallery in Prague and the Department of Chemistry at the Academy of Fine Arts in Prague, numerous pigments were evaluated with the help of non-invasive X-ray fluorescence analysis (XRF), μ -Raman spectroscopy (μ -RS) and scanning electron microscopy with X-ray microanalysis (SEM-EDS). Composition of organic materials in the paint layers was studied with gas chromatography-mass spectrometry technique (GC-MS) in cooperation with the Conservation Science Department, Kunsthistorisches Museum Vienna, Austria.

As part of the research of underdrawing, typical pencil graphite was found with the help of IRR analysis. Pentimenti and other sketches, invisible in the daylight, were discovered in paintings by Slavíček, Lebeda and Mařák. Macro photography revealed bubbles in the paint layer, likely caused by the vigorous way painters mixed the colours on the pallet. The character of the craquelure corresponded with that in other “syntonos” tempera paintings.

The results showed a wide range of mixtures of both pigments and binders. Mařák’s followers typically used red imprimatura and dark green underpainting. XRF, SEM-EDS and μ -RS techniques revealed the Naples yellow pigment in some of the paintings. In addition, an amount of barite white, which was added in impasto paint layer, was also identified.

The binding media detected included proteins (animal glue, egg yolk), polysaccharides (plant gum, e.g. cherry tree or apricot tree gum, starch), oils (beeswax, tallow, linseed oil, rapeseed oil and castor oil), and soft wood resins.

Based on these results it was possible to conclude that Mařák’s followers, although they each applied different methods to prepare colours, all combined a fairly wide range of paints from different tubes on the pallet and used similar materials, all of which could have probably slowed down the process of degradation. The syntonos technique described in Beckman’s patent was identified in one painting only. Although results on other paintings were ambiguous, the identified substances and the nature of the paint do not exclude the possibility that a combined tempera technique was used.

This work has been financially supported by a project of the Ministry of Culture in the Czech Republic for Specific university research from Student Grant Competition for 2015, Student Grant Competition for 2016 and Student Grant Competition for 2017.

This work has been financially supported by a project of the Ministry of the Interior of the Czech Republic: Comprehensive Instrumental Methods for the Assessment of an Artwork’s Authenticity, a Material Database of the 20th century (VI20172020050).

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John Roddam Spencer Stanhope: Pre-Raphaelite pioneer in the English Tempera Revival

Elise Effmann Clifford

In 1905 in a review of the Tempera Exhibition at the Carfax Gallery in London, the critic Aymer Vallance wrote that the Pre-Raphaelite artists "...of all people, should have been by rights tempera painters. That they were not is one of the strangest paradoxes in the whole history of art." To underscore his point, Vallance noted Dante Gabriel Rossetti's attempts to copy in oil Sandro Botticelli's Smeralda Bandinelli now in the Victoria and Albert Museum-- a failure that he believed a tempera advocate would, without question, attribute to the incorrect choice of materials.

Like Rossetti, other Pre-Raphaelite artists primarily painted in oil when working on canvas or panel despite using early Italian paintings as frequent sources of their inspiration. A notable exception was John Roddam Spencer Stanhope (1829-1908), an artist of the second generation of Pre-Raphaelites, who abandoned oil for tempera as a medium in the second decade of his career. A pioneer in the tempera revival in England, Stanhope spent significant periods of time in Italy, settling permanently in the hills outside of Florence in 1880. His shift to tempera coincided with the escalation of interest in Botticelli by the Victorian art world, and the earlier artist's influence is manifest in Stanhope's work.

Reminiscing in 1901 in an essay on the "Yolk of Egg Tempera" for the newly formed Society of Painters in Tempera, Stanhope noted that the more he worked with an egg yolk medium, the less he liked oil. He saw the brilliance of color and the resiliency of the final surface as strong advantages over the oil medium. However, a recent technical study of his painting *Love and the Maiden* (1877) in the Fine Arts Museums of San Francisco, has revealed that, although painted in tempera, Stanhope's technique differs in some significant ways from that of the early Italian artists that he so much admired.

