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Abstracts from

The Ulrich Schiessl PhD Colloquium

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The Ulrich Schiessl PhD Colloquium

Dresden 24-25 November 2014

The symposium was organized by ENCoRE in co-operation with the Academy of Fine Arts Dresden (Hochschule für Bildende Künste Dresden) in Germany

Presenters:

Robert Szemző Academy of Fine Arts and Design in Bratislava Supervisor: Boris Kvasnica	5
Anna Nowicka Academy of Fine Arts Warsaw Supervisor: Marzenna Ciechanska	6
Monika Stachurska Academy of Fine Arts Warsaw Supervisor: Helena Hryszko	7
Katarzyna Górecka Academy of Fine Arts Warsaw Supervisor: Joanna Szpor	8
Maciej Baran Academy of Fine Arts Warsaw Supervisor: Paweł Marek Jakubowski	9
Markus Pescoller Academy of Fine Arts Vienna, Supervisor: Wolfgang Baatz	11
Johanna Wilk University of Applied Arts Vienna Supervisor: Gabriela Krist	12
Eva Putzgruber University of Applied Arts Vienna Supervisor: Gabriela Krist	13
Roberta Renz-Zink University of Applied Art Vienna Supervisor: Gabriela Krist	14
Daniela Karl Academy of Fine Arts Dresden Supervisor: Thomas Danzl	15
Thomas Krämer Academy of Fine Arts Dresden Supervisor: Ursula Haller	16
E-Newsletter 5/2014	3

Beate Fücker Academy of Fine Arts Dresden Supervisor: Thomas Danzl	17
Sibylle Schmitt Academy of Fine Arts Stuttgart Supervisor: Volker Schaible	18
Chiara Pasian The Courtauld Institute of Art London Supervisor: Sharon Cather	19
Marta Kamińska The Academy of Fine Arts in Kraków Supervisor: Zofia Kaszowska	20
Karina Niedzielska The Academy of Fine Arts in Kraków Supervisor: Zofia Kaszowska	21
Monika Piotrowska The Academy of Fine Arts in Kraków Supervisor: Zofia Kaszowska	22
Johanna Lang Technical University Munich Supervisor: Erwin Emmerling	23
Elena Aguado-Guardiola Polytechnical University of Valencia Supervisor: Xavier Mas I Barberà	24
Miquel Herrero Cortell Polytechnical University of Valencia Supervisor: Xavier Mas I Barberà	25

Development of Complex, Three-Dimensional Acquisition System for Digitisation of Wooden Polychrome Sculptures.

Robert Szemző, Academy of Fine Arts and Design in Bratislava

Cooperation between conservation and information technology specialists is essential for the development and application of beneficial solutions for the future strategies of the cultural heritage protection. This presentation is devoted to an ongoing cooperative project build on the intersection of two separated PhD. research projects. Its main goal is to define and develop a suitable method for three-dimensional, non-contact remote sensing of specific Cultural Heritage objects.

Among a variety of solutions for 3D reconstruction available nowadays, it is often very difficult to choose a suitable approach and to balance the advantages and disadvantages of different acquisition methods. Building the digital representation of historical wooden polychrome sculptures, it is important to preserve the optical properties of the surfaces of these objects. It is ongoing technological challenge to provide a faithful and realistic record of the object using an automated acquisition process along with extended detection, characterisation and segmentation of its surface properties. The effects of coloured finishes created using a combination of glossy and diffuse surfaces is often achieved using layering including varnishes, underpaintings or coloured patinas.

To record the corresponding data the SMISS (Scalable Multifunctional Indoor Scanning System created by Mgr. Tomáš Kovačovský) structural light scanning system was adapted. Fast, precise and automated digitization of an object's surface can be performed, resulting in a dense point-cloud with specific radiometric properties recorded for each point. In order to characterise the specific anisotropy of various surfaces with reference to particular technological approaches or for identification of recent interventions (e.g. overpaints) multispectral surveyance mode may be used. Subsequently a variety of image analysis procedures may be executed and aligned to the point-cloud of

each scan using a predefined pipeline. It is also possible to carry out difference filtering using a false colour to visualize specific features in the 3D parameters of the object volume. The data obtained by SMISS system was compared with data acquired by conventional methods such as laser scanning and photogrammetry. The scans performed on selected samples with respect to the specific characteristics of the recorded objects. Evaluation of the tests is accompanied by proposals for the future development of the device.

The project was conducted in cooperation with the Faculty of Mathematics, Physics and Informatics of Comenius University in Bratislava (RNDr. Zuzana Berger-Haladová Comenius University) and the Department of Conservation and Restoration at the Academy of Fine Arts and Design in Bratislava (Mgr.art Robert Szemző)

Key words: Digitisation, Polychrome sculptures, 3D scanner

The deacidification of paper substrates as one of the stages in the conservation of modern paintings – research and practical application, based on the example of conservation of selected paintings by Mieczysław Szymański from the Museum of the Academy of Fine Arts in Warsaw

Anna Nowicka, Academy of Fine Arts Warsaw

The aim of the research was to introduce into the preservation practice the process of deacidification of the support. It is especially important for works done in 19th and 20th centuries which were painted on low-quality papers. It was also intended to test the influence of the deacidifying substance on the paint layers of paintings on paper supports where oil techniques were applied.

The issue of so called acid paper has a significant influence on the state of preservation of paintings done on cellulosic supports. A low pH-value causes the degradation of cellulosic chains as a result of acid hydrolysis. This leads to a gradual decomposition of the paper which in turn leads to the inevitable destruction of the work of art.

The concern for the safety of painting layers, however, constrains the conservator from neutralization of acid substances, even if, in relation to the support itself, that is desirable. Planned research is intended to provide knowledge of the potential effects of deacidification. Case studies of the project comprise chosen paintings by Mieczysław Szymański: an artist, a teacher with a long-term experience and a professor at the Academy of Fine Arts in Warsaw between the years 1956-1972. The chosen method of deacidification was the Bookkeeper, a water-free method, the deacidifying substance of which is the microcrystalline magnesium oxide (MgO), suspended in an organic liquid: perfluoroheptan (C₇F₁₆). The carrier of magnesium oxide, perfluoroheptan, is a neutral liquid with regard to

the majority of organic substances and does not cause swelling of the paper.

The project intended to compare the changes occurring in the paint layers of the model samples on which the deacidifying substance was not applied with the changes in the samples saturated with the MgO suspension.

In order to do that, all the samples were to undergo accelerated ageing tests. The differences between the processes that occurred were registered by comparative measurement of colour changes, as well as with scientific analyses conducted with instrumental methods before and after ageing (FTIR, GC-MS, SEM, colorimetric measurements).

At first, the deacidification was applied on the model samples and then, because the result of research was satisfactory, also on the original works of art, Mieczysław Szymański's paintings. The paintings were also examined and conserved.

