Experience and Evidence
ICOM-CC Graphic Documents Working Group

Interim Meeting 1 – 3 June 2016

French National Library
Bibliothèque national de France (BnF)
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Welcome

The Interim Meeting 2016 is dedicated to the theme of experience and evidence. Lectures and posters will reflect experience gathered in the treatment of challenging formats, colour and media on paper. Mounting and storage solutions will be discussed. Evidence gained in research on material, storage and treatments will be presented. Together we want to reflect on the value of experience in conservation and the transfer of this experience in evidence.

The meeting shall encourage the dialogue between conservation research and conservation.

The meeting is supported by the French National Library. The Louvre Museums, the French National Archives, the French National Library, INP, the school for conservation, the Centre of Research on the Conservation of Collections (CRCC) and the Conservation studio at Ecole des Beaux-Arts offer a wide programme of tours. We thank the companies that use this brochure and the meeting to inform on their products. My special thanks go to Valentine Dubard and Isabelle Bonnard who have prepared this conference with great dedication.

I wish all participants that this meeting in Paris will be a good experience with deep impact.

Christa Hofmann
Coordinator, Graphic Documents Working Group, ICOM-CC
Wednesday 1 June

PROGRAM

09.00  Registration
10.00  Opening

SESSION 1

Valentine Dubard, Charlotte Kasprzak (FR): Portfolios for Le Brun’s Cartoons
Lucy Angus, Jürgen Vervoort (UK): Paper does not get much bigger than this! – The Conservation of Samuel Holland’s 1765 Map of Prince Edward Island
Laurence Caylux, Eve Menei (FR): Architectural plans at the École Nationale Supérieure des Beaux-Arts or the Preservation of Rolled Works

11.30 SESSION 2

Paul Garside et al. (UK) : Reframing Magna Charta
Anne Maheux et al. (CA): Making the Case: Storage and Display of Foundational Documents at Library and Archives Canada
Coralie Barbe, Nadège Dauga et al. (FR): Study and Discovery of Musée d’Orsay’s Drawings Collection through a Wide Range of Sketchbooks and Albums

13.00 Lunch

14.00 SESSION 3

Fabienne Meyer et al. (DE): Volatile organic compounds (VOCs) and paper – risk assessment and mitigation strategies
Marinita Stiglitz, Julia Bearman (UK): A Pair of Ming Hanging Scrolls: from Past Repairs to Present Conservation.
Axelle Deleau Cazabonne, Aurélie Stréri (FR): Islamic Miniature Paintings Conservation at the Louvre Museum

15.30 Coffee break

16.00 SESSION 4

Camilla H. M. Camargos et al. (BR): Nanocellulose for Conservation of Graphic Documents

18.00 Business Meeting of the Working Group
Thursday 2 June

PROGRAM

9.00 SESSION 5
Jasna Malešič et al. (SL): Evaluation of Treatments for Stabilisation of Verdigris and Malachite Containing Paper Documents
Lynn B. Brostoff et al. (USA): Analytical Study of Neutral Verdigris Pigment by Combined X-ray Diffraction and Raman Spectroscopy
Laura Völkel et al. (AT): Verdigris and Organic Colourants: Visual Comparison and Evaluation

10.30 Coffee break

11.00 SESSION 6
Birgit Vinther Hansen et al. (DK): Fifty Shades of Grey: Darkened Lead White in Graphic Art – Sources and Decay Mechanisms
Lucile Desennes, Nadège Duqueyroix (FR): «Demain, dès l’aube, à l’heure où blanchit la campagne….» Lead White Conversion Treatment with Mist: from an Ancestral Practice to an Actual Conservation Method
Ute Henniges et al. (AT): Bleaching Iron-Contaminated Paper with Hydrogen Peroxide

12.30 Lunch

13.30 Poster Session

14.30 SESSION 7
Mary Broadway, Celine Daher (USA): Chromatic Resonance: Interpreting Gauguin’s Graphic Legacy through Conservation, Science and Digital Technology
Olivier Masson (CH): The Pastels of Jean-Etienne Liotard: Conservation and Display

15.00 Coffee break

16.30 SESSION 8
Cristina Duran Casablancas et al. (NL): Survival in Archives: Factors Contributing to Mechanical Degradation
Irmhild Schäfer (DE): Digitisation of Manuscripts with Ink Corrosion: Experiences based on the Munich Tissue