Biography: Head Paintings Conservator, The Fine Arts Museums of San Francisco

The use of tempera in late Nazarene wall paintings of Anton Jebač in Škofja Loka castle chapel in Slovenia

Anita Kavčič Klančar, Andreja Padovnik, Ajda Mladenovič

One of the most discernible representatives of the 19th century church painters in Slovenia is Janez Wolf (1825-1884). After his study years in Venice, he firmly established the Nazarene style painting in Slovenia and worked on altar images and mural paintings. Wolf painted more than 30 murals in church interiors and exteriors but due to poor technological execution one third of his work has already been ruined. He is well known for the use of the Wolf's Tempera, a painting medium consisting of an egg white, flax oil and vinegar. Over the years, he instructed, mentored, and worked with numerous students.

One of them was also the painter Anton Jebačič (1850-1925), who worked alongside Wolf, creating numerous monumental wall paintings and later, as an independent artist, also following Wolf's stylistic and technological guidelines. In 1915, the Ursulines entrusted Jebačič to paint the entire castle chapel in the renovated medieval castle in Škofja Loka. With its figural and decorative division of space, its idea and content inclination, as well as its execution and technology, the wall painting counts as one of the last echoes of the (late)Nazarene painting in Slovenia. After WW2 (in 1959) the chapel was completely whitewashed, then uncovered and partly restored between 2013 and 2015. The conservation and restoration work and research of the obtained samples have shown that the painter worked in three different techniques.

To identify the binders in colour layers and plaster, the infrared spectroscopy with Fourier transform (FTIR) and Raman spectroscopy (RAMAN) for identification of the pigments was used. The results have shown that the decorative sections of the painting were done in the lime-wash technique, whereas the figural sections were done partly in tempera with protein and oil binders, and partly in tempera with added wax. The execution of the wall painting in three different techniques initiated different levels of damage, as well as different approaches to conservation and restoration. On sections painted in tempera the problem lay in the weakened adhesion of colour layers, which consequently resulted in the flaking and falling off of the painted layer.

In Slovenia, tempera and its durability in various climatic and physicochemical processes that take place in wall paintings has not been thoroughly researched. Therefore, we wish to compare the technological preparation behind Jebačič and Wolf's tempera, and inspect Wolf's influence on Jebačič's tempera preparation. The technological comparison of the tempera techniques is based on results from the already obtained chapel samples and from the samples to be taken from Wolf's wall paintings. In addition, based on recipes and previously gained results, several sample tempera techniques will be prepared, aged in acceleration, thus revealing their durability in various climatic conditions.

Biographies:

Anita Klančar Kavčič graduated with a degree in Painting from the Academy of Fine Arts and Design at the University of Ljubljana in 1998 and finished her MA studies of Conservation and Restoration in 2001. In the same year she gained the status of independent artist and in 2003 started working at the Restoration Centre of the Institution for the Protection of Cultural Heritage in Slovenia, at the Wall Paintings Department. Besides leading and conducting conservation and restoration projects on wall paintings, Anita helps organize research meetings and workshops, and shares her knowledge with students of the conservation/restoration programme at the Academy of Fine Arts and Design in Ljubljana.

Ajda Mladenovič graduated in 2005 at the Restoration Department of Academy of Fine Arts and Design at the University of Ljubljana and in 2010 at the Department of History of Art at the Faculty of Arts, University of Ljubljana. Since 2010, she worked as a Conservator-Restorer of the Ministry of Culture of the Republic of Slovenia, specialized in wall painting conservation. She currently works at the National Museum of Slovenia, holds assistant position at the Academy of Fine Arts and Design, and is a History of Art PhD candidate at the Faculty of Arts.

Andreja Padovnik graduated in 2008 at the Restoration Department of Academy of Fine Arts and Design at the University of Ljubljana and in 2015 she received her PhD at the Faculty of Civil and Geodetic Engineering, University of Ljubljana. Since 2008, she worked as a Conservator-Restorer of the Ministry of Culture of the Republic of Slovenia, at the Natural Science Department and she specialized in wall painting materials. She currently works as a PhD research assistant at the Faculty of Civil and Geodetic Engineering, University of Ljubljana. Her research work focuses on the development of lime-based injection grouts for the conservation of decorative surfaces.