Providing an answer to the above questions became the goal of a part of the research project performed at the Faculty of Conservation and Restoration of Works of Art at the Academy of Fine Arts in Warsaw and financed by the National Science Centre (Project No. 2011/01/N/HS2/02308).

Key words: deacidification, paper, oil paint

“Between harmony and matter” — conservation issues of the late gothic, embroidered orphrey of a chasuble from the Treasury of the Jasna Gora Monastery.

Monika Stachurska, Academy of Fine Arts Warsaw

As the part of the dissertation, the conservation and restoration of two embroidered pillar-orphreys decorating the front and back of the chasuble from the collection of Jasna Gora's Treasury, were carried out. This conserved vestment decoration comes from the first third of the 16th century made in the spatial relief embroidery technique which was characteristic of the end of the 15th and beginning of the 16th century. Originally it was one piece in the shape of a Latin cross and was used as a cross-orphrey on the back of another chasuble of the late Gothic form. At an unspecified time, the arms of the cross-orphrey with the scenes of the Annunciation and Adoration of the Shepherds were cut off and cut in half and then were composed as the pillar-orphrey in front of the current chasuble. At the back of the current vestment there remained only the central part of the cross-orphrey which presents God the Father, Madonna and Child and St. John Evangelist.

While defining the goals of the conservation and restoration of embroidery, the aesthetic status of the work of art within the meaning of period in which it was made was the point of reference. In accordance with medieval aesthetics, beauty is the harmony of proportions of the various elements of the work of art, both in relation to the matter, as well as the function. Following such an interpretation, a decision was made to restore the original cross shape of the orphrey. The cut parts of embroidery, previously moved to the front of the chasuble, were connected and attached to the central parts of the orphrey. It was restored in form and ideas as closely as possible to the original artistic, iconographic and semantic intentions. It should be emphasized that the conservation treatment was not the reconstruction of embroidery, but the recomposition of the original fragments, taking into account the results of the research.

The commencement of conservation of a work of art is a unique opportunity to develop a variety of issues related to the conserved object. In the case of the conservation of Jasna Gora's orphrey it has been

decided to take this opportunity and study in detail how the medieval relief embroidery was made. This task was facilitated by the condition of the Jasna Gora monument. The aim of the research was to develop a methodology of analysis and documentation of the materials visible on the surface of embroidery, as well as the invisible ones, inside the three-dimensional figures, responsible for their shape, form and spatiality. As part of the dissertation, a method that allows observation, analysis and documentation of the invisible materials has been developed. A number of trials with a variety of analytical techniques using X-rays to analyse the stuffing of embroidery (radiography, computed tomography [CT], X-ray scan) were carried out. Due to the relatively small scale of embroidered figures X-ray microtomography (μ -CT) and microradiography proved to be the most effective methods. The study was carried out in collaboration with the Faculty of Materials Science and Engineering at Warsaw University of Technology. Thanks to this innovative method on the cross-sections and three-dimensional models, all kinds of stuffing of the embroidered figures have been revealed.

The technology and technique of the orphrey also became the starting point for a comparative analysis of other relief embroidery from the late 15th and the beginning of the 16th century preserved in Polish and European collections (mainly German and Austrian), in order to determine the provenance of the Jasna Gora monument. The highly skilled embroidery, the extreme precision of each detail's elaboration, a large variety of metal threads and a wealth of pearls makes the orphrey an exceptional and unique masterpiece in Polish and European collections.

The research presented in the dissertation was carried out in the framework of a project (N N105 333339) funded by the National Science Centre in Poland.

Key words: Textile conservation, raised embroidery, relief embroidery, three-dimensionality embroidery, late Gothic embroidery, metal threads, X-ray microtomography,

Conservation and restoration solution for the curvilinear large - size canvas painting „Adoration of the Magi” by Mauritius Heinrich Loder (XVIII c.) from Saint Aubain’s Cathedral in Namur (Belgium)

Katarzyna Górecka, Academy of Fine Arts Warsaw

Large-size paintings represent precious part of the heritage of European culture. In the Baroque period, paintings on canvas reached enormous dimensions and became a decorative element closely connected with architecture. Sometimes canvas was adapted to curved walls, curvature of pillars and even barrel vaults. The main subject of the PhD project supervised by prof. Joanna Szpor from the Academy of Fine Arts in Warsaw are pioneer theoretical and experimental works, that are undertaken to study the reason and nature of anisotropic support deformation of such unusual canvas paintings.

The aim of the PhD project is development of the conservation solution for the eighteenth century curvilinear canvas painting “Adoration of the Magi” from the Saint-Aubain Cathedral in Namur (Belgium). This masterpiece belongs to the group of four large-size canvas paintings, presenting the scenes of the Christ’s childhood, exhibited in the cathedral presbytery. The artist is Mauritius Heinrich Loder who was born in 1728 in Mainz (Germany) and died in 1793 in the province of Namur. The atypical form of the painting bowed in the horizontal plane, adapted to the apse wall, and its enormous size (3.70 x 4.50 m) and weight (about 280 kg with the frame) required using some innovative technologies and materials. The painting was in a very poor condition and required complex conservation work. The main conservation problem was serious deformation of the canvas support resulting from synergic impact of several factors: the weight of the object, quality of straightening system, temperature fluctuation and relative humidity of air. The conservation process was based on the detailed analysis of the canvas shape using optical methods: photogrammetry and 3D laser scanning. The concept of the conservation was preservation of the curvilinear canvas form during each step of the conservation works which required construction of two curved platforms:

concave and convex. To avoid rolling the fragile painting a new system of canvas turning was also designed. An innovative method of strengthening the canvas in the vertical direction during the lining process by using Kevlar fibres was applied. The original stretcher frame as an example of historical construction was preserved. The modification of the stretcher system was made from the original stretcher frame.

The conservation and restoration work of Loder’s painting was finished in August 2014. During the cleaning operation the signature of the artist was found. Archival research and iconographic studies allowed identification of his self-portrait and the portrait of the paintings’ patron. Works on the Loder’s biography is in progress.

Optical and mechanical researches was achieved as a scientific project executed in collaboration with specialists: Piotr Pawłowski PhD, Marek Skłodowski PhD from the Institute of Fundamental Technological Research, at the Polish Academy of Sciences in Warsaw and M.Sc.Eng. Grzegorz Osowicki, in charge of technical assistance. Presented work was supported by the Polish National Science Centre under Grant DEC-2011/03/N/HS2/01936 “*Innovative measurement of deformations in large-size canvas paintings by remote optical methods and its application in documenting, designing and evaluation of technical conservation solutions*” No. 165419. Conservation project of the non-planar canvas painting “Adoration of the Magi” from the Saint - Aubain Cathedral church in Namur allowed development of conservation methodology for other curvilinear canvas paintings.

Key words: conservation and restoration, large-size canvas painting, curvilinear, deformation of the support, lining, stretching, stretcher frame, photogrammetry, 3D laser scanning

Conservation and restoration of the *Dutch Cabinet* in Wilanów Palace. The search for ideological content and artistic solutions in ceiling painting.