18.00 Closing
Cocktail
lectures
Wood Structure Portfolios: Solution to Keep Oversized Cartoons by Le Brun in Loose Sheet Cartoons

Valentine Dubard*, Charlotte Kasprzak, FR

The Department of Drawings and Prints of the Louvre Museum has conserved more than three hundred and fifty cartoons by Charles Le Brun (1619-1690) that were executed for the decorative schemes of royal palaces of King Louis XIV. A restoration campaign began in the early 1990s and allowed for the restoration of about seventy cartoons. In 2015 and 2016, seventy-five were chosen to be exhibited in Madrid and Barcelona with the collaboration between the Caixa Forum and the Louvre museum. Some of these cartoons have not yet been restored and the preparation for the exhibition required the work of twenty conservators for nearly two years and involved numerous teams from the Louvre.

The experience acquired in the treatment of cartoons of large formats over the past twenty-five years, prepared us for this exhibition. It encouraged us to develop our thinking, and gave us a new perspective: that of leaving accessible the transfer traces of the drawing in the architectural setting - pouncing pattern or incisions with a stylet - present on both sides of the cartoons. Up until now, the cartoons were systematically lined, thereby limiting access to this information. The wish of the Department and the exhibition curator was to exhibit the cartoons as closely as possible to their original functional meaning as loose sheets. Our thinking focused on the cartoons preserved in sheets and rolled up since they entered the museum in 1690.

We sought solutions for transporting, preserving, storing and exhibiting these outsize works after their restoration. Small cartoons could be transported in a honeycomb cardboard portfolio, but huge cartoons induced more specific problems of transport, storage and exhibit, and had particular requirements: to keep the cartoon flat (unrolled and unfolded), offer an outsize consultation support, take little place in storage, allow transport and handling out of the storage. The idea was to keep the portfolio principle because of flatness and rigidity, and to search for a way to make huge portfolios with light materials. Plywood and polycarbonate are too heavy (6.2kg/m² and 3.8kg/m²) and honeycomb cardboard too small. The Japanese Kari Bari seemed to offer a good alternative, and structures of lattices of light wood (about 1.7-2kg/m²) covered with non-woven polyester felting were realized. After several tests, canvas (buckram) lined with Bondina® for strength is stretched on the outside. Straps and clips close the portfolios. These allow ease of handling and consultation. The creation of these structures for the needs of the exhibition was subject to the criteria of cost and the time to make them. Prototypes were made to measure and adapted to the constraints encountered. The objective is to make them evolve according to the criticisms that we might encounter whilst respecting our imperatives of lightness and manageability.

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Two hundred and fifty years ago Samuel Holland created the first truly modern and accurate map of Prince Edward Island, Canada, a map which has had a lasting impact on the island to this day. To celebrate this anniversary, The Confederation Art Centre Gallery, Charlottetown, Canada requested the loan of The National Archives ‘CO 700/PrinceEdwardIsland3’, Holland’s 1765 map of Prince Edward Island (then St. John’s Island) as the centrepiece for their exhibition ‘Imperial Designs: Holland’s Map and the Making of Prince Edward Island’.

From March 2014 to July 2015 a major project was launched to conserve and prepare the map for exhibition. Given its size (3x4 metres) and physical state the conservation challenges were considerable.

The map was conserved in 1973 following the protocols typical of the period, including adding a waterproof linen lining, a silk facing, additional paper boarders and repairs applied to the front. The intention of this approach was to make the map sufficiently strong to withstand robust handling in the reading rooms. Unfortunately over time the incompatibility of papers, linings and adhesives caused significant undulations, tenting, considerable stiffness, discolouration, and the silk facing yellowed, compromising the visual interpretation of the map. Consequently, the map was unsuitable for display. Due to the widespread use of this or similar conservation techniques, these are common problems for many map collections.

This paper outlines the complex conservation treatment of a large scale object and how creative problem solving, innovative techniques and some unusual materials have helped to overcome the substantial challenges of getting this map ready for exhibition. Logistical factors such as space and size also played their part and informed the treatment. Treatments and relevant aspects include:

- Removing old borders and repairs, the waterproof backing, a silk facing and various starch and protein based adhesives from previous treatments using a variety of humidification techniques
- The aqueous treatment and repair of the fragmented, skinned and significantly torn map
- Realignment of the distorted object in multiple pieces
- Lining the extraordinarily large item which involved building a bridge and platform (which also doubled up as a surface for tension-drying)
- Team-work and team coordination required to achieve the multiple layered lining and turning over the newly lined map for pressure drying
- Final touch-ups.