A combined Attenuated Total Reflection FTIR spectroscopy and Principal Component Analysis for the identification and characterisation of aged paint binders: case study on the polychrome decorations of an 19th century wooden church

Ioana Maria Cortea

This study presents some analytical aspects on regard the use of Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR) for the characterization and identification of aged oil and tempera paint. Complex material systems, the investigation of these Artist's paint materials pose some problems due to the interfering signals of the original paint components and of the characteristic oxidative ageing products formed during time. Interpretation of standard FTIR spectra is often limited or hindered, broad overlapping absorption bands masking key analytical information that could aid in material identification. A spectrum refinement method such as given by the second derivative can be used in order to achieve a signal enhancement, while application of Principle Component Analysis (PCA) to derivative spectra can highlight small chemical variations that further make it possible to detect or distinguish minor organic compounds. This combined ATR-FTIR and PCA analysis was used to investigate the altarpiece and the outside polychrome decorations of a small wooden village church build between 1883 and 1887 in northern Oltenia (Romania). The aim of the study was to carry out a systematic collection of data in order to allow a correct interpretation in terms of the materials that were used. In the analysis, emphasis was placed on the capacity to identify and discriminate between the various organic materials found, moreover as the analyzed samples were affected by various levels of degradation. On regard the painting technique, performed methodology allowed identification of proteinaceous materials - indicative of the use of egg tempera, along characteristic spectral features that may be ascribed to siccativ oils and natural resins. Specific binder-pigment interactions could also be highlighted as well as the presence of anhydrite (anhydrous calcium sulfate) in the ground layers of the altarpiece painting that may point to the so called gesso grosso.

Biography

Junior researcher within The National Institute for Research and Development in Optoelectronics, department of optoelectronic methods and techniques for artwork restoration and conservation, with main expertise in infrared spectroscopy techniques (FTIR). Research interest include ageing effects in paint layers, kinetics analysis of deteriorated organic binders, mapping of chemical changes and their correlation with

physical aspects. Background studies in applied physics and MS degree in conservation science.

Proteomics analyses of egg binders – distinguishing between whole egg and egg yolk tempera

Stepanka Kuckova, Ursula Baumer, Patrick Dietemann

While pigment analysis in paintings is well established, the precise determination of binders is still a problem, especially for mixtures of proteins and oils. It seems that art historical categories such as “oil painting” or “tempera painting” (with egg) do not necessarily correlate in a straight-forward way with their material composition, because egg and oil binders can be mixed and applied in many different ways, which is not sufficiently understood yet. Egg yolk, egg white or whole egg have all been used in 19th and 20th centuries tempera formulations. However, these materials have quite different properties, especially in combination with other, non-aqueous binders, and therefore it is important to be able to distinguish between them. The poster will demonstrate an analytical method (nanoLC-MS/MS, nanoscale liquid chromatography coupled to tandem mass spectrometry) that is capable of identifying specific proteins occurring in egg white and egg yolk that could be used for the distinguishing between the different types of egg temperas.

The main goal of this work was to distinguish between whole egg and egg yolk tempera in 23 years naturally aged mock-up samples and in samples taken from real artworks by nanoLC-MS/MS. Using the mass spectrometric results we calculated the content of egg white proteins relative to yolk proteins in the analyzed samples. (It has to be pointed out that egg yolk always contains egg white proteins, although in small quantities.) The ratio of egg white and yolk proteins allowed us to distinguish between whole egg and egg yolk tempera as the first group in the world with having an analytical evidence for one or the other.

Up to today, after the analyses of only very few, but relatively very old artworks, egg yolk was identified as binder in the samples of paintings of Bernardo Daddi, Fra Filippo Lippi and Domenico Ghirlandaio of 14th and 15th century. Whole egg was identified in one early Italian artwork of the 13th century. At the moment it is unclear whether this use of binders is chronologically significant or not because the number of samples is still too low. However it seems that there is a predominance of egg yolk, which has been suspected but could not be proven until now.

Biography

Dr Stepanka Kuckova has been working as associate professor at the University of Chemistry and Technology, Prague, Czech Republic since 2015. She was awarded with Ph.D. in analytical chemistry at Charles University at 2006. She graduated from analytical chemistry (Msc.) at Charles University in 2003 and from biochemistry (Ing.) at the University of Chemical Technology in 2006. Her main scientific scope is the identification of protein materials in artworks by mass spectrometric techniques. During her research stay in Belgium in 2015 (Marie Curie Fellowship, Institut Royal du Patrimoine Artistique (IRPA/KIK)) she has started with protein identification on samples cross-sections by immuno-SERS.