Maciej Baran, Academy of Fine Arts Warsaw

The subject of the Ph.D. is based on the conservation work of the Dutch Cabinet in the Museum of King Jan III Sobieski in Wilanów carried out in the years 2009 - 2012. The work included: architectural research about the walls, conservation and reconstruction of silk velours Genoese in *cisele* type and wooden paneling (excluding the gilded woodcarving items), monumental illusionistic ceiling painting by Samuel Mock, as well as the reconstruction of colours and interior design of the whole room, with the general idea of revealing the original elements, and research on the Saxon era. Additionally complex chemical research and extensive documentation of the interiors and activities was made.

Topics discussed within the dissertation are on the border of several fields of knowledge: history, art history, technique and technology of works of art, and the conservation and restoration of monuments. Basically the dissertation consists of two areas of research.

The first one covers issues of art history. In this part the iconographic analysis and ideological meaning of wall decoration was carried out as a fundamental element of the artistic design of the whole interior. This part describes the recognition of semantic works together with the art historical context (authorship, changing of the functions of the room, the aesthetics of the first half of the eighteenth century etc.). In this particular case, a good understanding of the meaning and historical context of the work of art is the starting point for the proper conservation and in particular the restoration and reconstruction process.

The second part covers the technique and technology of elements and mainly the methodology of conservation. This paper takes the issue of the ceiling painting technology, interior

technological changes, the mode of creating historical decors, and search for appropriately selected methods of preservation. It presents the painting technique and restoration problems and processes used in the illusionistic ceiling painting. Its technological specificity had a huge impact on the current state of preservation of the work. The dominant issue turned out to be how to solve the problem of structural and inter-layer consolidation. This work was performed using innovative adhesives (amongst others, nano-calcium).

In addition the issue of overall restoration and arrangement of the eighteenth century interior was raised. These activities required a colour design process, as well as ideological-formal understanding. Reconstructions that were performed covered amongst others, the interior colour scheme based on the above-mentioned achievements of iconographic analysis and material evidence. In order to expose this nature of the epoch, window decorations and hangings were reconstructed which required a dedicated project based on eighteenth century iconographic patterns and sources.

Both research areas (ideological and technological) formed in this case particular tools for the whole conservation and restoration process and proper interior arrangement. Together they enable us to understand the method of formation of the Dutch Cabinet conservation project.

On the basis of the Dutch Cabinet in the Museum Palace in Wilanów the methodology of the conservation process was analysed. Its primary idea was to recognise and understand the work of art (in this case composed of many elements of interior design of the palace).

This was the starting point for the reconstruction works and arrangement, consistent with

the message written in the original elements of the room, and in line with the spirit of the era of Augustus II the Strong in which it arose. Summing up the work refers to the process of reconstruction and interior restoration and its methodology shaped for a specific example of unique importance to Polish and Saxon art. What is more, the restoration workers themselves aim to find the right conservation technology solutions.

The results that appear today in the Royal palace room at the end will be compiled with analogous restoration works undertaken at the other Saxon royal premises, e.g. Dresden (Residenzschloss) or Wilanów Palace.

Key words: wall painting, ceiling painting, Samuel Mock, August II der Starke, Jan III Sobieski, Saxon art in Poland, XVIII cent., Royal Palace in Wilanow, iconography, iconology, conservation, nano calcium carbonate, architectural research, discovery, conservation of wall paintings reconstruction, arrangement of interior, velour ciselé upholstery fabrics, wooden paneling, colour, baroque aesthetics, projects, planning, accomplishment

Work and Discourse

Markus Pescoller, Academy of Fine Arts Vienna,

A work is a complicated entity. To decide how to deal with an artefact we need instruments, which analyse the individual parts of a work, assess them and evaluate them. If we break-down the work into (1) a generative object, a contribution made by the manufacturer, the creator of the work (2) a rigid object, a contribution made by the natural and human scientist who examines the work and (3) a narrative object, a contribution made by recipients who perceive the work in various ways, we create a complicated network. Furthermore, if we assume that we are not only dealing with one initial generative object but a series of generative objects, the quantity of which varies from object to object, as objects are continually modified, reconstructed and adapted we create a rhizomatic figure consisting of partial narratives of varying weight and correlation. Now we can assess the extent to which the material, the form, the content and function of the work contribute to the uniqueness of the work. The methodical strategy of converting the work into partial narratives offers the advantage of escape from the true/untrue or objective/subjective dichotomies. The question is no longer: true or untrue, correct or incorrect, objective or subjective; rather we can now hear what the creator, the scientist, the recipient are saying and have to say. Assuming that we do not want to hold the work at our disposal

through the exertion of external authoritative force and therefore reduce the complexity of the work - the rhizomatic web resulting from the analytical phase can only be resolved into discourse in an environment free of extraneous force. The resolution, that is the discourse, is based on prerequisite norms and is indicative of a course of action – a decision on how to deal with the work. It is important that submissions with their narratives be permitted from every interested party, that each individual aspiration is mutually recognised, and that it is fundamentally accepted that our own claims on the work are included as a continually changing pattern of emphasis. Ultimately, the question is not whether conservation is right or wrong in an absolute sense. The question is merely what should be retold and which narratives, for good reasons, can be dropped.

This paper will describe the tools of analysis and the advantages inherent within the terminology of narration. It will also present a brief overview of communicative discourse leading to decision making.

Key words: generative object, rigid object, narrative object, selfnameness, possible worlds, discourse

Applied Collection Care in the Monastery Neukloster

Johanna Wilk, University of Applied Arts Vienna

The thesis project is dedicated to the scientific analysis and practical care and conservation of the collection of the Cistercian monastery Neukloster in Wiener Neustadt in Lower Austria. This unique treasury of more than 5000 paintings, arts and crafts objects, parchments and naturalia resembles a so called "Kunst- und Wunderkammer" - an arts and natural wonders chamber. Such collections developed in monasteries all over Europe, but often they were lost, scattered or depleted. In Neukloster, however, numerous objects of remarkable quality remained intact. The collection started as an ecclesiastic treasure in 1444 with donations from the Austrian emperor Friedrich III and was augmented during the blooming baroque era at the beginning of the 18th century. During World War II the historical exhibition rooms were totally destroyed and although the treasury of Neukloster was saved, it was soon forgotten and neglected. When the research project started at the end of 2013, the collection was nearly unexplored and not known by the public. The storage conditions were not appropriate.

The central aspects of the thesis lie in producing valuable new knowledge about the unexplored collection of Neukloster and the assurance of its long-term preservation. The research therefore comprises an inventory an in-depth analysis of the whole collection and the development of a storage and exhibition area in the monastery. Perspectives of conservation and of art and cultural history are considered. The historic

museum of the baroque era is investigated and the collection history is traced back by archival and literary research and interviews with involved people. Important topics include for example sales, loans and other take-overs of collection items in the course of time. The concepts for collection care and future storage include the evaluation of methods of inventory, maintenance, handling and the selection of proper furniture and storage materials for a chamber of liturgical garments and a new exhibition-storage for naturalia, paintings and arts and crafts objects. The planned measures will be implemented by 2017. The aim is that the collection care in Neukloster can be considered as an example for best practice and serve as a pilot scheme for the care of small collections with few human resources.