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Everything Old is New Again: Investigating a Modern Tempera Fake of a Medieval Panel Painting

Glennis E. Rayermann, Anna Stein, and Gregory D. Smith

The Indianapolis Museum of Art's (IMA) *Madonna and Child* (IMA#51.98) was acquired by its donors as a school of Duccio Trecento Italian panel painting. However, stylistic anomalies and potential red flags in the known provenance led to questions of its authenticity and its subsequent reattribution to Icilio Federico Joni, an Italian artist, restorer, and forger active in the first half of the twentieth century. The IMA's *Madonna and Child* is a modern fake, created to convincingly imitate the tempera paintings of Italian masters.

In response to the vogue for medieval Italian paintings and the corresponding lack of interest in modern Italian works, Joni created new pieces made to look old, and delighted in fooling experts with his fraudulent panels. Joni taught other artists the techniques he used and detailed some of his counterfeiting methods in his memoir *Affairs of a Painter*, evidence that he was more intellectually than financially motivated to create his deceptive pieces.

As an artist, Joni presents an interesting example of the renewed interest in tempera painting in the 20th century. While many of his contemporaries looked to the past to aid the expression of their modern artistic vision, Joni looked to the present to help him best emulate the artistic vision of the past. When operating as a forger, he leveraged the knowledge of medieval-era techniques he gained while apprenticing in a gilding workshop, studying at the Academy Belle Arti in Siena, and restoring medieval artworks. Utilizing this strong technical background, he constantly experimented with materials and techniques in service of making credible fakes. Joni had no qualms about dipping into the modern artist's toolbox in order to create works with the appearance of centuries old masterpieces.

The technical analysis of the IMA's *Madonna and Child* presents a case study to understand how a modern imitation of a medieval tempera painting was created. A variety of analytical tools were used, including imaging techniques, pyrolysis gas chromatography/mass spectrometry (py/GC-MS), Fourier transform infrared (FTIR) spectroscopy, Raman spectroscopy, X-ray fluorescence (XRF) spectrometry, scanning electron microscopy (SEM) coupled with energy-dispersive X-ray spectroscopy (EDS), chemical staining, and polarized light microscopy (PLM). The data gathered from the IMA's *Madonna and Child* using these methods informs a thorough discussion of the binding medium, the pigments used, and the methods for generating the expected aged appearance. These results are compared to those from technical studies of known Joni forgeries and methods documented in Joni's memoir, interviews, and by his students.

Glennis Rayermann is a graduate student earning her Ph.D. in physical/materials chemistry at the University of Washington (UW) in Seattle. She earned fellowships from the ARCS foundation, the Department of Defense's National Defense Science and Engineering Graduate program, and the National Science Foundation's (NSF) Graduate Research Fellowships Program. During her NSF fellowship, she spent four months working in the conservation science lab at the Indianapolis Museum of Art (IMA). Her current research at UW investigates phase behavior in lipid membranes.

Scientific documentation and conservation of John the Armenian tempera painting from nineteenth century St. Mina Church

Rasha Shaheen, Mona Fouad Ali, Medhat el-Dabaa, Ahmed Zwain, Emil Henin

Tempera is a fast-drying water miscible emulsion paint consisting of a colored dye mixed with a water-based adhesive. It has appeared since the first century AD and continues to this day. Tempera continued to be used as a major coloring material until the 15th century during the European Renaissance, when oil colors were invented. This art of Coptic art is also known for painting on walls, on wood paintings and on other supports. Tempera painting a method of painting with pigments dispersed in an emulsion miscible with water, typically egg yolk. In this technique, a completely dry painting ground is prepared, and the artist depicts it with coloring materials mixed with a medium of water-soluble adhesive, such as Arabic gum, animal glue or egg whites. The most important of which are the domes of the altars. The painting is different in the style of Tempera in Egypt than in Europe. This paper presents the results of analytical studies of John the Armenian Tempera painting. The anatomical structure of the stamping plate was also studied. This method was studied and applied, the quality of the paint used, the color materials used in the coloring, and the color media used as a link to the grain of the colored material. In the study, the best methods used for recording, examination and analysis of mural images were used, namely archeological, architectural and photographic recording. Optical scanning and scanning of devices such as the use of optical microscopy and polarized microscopy, as well as the use of a scanning electron microscopy, which has the ability to maximize magnification, helps to identify the topology of the surface. The scan is also used in infrared and ultraviolet imaging, which helps to study subterranean drawings and to distinguish between modern and archaeological colors. In the field of analysis X-ray diffraction, which is one of the most common types of analysis, is used in addition to the use of infrared analysis and gas chromatography to identify the paint media used in the application. These tests have been used to develop a successful treatment plan that helps keep the painting alive throughout the ages.

Biographies

Rasha Shaheen, Director of conservation department at Egyptian Textile Museum, Ministry of Antiquities, Cairo, Egypt.

Mona Fouad Ali, Professor of conservation of mural painting vice dean for community service and environmental development, Faculty of Archaeology, Cairo University, Egypt.

Medhat el-Dabaa, Researcher at Egyptian-Italian Center for Historical Paper

Ahmed Zwain, Conservator at Ministry of Antiquities

Emil Henin, Conservator at St. Mina Church in Sayeda Zeinab, Egypt.

Hiding in plain sight? Tempera-based British paintings at Tate, London

Joyce H Townsend

Excepting the 'fresco' paintings by William Blake (1757-1827) which were executed in tempera on a variety of supports using a mixture of unrefined sugar or honey, gum Arabic and gum tragacanth, varnished with animal glue, leading to poor preservation or even survival of these works, there have not been detailed technical studies of the occurrence of tempera-based paints in the Tate collection. There is a practical reason for this: suspected works in tempera by both British and European artists appear to be in good or excellent condition – with fewer signs of ageing and less necessity for conservation treatment than their counterparts made using oil-based paint. Therefore some examples may be 'hiding in plain sight'.

Documentary sources can suggest candidate artists but not usually candidate paintings: George Frederic Watts (1817-1904) and William Holman Hunt (1827-1910) both wrote of using tempera-based grounds, but these have not yet been found in Tate works. Walter Crane (1845-1915), better known as a commercial illustrator, did use a technique combining tempera and oleoresinous paints in his single work in the collection, *The Renaissance of Venus* 1877. The protein-based varnish on top, not necessarily original, has compromised its appearance and has so far proved too challenging to remove. John Roddam Spencer Stanhope (1829-1908) is represented by only two paintings, neither of which were made in the period when he is known to have used tempera.

In the earlier twentieth century, the Herringham translation of Cennino Cennini into English encouraged Charles Sims (1875-1928) to experiment with tempera-based paints, using the term in its widest sense, and served as a justification for Joseph Edward Southall (1861-1944) and Maxwell Armfield (1881-1972) to use pure egg tempera. Edward Wadsworth (1889-1949) preferred traditional egg tempera for his paintings too, though the analytical evidence suggests that he had to substitute for this rationed food during the Second World War. His paintings show unusual deterioration problems which may be the consequence.

The poster will highlight a number of tempera-type paints which have been investigated analytically, with an emphasis on the sometimes subtle visual characteristics that could suggest the use of tempera paints rather than oil tube paint. It will address two of the conference themes: 'The bigger picture: tempera painting as an alternative trajectory' and 'In the studio: possible implications for conservation decisions'.

Biography

Dr Joyce Townsend is a senior conservation scientist, based at Tate Britain, London. She works on the identification and deterioration of painting materials and on the interpretation

of artists' techniques, principally for British art from the nineteenth to the mid-twentieth century. Her skills include optical and electron microscopy, colour measurement, microfadometry, and supervision and management of many research projects, and she works regularly with Tate conservators. She has published extensively, edited many Archetype conference proceedings, and is the author and/or editor of several Tate books on the techniques of nineteenth-century artists.

Formation of Efflorescence and Soaps in a Group of 30-Year-Old Egg Tempera Paints: A Baseline for Comparison

Jia-sun Tsang and Stephanie Barnes

The artist Jacob Lawrence (1917-2000) used a variety of commercially produced tempera paints over the course of his career. In 2016, in preparation for an upcoming exhibition, a technical study investigated the deterioration of tempera paint in one of Lawrence's later works. The examination revealed tiny circular losses with the appearance of burst bubbles in the blue tempera throughout the painting's surface, as well as small areas of paint loss that had accrued over the years. An analysis of paint samples near the areas of loss identified egg tempera with cobalt pigments and the presence consistent with zinc palmitate/stearate