The contribution to the Colloquium will cover comprehensive information on the history of the collection in Neukloster and a detailed description of its situation today. In addition to that, the first results of applied collection care will be discussed.

Key words: Collection care, conservation science, monastery, Neukloster, Kunst- und Wunderkammer, arts and natural wonders chamber

The Lampworked Glass Collection of Archduke Ferdinand II of Tyrol

Research on Collection History and on Lampworking Technique in the 16th Century

Eva Putzgruber, University of Applied Arts Vienna

The Kunstkammer of Ferdinand II of Tyrol at Ambras Castle near Innsbruck attracted scholars, sovereigns and travellers already in the Archduke's lifetime. The encyclopaedic collection included outstanding works of art. Among these was a large collection of lampworked glass jewellery and glass objects. The glass jewellery includes glass chains, earrings, glass buttons, floral bouquets and glass figurines. The glass objects contain glass pictures and goblets with scenes and figures as well as a glass mountain landscape and a chessboard. Today the items belong to the Kunsthistorisches Museum Vienna. Long neglected by scholarship, the collection is research topic of an ongoing dissertation at the Institute of Conservation at the University of Applied Arts Vienna.

The glass collection is exceptional because of its unique artistry and extraordinary rarity. Glass jewellery and glass objects were made by lampworking, a technique carried out with fine glass rods and tubes, which were heated in front of the flame of an oil lamp. The flame was enforced by air, thus creating a hot, even horizontal flame in front of which the glass could be manipulated. Between 1570 and 1591 Archduke Ferdinand had a glasshouse installed in the gardens of the Innsbruck Palace. The court glasshouse produced glass exclusively for the court and the Venetian government loaned him the expertise of a series of glassmakers. In 1578 and 1590 Ferdinand also engaged glass workers for the production of glass chains and other glass items probably produced by lampworking.

History and technique of the lampworked glass collection are largely uninvestigated. In the framework of the dissertation at hand, both

topics are studied using a combination of conservation science, art historical and scientific methods. The basis for conservation sciences is the implementation of a survey recording the materials, technique and condition of the glass collection. Practical experience in the framework of a lampworking course contributes to the understanding of the technique. For art historical research transcription of numerous archival documents and the consultation of literature are necessary. Scientific investigation is carried out both with microscopic and instrumental methods, providing semi-quantitative to quantitative results about the materials of the collection.

The dissertation is composed of three parts. The first part focuses on design and function of the glass collection. Shapes and motives of the glass jewellery and the glass objects are studied. Subsequently the use of the glass items during court festivities and as valuable collectibles is discussed. The second part deals with materials and technique of the lampworked items. Investigation of the glass objects provides information on glass making and glass working, leading to conclusions about tools and methods used for lampworking in the late Renaissance. The third part concentrates on Innsbruck and Venice as lampworking centres. Comparable glass items of other collections are discussed and finally the provenance and dating of the lampworked glass collection are clarified.

Key words: Lampwork, Flamework, Glass Jewellery, Renaissance, Innsbruck, Venetian Glass, Glass a la façon de Venise, Court Glasshouse, Glass Analysis, Glass Technology

“Kronengrund” and “Membranit” – Early use of synthetic resins in German and Austrian paintings

Roberta Renz-Zink, University of Applied Art Vienna

This doctoral thesis discusses to what extent it is likely to find synthetic resins in German and Austrian paintings of the first half of the 20th century. The paper focuses on the years prior to the resounding success of artists’ acrylic emulsion paints.

To understand the development and the image of synthetic resins a review of the German and Austrian paint industry within the time span concerned is described first. The economic effects of World War I and the subsequent economic crisis caused a dramatic shortage in tropical resins and linseed oil, the main components for the production of paints and lacquers at that time. As a result, legal restrictions regulated the consumption of these raw materials. Furthermore, during World War II the usage of linseed oil remained strictly limited to certain purposes. Home-produced oil-saving binding media and synthetic resins were therefore recommended and promoted by the Nazi-regime. The need for substitutes eventually resulted in the advanced production of synthetic resins and the establishment of polymer chemistry. Within the first half of the 20th century synthetic resins transformed from accursed “substitutes” of low quality to valued raw materials of constant composition and purity.

Whereas craftsmen and painters had to adapt to the new materials early on, it took longer to establish synthetic resins for the use in the art world.

At the beginning of the 20th century artists were facing problems that led to the return to Old Master techniques and to mistrust of the paint industry. The alarmingly poor conditions of paintings just a few decades old and the fading of early synthetic dyes are eventually ascribed to the use of commercial prepared paints and canvases. Given these circumstances it is not surprising that technical discussion among the established artist community up to

about 1930 only cautiously and therefore belatedly addressed the issue of synthetic painting materials. Eagerness to experiment with new products from the paint industry has always been dampened by warnings of failure and disappointment. Nevertheless there were a few products containing synthetic resins that have found their way into artist’s hands.

One of them was “Kronengrund”, a cellulose-nitrate based primer, produced by Jaeger Lacke in Stuttgart. The product has been discussed in various pertinent articles from about 1925 to 1935. Hans Wagner, at that time a chemist at the Academy of Art and Design in Stuttgart, subjected “Kronengrund” to technical examination and also claimed to know of several artists that were using the primer to their complete satisfaction.

Another product based in the house paint sector was tested for use as an artists’ material not only by Wagner, but also by the Doerner Institute: “Membranit”, an alkyd-based emulsion produced by the IG Farben.

The thesis will present a selection of relevant synthetic resins describing their history of development and their properties, each with examples of popular products or manufacturers. Where applicable, references for implementation by artists will be given.

Key words: synthetic resin, painting, Germany, Austria, paint industry, artists, modified natural resin

The polychromy of the Naumburg founders' statues. Art technological investigation of the paint layers of the 13th and 16th century.

Daniela Karl, Academy of Fine Arts Dresden

The twelve famous statues of the founders are situated in the west choir of the Naumburg Cathedral, emerged by the so-called *Naumburg Master*. These stone sculptures from the middle of the 13th century show two different layers of paint, the first one, from the date of origin and the second from the 16th century.