The investigation of Lawrence's intensely efflorescent paint led to a 2016 comparative study of several egg tempera paints prepared at the National Gallery of Art in Washington D.C in 1986 by Tsang. These samples of naturally aged, egg tempera paints had steadily developed pustules and/or a crystalline efflorescence. They also often contained metal soaps. The analysis further noted that 1) pigments that did not contain metal ions to which free fatty acids could bind (e.g., ivory black, raw umber, Prussian blue) tended to have crystalline fatty acid efflorescence on the surface. 2) Pigments that did contain metal ions to which free fatty acids could bind (e.g., zinc white and malachite) tended to form fatty acid soaps that appeared as pustules or agglomerations within the paint film, rather than surface efflorescence. 3) Analysis of ultramarine and smalt was less conclusive, although there appeared to be some fatty acid efflorescence. 4) Cadmium red paint was the best preserved, showing only a small amount of efflorescence on the surface and no obvious pustules or protrusions within the paint layers.

The egg tempera paints had been prepared by Tsang using techniques learned at the Winterthur/University of Delaware Program in Art Conservation. A muller was used to grind dry pigments (ivory black, raw umber, cadmium red, zinc white, lead white, malachite, smalt, Prussian blue, and French ultramarine) and disperse them into a base of egg yolk mixed with a small amount of distilled water. No additives were used in the preparation. The egg tempera paints were cast on glass slides and kept in a storage box in a stable, dark environment. The samples were occasionally removed from storage for viewing and sampling for binder analysis.

Analysis of these aged, laboratory-grade egg tempera paint samples provide valuable baseline data for comparison with modern tempera paintings exhibited or stored under real-life conditions. It is hoped that this study of the formation of efflorescence and soaps in egg tempera paint samples, employing in-house instrumentation analysis currently used to

investigate metal soaps, will lead to a deeper understanding of the mechanisms of aging, chemical migration, pigment interface, and chemical changes seen in egg tempera paintings.

Biographies

Jia-sun Tsang is senior paintings conservator at the Smithsonian Institution's Museum Conservation Institute, where she has served for 29 years. She also serves SI museums that do not have an in-house paintings conservator. She holds a M.Sc. from the Winterthur/University of Delaware Program in Art Conservation and an M.Sc. in chemistry from Bowling Green State University in Ohio. Since 2007 she has focused on the conservation and analysis of paintings from the collections of the National Museum of African American History and Culture in preparation for its grand opening in fall 2016. She specializes in modern materials research and the conservation of modern and contemporary art.

Stephanie Barnes received an M.A.C. in art conservation from Queen's University in Ontario. She also has a B.Sc. in chemistry from Mount Allison University in New Brunswick and a M.Sc. in chemistry from Laval University in Quebec. She recently completed a fellowship in painting conservation at the SI's Museum Conservation Institute, where she worked on the conservation and analysis of paintings from the collections of the National Museum of African American History and Culture in preparation for its grand opening in fall 2016. She has also completed internships and contracts at the Canadian Conservation Institute, the National Gallery of Canada, and Library and Archives Canada.

Frances Hodgkins: tempera painting in St Ives

Sarah Hillary

Frances Hodgkins (1869-1947) is an artist known principally for her paintings in watercolour, oil and gouache, but what is less-known is her work in tempera, which occurred at a formative period in her development as an artist while living in the artist's colony of St Ives from 1914-18. This paper explores the reasons behind her use of the tempera medium – how it related to her overall practice and its implications for conservation.

Hodgkins was born in New Zealand but spent most of her working life in Britain. She received recognition for her work late in life - was a member of the avant-garde group the Seven and Five Society from the age of 60 and in 1940 was chosen to represent Britain in the Venice Biennale. She worked in a modernist style of simplified forms and colour relationships but she was particularly known for her calligraphic brushwork and unique colour sense.

When World War I broke out Hodgkins was in France and was forced to return to England. She moved to St Ives, Cornwall, where she could live cheaply and which was the home of her friend Norman Garstin - a member of the Newlyn School of artists. Hodgkins had been a successful watercolourist and teacher for many years before this, but struggled to be taken seriously as an artist in what was considered a medium for amateurs. It was in St Ives that she renewed her resolve to begin to paint in oil, which she had begun with lessons in Paris in 1908. However instead of pure oil paint, she appears to have begun by painting a suite of works in a tempera medium on either a gesso support on plywood or on primed canvas.

Painted around 1916, Refugee Children is from this group and one of a number of works depicting the plight of the Belgium refugees who had fled to England after the German invasion. The paint is applied in washes over a textured gesso ground on muslin and plywood. Samples of the paint media have been identified as oil (walnut or linseed/poppy mixture), animal glue, and a small amount of egg or casein.

War restrictions meant that it was difficult to obtain art materials and Hodgkins had limited means, so being able to easily source the materials used to make up the tempera and gesso was an advantage. There was also a renewed interest in tempera at the time, and most importantly, it allowed Hodgkins to continue painting in a similar fashion to her works on paper, but on a more robust textured support than paper.

The tempera paint is thinly applied with a delicate matt surface, and although the gesso supports are stronger than paper, they are also very vulnerable to cracking and soiling. Radical conservation treatments have been carried out on at least one of these works which has saturated the surface and permanently changed the appearance so knowledge of the paint medium is important to ensure their preservation.

Biography

Sarah Hillary is the Principal Conservator at the Auckland Art Gallery Toi o Tāmaki. She graduated with a Masters in Applied Science in the Conservation of Paintings from the University of Canberra and her first degree was a Bachelor in Art History from the University of Auckland. Sarah has specialised in the technical examination of paintings and published work on the techniques of New Zealand artists such as Colin McCahon, Rita Angus, and Frances Hodgkins. She has also been involved in curating exhibitions about artist technique including Modern Paints Aotearoa (2014-15), Frances Hodgkins: forgotten still life (2015-16) and Identifying Lindauer: his materials and techniques (2016-17). Sarah is a practicing artist and is represented by Anna Miles Gallery.

Art-technological investigation of the murals of the Goethe Gallery in the Weimar City Palace

Veit Gröschner

In connexion with restorations commissioned by the Klassik Stiftung Weimar in 2010, investigations on the structure of the paintings from a technical point of view were carried out. The starting point was an extensive confrontation with the historical sources relating to the creation of the room and the artists who worked on it.

Commissioned by the Russian Grand Duchess Maria Pavlovna (1786–1859), a unique ensemble of complex room architecture was created during the nineteenth century in the west wing of the Weimar City Palace to commemorate the leading literary figures associated with Weimar. This ensemble is now the oldest example of its kind to survive in so complete a state.

We may take the Goethe Gallery as an example of all the rest. This room was created between 1835 and 1852 by very different artists from the original design to the final execution. The client made very clear stipulations as to not only the pictorial programme but also the painting techniques to be used. Among those involved in the planning of the decoration of the room were personalities such as Karl Friedrich Schinkel (1781–1841), Clemens Wenzeslaus Coudray (1755–1845), and Ludwig von Schorn (1793–1842). In general charge of the designs and the execution was Bernhardt Neher. He planned the central pictures on the walls on plaster panels which were prepared in the workshop and only subsequently incorporated into the room. Responsibility for the paintings, based on the 'decorative design of Herr Geh. [= Privy Coucillor] R. Schinkel' passed to Carl Hütter.

The investigations of the murals undertaken in the context of the restoration confirmed the different painting techniques used in the individual wall zones, as stipulated by the client. The decorative painting we find here ranges from pictorial scenes to the purely ornamental. A number of different painting techniques were used here, primarily for the motifs but also for the achievement of the desired 'Pompeian effect of the rooms'. Even so, the investigations into the painting techniques and preceding the restoration revealed no encaustic painting. Rather, what we have here is a mix of binding agents consisting of beeswax and a resin component, possibly mastic, which was applied cold.

The scenic depictions on the murals were executed in the fresco-secco technique on a multilayer plaster system containing gypsum. The supports were plaster panels framed in angle steel with an integrated wire mesh. Two gypsum-lime plaster layers were incorporated into this support. These plasters have a high proportion of additives such as wood fibres and shredded straw, reducing the compressive strength of the plaster layers towards the room side. The third, top, layer of lime-gypsum plaster is just a few millimetres thick. The outlines were drawn and incised on this layer while it was still wet. Immediately afterwards, the ground of the painting was applied in the fresco technique. No organic binder was attested here. The sample for analysis was taken from the edge of the picture, which was not painted over when the painting was later completed in a number of layers. The botto-most of these layers were applied over large areas and are relatively thick. Glazes were used locally. The final modelling of the motifs was done using multilayer hatching and shading. Light and shade effects were also created in a number of colours in places.