After the positioning of the sculptures in the choir, the application of the paint layers was accomplished. Two different materials were used. Due to binding problems, the chalk ground on the garments has nearly been lost today. In the other areas lead white was used. The gold leafs were applied directly on the lead white, followed by the painting. The colour is based on the outlines of the sculptural elaboration. Thus, the realism of the sculpture in the painting is continued. For this reason, detailed studies or knowledge of the models are to be accepted by the painter. Most of the layers of paint are very thin and single-layered. The opaque paint is executed in monochrome and only the incarnate shows colour differentiation. The colours characterize the wet-in-wet paint application. The pigments and dyes used relate to the known medieval palette of the 13th century. Extensive red and green glazes form parts of the sculptures. Detailed patterns decorate the tassel bands, the strands of hair, the swords and, especially, the shields. An unusually high original polychromy was used on the statues of the founders and only the garments show significant losses. The richness of detail and realism of the polychromy demonstrates the high quality of the painting, which is consistent with the outstanding sculptural execution. The polychromy of the statues of the founders reflects the high quality of painting of the 13th century and thus provides an important example for investigation of polychrome stone sculptures of that period.

Over the centuries, the statues have undergone numerous revisions. Willful damage, changes due to alterations in taste, and restorations characterize the present-day appearance with losses and discolouration. At the beginning of the 16th century there was an extensive change. As part of a redecoration of the west choir in the years 1517/18 the figures were repainted in different colours, which today define the colourful appearance. The borders of the garments are now golden or decorated with cast appliqué brocade. In contrast to the 13th century, the tassel bands and the swords do not show any decorations. Shortly thereafter a fire in 1532 caused a lot of damage, and in particular the four figures of the choir bay were affected. Before 1747 the founding statues received a partial monochrome white painting, which was removed during the restoration of the years 1874–78. In the 20th century two moulding campaigns consciously performed exploration and the air-defence measures during the period of the Second World War led to extensive damage. Not until the middle of the 20th century the study of polychromy using art technological and scientific methods began.

Key words: founder statues, stone sculptures, Naumburg Cathedral, 13th century, polychromy, art technological investigation

Original and historical varnishes on paintings of the Old Masters Picture Gallery Kassel – layer sequence, damage forms and causes, restoration issues

Thomas Krämer, Academy of Fine Arts Dresden

The Old Masters Picture Gallery in Kassel has its collection focus on Dutch and Flemish painting of the 17th and 18th centuries. The majority of the pieces shares a long history of collection and restoration.

Historical varnishes are preserved on numerous paintings. These varnishes consist of multiple layers, which mainly stem from earlier restorations. In many cases, strong yellowing and high film thickness, dilated cracks and bark-like deformations are noticeable. Varnish removals have repeatedly proven to be extraordinarily difficult, even impossible in a few cases, because the paint layer is very sensitive to solvents. Research since the 1980s has shown structural changes of the paint and varnish layers to be the cause of this. According to findings so far, they are the consequence of swelling and solution processes during earlier varnish regenerations.

This project continues this research. It is divided into two parts: The first part concerns the restoration history of the Kassel Gallery in written sources. It shows how the condition of the varnishes was assessed, which restorations were carried out and which results the restorations yielded.

The second part deals with art technology, the changes and damages as well as with the issue of restoration by means of examining selected paintings of the collection. The object examinations serve to establish the layer sequence of the varnishes, date the individual layers and identify potential original varnishes. Another focal point is the unusual forms of damage to the varnish, namely the dilated cracks and bark-like deformations. They developed in multiple phases over long periods of time and in connection with previous restoration treatments.

Special attention needs to be paid to one unusual difficulty in varnish removal. The varnish often dissolves unevenly. Varnish residue partially remains, while other parts of the already exposed paint layer are excessively influenced by the solvent. Here, the diluted cracks and deformations of the varnish as well as the structural changes of the varnish layers play a decisive role.

The proposed presentation brings the examination of the paintings into focus by means of three examples. The first of these is the painting "Susanna and the Elders" (1722) by Bartholomeus Frans Douven. In addition to the findings, newly developed methods of documentation and evaluation will be presented, namely microscope photography for different recording and lighting situations and a graphical analysis of the cracks and deformations. Rembrandt's "Holy Family with a Curtain" (1646) serves to show the examination of the layer sequence of the varnish as well as the examination of the deformation and disintegration of the varnish layers. In one section of Melchior de Hondecoeter's (1636-1695) painting "The white Hen and her Chicks", tests for a varnish removal with solvents damaged the paint surface. The solution process can be shown on the paint and varnish cross-section by means of an examination method developed within the context of this project.

Key words: painting, varnish, craquelure, deformation, varnish removal

Dressed sculptures in the German-speaking areas 1650-1850

Beate Fückler, Academy of Fine Arts Dresden

Dressed sculptures are completely or partially anthropomorphic figures clothed in real textiles. In churches and monasteries in Southern Europe dressed sculptures of the Baroque era still seem omnipresent, but in German-speaking areas the tradition of their liturgical use is less known. The aim of the dissertation was to enable a new assessment of the figures' historical and art-historical significance in the German-speaking areas by studying early textual and visual sources, and, more importantly, by a systematic art technological in-situ investigation. Due to a high number of such artworks preserved in the area of Hildesheim/Paderborn, Bavaria and Tirol the field research concentrated mainly on these areas.

Dressed sculptures can be divided in two fundamentally different groups: *Secondarily dressed sculptures*, for which permanent clothing was not originally planned, and *primarily dressed sculptures* that were made to be clothed and whose textile dress and accessories (wigs, crowns etc.) form an intrinsic part of the figural concept.

Based on the serial study of about 200 dressed figures and further examples from unpublished documents and secondary literature, it was possible to distinguish five different construction types of primarily dressed figures. It became apparent that the regional distribution of these construction types varies within the research area.

The study also identified characteristics of the construction, which is closely linked to the liturgical use of the objects (e.g. as *Andachtsbild* or in-procession). A major finding was that the numerous joints and removable parts

not only facilitated the clothing of the figures but also made it possible to use the figures in varying iconographic arrangements. Also of special interest were the common alterations of older (Romanesque or Gothic) cult figures which were adjusted to the Baroque taste, as well as changes to Baroque figures themselves, which likewise had to follow new trends in fashion. Ecclesiastical and secular laws concerning dressed sculptures also influenced their appearance and have therefore also been surveyed.

Poor condition or inappropriate refurbishment continues to complicate the appraisal of dressed sculptures, which in recent decades have often been categorized as folk art with less artistic value. At the time of their creation, however, dressed sculptures were highly valued which is apparent from the important sculptors' workshops involved in their production (A. Faistenberger, J.B. Straub, I. Günther). In addition the creation and full adornment of the figures was extremely costly, since it required the collaboration of such various craftsmen as carpenter, turner, sculptor, glass blower, polychromer, gold- and silver-smith, wig maker, embroiderer and tailor. Also many of the materials employed were considered luxurious goods and the figures, apart from being sacred, played an important role in the social representation of the ecclesial and secular elite. Written sources and historic depictions give us an idea of the splendid appearance of the sacred figures in the Baroque era.

Key words: dressed sculpture, baroque, religious art, processional sculpture

The Pettenkofer Process – A study of the history of restoration, experiments on its effects and analysis of pigment migration in regenerated paintings of the 17th century.

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Max von Pettenkofer, a nineteenth-century scientist, systematically studied turbidity in the surfaces of paintings and developed a method to regain transparency in 1863. In his process he used two substances, 80% Ethanol and copaiba balsam. This dissertation analyses the effects of the Pettenkofer Process following a three-fold approach. First, the historical reception of the process and the history of trade in and use of copaiba balsam are explored. Secondly, the effects of the process are reconstructed in an historical adequate manner based on experiments including chemical analysis and mechanical measurements.

Thirdly, a field study combines research on paintings that have undergone the process in the past with a morphological recognition chart systematically classifying and diagnosing their apparent damages. Finally, the results are discussed in the context of painting technique, ageing and restoration. This three-fold approach allows recognition of the specific morphology of the "Pettenkofer effects" in the general appearance of the historically evolved condition of paintings. An appropriate descriptive terminology, a catalogue of investigated paintings and an annotated glossary support this analysis of damages. The findings of this dissertation provide reference material for future comparison and diagnosis of damages.

The historical part critically reviews the genesis of this process on the basis of international historical correspondence, contemporary translations of Pettenkofer's central publication "Über Ölfarbe" into Dutch and Italian, reports on paintings treated with this method in Munich and London, as well as Commissioners' opinions of the time issued in Vienna, Florence and Venice.

The experimental part of the thesis focuses on alcohol, Copaiba balsam and Pettenkofer's procedure. Independent of the purpose of use, the presence of copaiba resin raises the softening effect of alcohol and dramatic resoftening takes place even after several years, because the glass transition temperature is lowered significantly and permanently.

The author's field study reveals evidence of regenerated paintings in Germany and abroad. An analysis of the paintings' restoration history revealed national differences in practice. The data about paintings and test materials are presented as a catalogue, including relevant information on further collections at Dresden, Vienna, London and Petersburg.

The recognition chart presents observations by the author on defects in regenerated paintings in Munich, Kassel and Berlin, gathered through microscopic investigations over period of several years. "Pettenkofer-defects" are defined and classified. The author proposes a vocabulary of descriptive terms which adapts appropriate terms from neighboring disciplines.

The final discussion takes into account contributing factors of painting technique, aging and conservation/restoration. The typical morphology of regeneration defects is probably made worse by 'blanching', efflorescence and saponification, and the additional application of 'slow' solvents notably worsen the softening.

Key words: Pettenkofer process, methodical criticism, history of painting conservation, reconstruction tests, analysis, terminology, recognition chart and systematically classification of paint film defects

Non-structural lime-based injection grouts with reduced water content for decorated surfaces

Chiara Pasian, The Courtauld Institute of Art, London

Wall paintings are complex, multi-layered porous systems often suffering from lack of adhesion between different plaster layers. This problem can be stabilised with injection grouting, introducing a compatible adhesive material with bulking properties, usually prepared with water as suspension medium. This intervention usually involves the introduction of large amounts of water both with pre-wetting before grouting and with grouting itself. The water contained in the fluid grout plays a role in the setting/hardening mechanism and in the improvement of injectability, but its presence can be problematic. In fact, it can be dangerous when water sensitive original materials are present and it can cause the solubilisation of salts, leading to the harmful phenomenon of their re-crystallisation. This is a common deterioration mechanism for porous building materials.

The objective of this research is to evaluate reduction of water in grouts (lime-pozzolan grouts are considered) to avoid or, at least, reduce the problems mentioned above, without chemical admixtures for water reduction. The study follows two lines of research: 1. ethanol is investigated as partial substitute to water in grouts preparation. Ethanol is a less effective solvent for ionic substances (e.g. soluble salts) when compared to water; 2. in conservation whisked albumin is considered as a water reducer in grouts preparation: this is investigated and assessed. The addition of whisked albumin imparts to the grout a number of properties, including good injectability, water retention, tackiness, light weight.

While it is possible to reduce the water content in grouts preparation, a minimum water amount is anyway necessary to allow carbonation and hydration reactions in lime-pozzolan grouts. A theoretical minimum water content is calculated considering slaked lime as binder. Water reduced grouts are designed, taking into

account the theoretical minimum water content, but also the practice, i.e. the need to obtain a material with suitable fluidity for practical use on site. In order to assess grouts *potential* suitability (results are compared to a reference lab plaster), working properties (fluid material) and performance characteristics (set material) of grouts are assessed through lab testing. Lab standards already existing for mortars and concrete are adapted; moreover, a methodology for "sandwich samples" preparation is developed (set grout in between two plaster layers, reproducing a real case) and tests adapted for this kind of samples.

In addition to grouts physical properties, mineralogical phases formed in grouts prepared with ethanol/albumin are investigated and compared with those formed in grouts prepared with water (XRD analyses). The kinetics of phase formation is also investigated.

The effects of the highly alkaline lime environment on the protein (albumin) are assessed through proteomic analyses.

Key words: Wall painting; delamination; soluble salts; reduced water content; ethanol; albumin

Research methodology on stained glass windows exemplified by the case of six panels belonging to the Grodziec Collection from the Wrocław National Museum

Marta Kamińska, The Academy of Fine Arts in Kraków

The aim of the PhD thesis is to elaborate a research methodology and a new approach to the conservation and restoration of stained glass windows. It is especially oriented towards Polish reality, where the majority of restoration work is carried out by artisans' workshops and based rather on tradition and intuition than knowledge of conservation issues. The PhD-research is a part of a project realized at the Jan Matejko Academy of Fine Arts in Kraków.

The Grodziec Collection consists of fourteen stained glass panels representing several figures of saints on architectural backgrounds. Eight of them are exhibited in the Jagiellonian University Museum Collegium Maius in Kraków. The other six belong to the National Museum in Wrocław and are actually undergoing a conservation/restoration treatment. The history of the collection is quite opaque. During World War II it was stored in Piast castle in Grodziec – a city in Lower Silesia – as Nazi plunder or brought there to be protected from destruction during warfare. There is no information if the panels were only stored in Grodziec or served also as a decorative glazing in the castle, palace or the view tower in the palace park. After the war eight panels were transported to Kraków. The remaining six became the property of the National Museum in Wrocław in 1966.

The six panels (each around 130cm high and 60cm large) consist of elements from different centuries. The oldest pieces were probably made in Austria in the first half of the 15th century, however the opinions on this subject are divided. Some coloured-glass elements and the geometric non-colour glazing was added later in the 19th or even 20th century during one of the restorations and in order to make them fit in the new windows. One panel contains also

a 16th century Netherlandish cabinet roundel. The dating is based only on visual analysis and cannot be confirmed by any archival material.

The history of the stained glass windows from Grodziec became the subject of an investigation performed by an interdisciplinary team consisting of art historians, conservator/restorers and scientists. By means of modern analytical techniques, we have already obtained a lot of information concerning the panels technology and their condition. We carried out chemical analysis of glass, paint and deterioration products. The results combined with visual analysis at macro- and micro-level let us elaborate an optimal conservation/restoration treatment program for the Wrocław panels and confirm the hypothesis of medieval origin of the oldest pieces. The project is funded by the National Science Centre, Poland (project no. DEC-2012/05/E/HS2/03867).