Scientific analyses showed that the binder used in these paint layers was a casein tempera, while among the pigments iron oxides such as ochre and red, carbon black, ultramarine blue, and zinc white were identified.

In a critical assessment of the implementation of the painting on the individual picture panels, one very quickly comes to the conclusion, these paintings were the work of different hands. Thus significant differences can be observed in the handling not only of the individual paint layers, but also of specific picture zones. These differences are most clearly apparent in the modelling of the faces.

Biography

Veit Gröschner studied at the Potsdam University of Applied Science and at the Bauhaus University in Weimar. Since 1991, as a graduate designer and restorer (VVD), he has been head of the Ingenieurbüro für Denkmalpflege, Rudolstadt, a firm specializing in heritage

conservation. With his staff, restorers, architects and art historians, he is active in a variety of fields of architectural and art conservation. His activities range from concept development across specialist planning in the areas of conservation and restoration, all the way to project management. Through academic projects he maintains close co-operation with universities and colleges. The focus here is on restoration and conservation technologies and research into historic pigments. In addition, Veit Gröschner works in specialist committees such as the WTA and the Thuringian State Monuments Council, and has numerous publications to his name.

Studies of the treatment of consolidation in a collection of XIXth Century Tuchlens from the Ducal Palace of Gandía (Valencia, Spain)

Esther Aznar Franco, Susana Martín Rey, María Castell Agustí.

The Palacio Ducal de Gandía (Valencia, Spain) is one of the major XIVth Century stately homes of the Crown of Aragon. Various historical stages are distinguishable since the construction by King Alfonso el Vell in the XIVth Century, through the period of the Borja family from XVth to the XVIIth centuries. After a brief period of abandonment, the Company of Jesus acquired the building in the XIXth Century. They decorated some rooms in Neo-gothic style and with a collection of eight paintings made as the olds Tuchlens mimicking tapestries. These works are made with natural fibres, probably linen or hemp, and are painted directly on the support with water-based paints with different saturation levels, going from the liquid paint which penetrates and is absorbed by the support, to denser paintings. The conservation of these works has two very important conditionings. On the one hand, they mimic tapestries and so they are exposed and treated as such without frames, hung from bars, and have a size of more than two metres; this has led to various problems of conservation. On the other hand, ligaments are made of taffetas with ribbed effect, which have a very marked texture and on which the pictorial film has greater difficulty to adhere. The process of consolidation of these works is based on two premises: an adhesive that respects the matte appearance of the paintings, and that any process must adapt to the ligament texture, since its irregularities make penetration in the pictorial layer an important factor to control. Matte paintings or without varnishing are a constant in mural painting, paper and contemporary painting techniques. Based on the premises we will start working the consolidating materials that are typically used in problems like ours, studying their characteristics, pigments, binders and textile fibers of the XIXth Century. Traditionally paintings of this type were consolidated with sturgeon size or starches, which offered a matte appearance required in these works. Currently the industry offers a multitude of materials that include the Aquazol®, Klucel® and Junfunori® algae that are being widely used, and for which we have enough information on how they perform in art conservation. The ideal binder material should adapt to the work texture, being agar-agar, a potential candidate as through the different stages of cooling it penetrates and leaves no residue.

Biography

After she finished her studies in conservation and restoration at the Polytechnic University of Valencia, she continued her professional training in Italy with a Leonardo programme scholarship. Since then she has been training halfway between Italy and Spain. Soon she will begin a training stay at the Superior Institute of restoration for conservation and restoration (ISCR) in the laboratory of paint on canvas in Roma. Her professional career as a conservator began in 1995 in the emblematic building of the Almudín of Valencia. Since then she has worked restoring easel painting, gilded and polychrome sculptures, and participated in campaigns of restoration of mural painting, both on her own and in several private and public companies. In particular, she has been working for 14 years in the Foundation La Luz de las Imágenes in the various campaigns of restoration of the Valencian Community and, more recently, the Church of St. Nicholas with the EMR company. All this training and work alongside other professionals, has given her a high proficiency on how to approach a work of art from a restoration point of view.