Key words: stained glass, conservation, research methodology, medieval glass

Comparative analysis of historic and modern injection grouts for re-adhesion of detached wall paintings

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The methodology of conservation actions to identify causes of damage to the building, selection of appropriate conservation methods and materials are key issues for the continued survival of works of art. Any detachment and blisters which occur between the substrate layers are a potential threat to the existence of a whole painting.

Detailed recognition of technology of works of art and the characteristics of materials planned for conservation treatments helps to reduce or completely eliminate the negative effects of introduction of a new material into the historic structure. Consequently, this affects the effectiveness of remedial treatments and limits the scope of future conservation interventions.

The global history of wall paintings conservation proves the fact that a wide palette of substances has been applied in order to save detached and delaminated wall paintings from total destruction. Among materials used for grouting the most common were those based on mineral binders (lime, cement, gypsum), organic binders (casein), synthetic resins (acrylic, vinyl, epoxy resins, polyurethane) with different addition of fillers like: sand, crushed brick, marble powder.

Despite over thirty years of research all over the world, the ideal grout for re-adhesion of delaminated wall paintings has not been invented. Characteristics of injection grouts and their impact on the historic substance is not fully defined and understood, and the process of gluing the wall paintings is rarely monitored in long-term, which is important for identification of the effectiveness of conservation treatments.

The project aimed to develop an injection grout for re-adhesion detached murals, compatible with specific historic plaster. The target group were paintings on sand-lime plaster, decorating

the interior of selected historic buildings from the Lower Silesia Region in Poland.

The research focused on grouts used historically and today, prepared personally by conservators as well as ready-made blends sold commercially, also global trends in this area has been discussed.

The study includes laboratory testing of selected physical and chemical properties of a plaster and grouts available on the market, using XRF, XRD, SEM-EDX and simultaneous thermal analysis (DSC-TG) and FTIR. These results are complemented by selected studies of properties of fresh and hardened injection grouts such as: injectability, penetration depth, bleeding, viscosity, shrinkage, water vapor permeability, compressive strength and pull-off strength of grouts. The essence of the project was also an appropriate choice of particle size of a filler, in order to apply it to cracks and voids of various size.

In addition, newly-developed grout was tested by using specially prepared samples, simulating the murals, as well as the final stage of testing using grouts in real life conditions - "in situ" - in the process of conservation of historic wall paintings.

The presented study is a part of research conducted within the project "The study and development of injection grouts for conservation of detached wall paintings on lime-mortar support" funded by the National Science Centre, Poland (NCN Project No. DEC-2011/01/N/HS2/03403)

Key words: wall paintings conservation, lime plaster, injection grouts

Materials and techniques of the “Berliner Lackvasen” from Polish collections

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This PhD thesis is focused on the “Berliner Lackvasen” – a unique and not fully recognized small group of vases (circa one hundred estimated in existence) of a wide range of forms and sizes, untypical and unidentified materials and techniques. These faience vases are glazed inside and underside, signed with a Chinese coin or Artemisia leaf mark, and on the outside richly decorated with European Lacquer. The lack of knowledge on the “Berliner Lackvasen” technology has been indicated in the literature on this object¹ and related works of art². The date of manufacturing is also still unknown despite many years of research. In literature three different dates are given: circa 1720, the end of 18th century and circa 1840.

The main objective of this PhD research is identification of the “Berliner Lackvasen” structure on the basis of cross-sectional analysis on vases from Polish collections. Examinations were performed in order to fill the gap in our knowledge of the “Berliner Lackvasen” and provide data that helps to conduct a safe conservation of this kind of artwork (for knowledge on materials and methods used in manufacturing the work of art is essential to conduct its successful and safe conservation treatment). Since the “Berliner Lackvasen” from Polish collections are little-known and are mostly not exhibited, cataloguing them is a partial aim of the PhD study.

This PhD dissertation is a continuation of a master’s project as a part of which materials and technique of the six “Berliner Lackvasen” from the Jagiellonian University in Krakow were identified. On that basis a method of conservation-restoration treatment of these vases was developed and applied to conserve one of them. The large number (21 pieces) of the “Berliner Lackvasen” in Polish collections combined with their considerable diversity in

size form and decoration renders them a good representation of the “Berliner Lackvasen” group.

Samples were analysed employing such scientific methods as: SEM-EDS, FTIR, FTIR-ATR, XRD, XRF. Additionally UV luminescence was observed, recorded and compared between vases. Also a series of technical experiments were carried out based on the information given in historic treatises and other source materials on European Lacquer. Experimental methods allow practical checking of conclusions and verification of theoretical assumptions. Furthermore, combined with analytical methods, they allow identification of materials and technique to the fullest extent possible.

As a result the technology of the “Berliner Lackvasen” was identified and some distinctions between suites of vases were revealed. Findings also provided data on the history of the “Berliner Lackvasen”. Detecting two dating pigments in the vases’ decoration allows specification of time of manufacture. It seems to corroborate the most recent thesis on this point formed in 2003 by S. Wittwer that the “Berliner Lackvasen” are not baroque but 19th century works.

Key words: “Berliner Lackvasen”, lacquer Berlin vases, lacquered faience, European Lacquer

1 S. Wittwer, *Die Berliner Lackvasen. Eine These*. [in:] M. Kopplin (Edit.), *Schwartz Porcelain*, München 2003, pp. 237-249.

2 Cornelia Morper, *Übermaltes chinesisches Porzellan*, [in:] *Weltkunst*, July, Issue 13, 1993, pp. 1654-1656.

Man in Wax. Studies on the Manufacturing Techniques and the Conservation of Figurative Ceroplastics

Johanna Lang, Technical University Munich

In the centre of the PhD stand three dimensional works made of wax depicting the human body or parts of it. A selection of such anatomical wax-works is closely examined in order to identify the materials and techniques used for their manufacturing but also to learn about their passage over time, their ageing characteristics and hence about the possibilities and constraints of conservation-restoration treatments.

The discussion is lead on basis of a so-called anatomical museum that was founded around 1850. Once the property of traveling showmen, it was presented at fairs as a means of health education but also entertainment. As such it was run as a business and therefore had to withstand frequent handling and often unfavourable surrounding conditions. In 2009, it was acquired by the German Hygiene-Museum Dresden and has since then been regarded and preserved as a cultural asset. The collection comprises about eighty wax models showing the development of the human embryo, scenes of operation and childbirth as well as injuries, pathological alterations and anatomic anomalies. Besides, there are works such as the "sword-swallower", the "girl stroke by lightning" and some hands tortured by finger-screws that presents a more sensational appeal. With this, the collection reveals the characteristic inventory of the traveling anatomical museums of the 19th and the beginning of the 20th century and is therefore so-far the only one known that has survived in its entirety.

To date, an in-depth investigation of the Dresden collection has taken place. Oral testimonies, historic photographs and written records were gathered and interpreted in order to find out more about the manufacture of the models as well as their subsequent history. Focus however lay on the examination of the wax-works

themselves since they reveal most striking evidence of the means of production and of the collection's history. For that purpose, the wax surfaces were inspected by naked eye and through stereo-microscope. With the help of specialized institutes, some models were further examined by material analysis with FTIR and gas-chromatography as well as by exposure to X-ray, infrared radiation and UV-light. Based on the knowledge gained hereby, selected conservation and restoration issues were discussed and treatment methods were developed that provide an authentic preservation of the entire collection with its traces of an eventful past.

As the investigation showed, the models are not made of one kind of wax. In fact, they consist of varying mixtures of waxes and non-waxen materials and hence reveal different ageing phenomena. Against this background, historic recipes on the making of ceroplastics were collected. Since only few of such written records exist, contemporary artists working with wax were interviewed about their material selection. This research will be completed and a practical experiment set up. Thereby, different material-mixtures will be prepared and aged artificially in order to learn about their ageing characteristics. With this, the thesis aims to provide knowledge for a better understanding of historic wax-artefacts but also for the choice of materials suitable for conservational infillings and amendments.

Key words: conservation-restoration of wax-artefacts, anatomical wax-models, ceroplastic, showmanship, wax-cabinet

Cleaning Painted Surfaces on Stone: the ageing and degradation of these materials and the development of cleaning' strategies

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The complexity and the changing nature of polychromies on stone may presents challenges in the development of cleaning protocols.

According to this, the present research focuses on the study of some chemical properties (i.e.: pH, conductivity, water sensibility, etc.) variations in these films during aging as a preliminary step to create cleaning strategies. In this study, two Spanish case studies carved on sandstone and on limestone and painted with oil and glue mediums are presented. The artists who made these sculptures at the beginning of the 15th century selected the stone, pigments and binding media with extreme care. As a consequence of their choices, the chemical-physical balances acquired by polychromies over time are unusual since they remain attached to the underlying stone and have stayed in good condition up to the present day.

The mock-ups used in this study were based on the results of analyses of the case studies and prepared with similar lithotypes, binding media and pigments. Other series of mock-ups were made on canvas (linen with gypsum and chalk glue grounds) and pine panels. Surface pH and conductivity were measured in both the case studies and the mocks-up after ageing. This data has been compared and correlated to the results of elemental and structural analyses of the films (before and after ageing). Some specific causes and consequences that chemical and physical studies of artist' materials have demarcated and isolated to explain the ageing have been considered. Nevertheless the chemical reactions involved in the mineralization of polychromies on the most characteristic varieties of stone typically used in sculpture remain partly unexplained.

Polychromies on stone are complex systems composed of several individual elements that involve multiple interrelated causes of change

and that are open to a complex environment. It is equally necessary to add the time variable and understand them as not static but dynamic systems of elements that change over time.

The changing nature of these films may be conditioned by the specific composition of the materials themselves which also depends not only on the source and processing techniques or the particular lithotype but also: on the way they have been combined in the layer, on the nature of the underlying films and on the particular lithotype where the film-forming materials has dried and ages.

This research studies the transcendence of the underlying lithotype in the properties of paint films on stone as a consequence of some mechanisms that explain the formation, deposition or migration of new by-products of an organic, inorganic and mixed nature. Such changes influence the aesthetic appearance of the sculptures surface but can also influence dramatically their durability.

To finish, and linking knowledge of materials with conservation practice, the knowledge of physics and chemistry behind polychromies on stone is crucial in conservation treatments such as cleaning. The development of appropriate cleaning strategies must be directed to minimize the risk in these complex and dynamic systems and to guarantee their stability in the mid-to-long term, under different environmental conditions once the conservation treatment has been completed.

Key words: polychromy, stone, cleaning strategies, sculpture, paint-film ageing

Artificial metal for conservation and restoration of metallic artistic and archaeological pieces and for sculpture and ornamental creation purposes

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The aim of this work is to show briefly the use of the research in *artificial metals* for conservation and restoration purposes, especially focusing on the production of replicas for the conservation of archaeological or artistic metal pieces, artefacts, sculptures and metal art-works.

Artificial Metals are complex polymeric semi-metallic composites obtained by the union of thermo-stable resins with atomized metal powders and mineral compounds in order to achieve composite materials which must be able to reproduce any metal, even in rusty or corrosion condition. Although during the latest decades of the 20th Century these materials had been slowly improved, an increase in the investigation of their uses has been made during the last years, due to the particular need of solutions in the production of metallic replicas, due to the research for new materials and composites and, particularly, by the emergence of 3D printing solutions.

During the research for this PhD, several polymeric composites have been tested in order to prove which ones are useful compounds, in terms of conservation and restoration of metallic cultural heritage, and different solutions have been obtained specially for bronze and iron. The first part of this paper is dedicated to the presentation of some metallic composites, empathising on their organoleptic properties, morphology and appearance, by showing examples. Artificial metals will be presented through images and graphics as useful tools in the reproduction and casting of metal replicas, featuring some advantages when compared with metal foundry castings and electrochemical processes, such as a decrease of the weight and working risks, a lowering of costs, and a faster manipulation and managing due to the simplification of procedures.

The second part contains a brief statement of the question, reviewing some of the most interesting contributions on the metal-composites in art and conservation literature up to the present day.

The third part is focused on the development of different artificial metals, also including some physical and chemical specifications, and considering also in a special way the methods of working with them. A direct casting and a stratigraphic-casting are shown. This part also reveals the importance of surface treatments, in order to get a truly metallic appearance, gilding, polishing and patination. This is one of the key points of this research because patinas are definitely important in the finishing of these composites, and even though they could be simulated over semi-metallic surfaces, real chemical patinas are preferred because that replicates what occurs on archaeological and artistic metals surfaces. In fact it's shown how after obtaining a patina it becomes difficult to discern between a real metal and a metallic composite.

As a conclusion, the fourth part reviews all the uses of these materials as a solution in replicating metal parts and even those uses which are still being researched, such as reintegration and restoration with metal putties, the implementation of these composites as electrochemical supports, or the possibilities of these materials as a solution for 3D printing.

Key words: metal conservation; archaeology; sculpture; replicas; copies



The participants of the The Ulrich Schiessl PhD Colloquium 2014

Scope of the Ulrich Schiessl PhD Colloquium

At the *Ulrich Schiessl PhD Colloquium* ongoing and recently finished PhD-projects of graduated conservator-restorers were presented, in order to show the wide variety of topics covered.

The purpose of the Colloquium is to provide a platform for PhD students in conservation-restoration and teachers involved in PhD study programs to discuss the state of the art of the discipline and to set up co-operation and exchange between institutions providing PhD programs in conservation-restoration.