Solutions to the transportation and display included: using an extendable roll, the use of rare earth magnets disguised to be in keeping with the lining, and a purpose built magnetic wall made with sheets of galvanized steel and heritage museum mount board to display the map on open display at the art gallery in Prince Edward Island round up the project.

This highly successful conservation treatment means the map is now accessible, visually engaging and flexible for the future.
To preserve a collection of large-sized graphic works, there is sometimes no other solution than to store them rolled up on shelves. The École Nationale Supérieure des Beaux-Arts of Paris has some 45,000 architectural plans rolled up in this way. The vast majority of them are works consisting of several elements (plan, section, elevation), presented by young architects for the major architectural competitions (Prix de Rome, Prix de Construction, etc.). The width of the scrolls varies from 1m to 2.5m, and the diameter from 8 to 18cm. In the course of a recent inventory and reconditioning, we observed the first 600 Prix de Rome, dating from 1720 to 1968. They provide an interesting testimony as regards the evolution of papers chosen from the 18th to the 20th centuries for these large-scale productions.

The storage, preservation and handling of large-size rolled-up works result in specific types of deterioration, of which we compiled a list. As work went on, we noticed that certain plans had been mounted on canvas at different times. These historic mountings, sometimes dated, show us the evolution of this technique and of the materials used. Today we can compare their ageing over time and their effectiveness in the preservation of plans. We studied each canvas, determining its thickness and density, and identifying the nature of the fibres. The composition of each lining paste was analysed, and the thickness of the layer evaluated. We also tried to reproduce its method of implementation (sewing systems, edges folded over, tension after mounting). Finally, we picked out the typologies of deteriorations associated with each mounting technique.

The last part of our work consisted of looking for packaging adapted to the dimensions of the scrolls as well as to the furniture in which they are stored. We compared all types of specific boxes proposed by suppliers from the points of view of price, quality of materials, weight and ergonomics. The difficulties lay in the heterogeneity of lengths of the rolled-up plans and the necessity of allowing the institutional agents to transport plans protected in boxes during requests for consultation in the reading room, outside the storerooms.

This systematic study on this large collection of oversized works enabled us to first apprehend a system of preservation that is little studied, the scroll, than observe the evolution of paper techniques and historical mounting methods. Finally, we had to look for and evaluate a mode of packaging adapted to these objects, unusual owing to their number, size and system of preservation.

Architectural plans at the École Nationale Supérieure des Beaux-Arts or the Preservation of Rolled Works

Eve Menei*, Laurence Caylux*, FR

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In preparation for the British Library’s exhibition to mark the 800-year anniversary of Magna Carta, the copies of this charter held by the Library, as well as several related documents, were removed from their existing frames, assessed and reframed in a more appropriate manner. This reframing had to fulfil several requirements: to be minimally interventive, and allow future re-treatability, thus disallowing adhesives and other permanent modifications; to fully show the rectos and ensure that all text, including marginalia, was visible; and to present the charters to emphasise their role as documents, rather than as works of art. This paper concentrates on two aspects of this process - decision-making for the selection of the new frames, and the practical challenges of mounting the charters prior to their framing.

After determining the general requirements for the work, and eliminating various unsuitable options, a range of frames from commercial manufacturers were considered. A selection was made after assessing them on the basis of several criteria: security, accessibility, provision of a suitable environment, avoidance of inappropriate localised microenvironments, aesthetic suitability, and versatility.

Before starting the reframing, a full risk assessment was carried out to determine appropriate display angles and mounting methods. This suggested that the charters should be displayed at no greater angle than 15° in general, though 30° would be acceptable for short-term display. A range of mounting methods, including the use of polyester tabs or strips, corner pockets and magnets were considered; parchment corner pockets, shaded to match the individual colours of the charters, were selected as the most appropriate option. In addition, particular features of each charter were borne in mind, such as seals, ribbons and seal bags.

When the charters were removed from their existing frames, it became apparent a variety of mounting methods had been employed; where possible, adhered mounting materials were removed, and where this could not be achieved, any residues were tested to ensure that they would not cause additional problems. Furthermore, all new materials used were thoroughly assessed for long-term stability and compatibility.

Boards were cut using a software controlled system, allowing for precise and reproducible fitting; these boards were then covered in fabric in colours selected by the exhibition designers (red for the copies of Magna Carta; blue for the other charters). The requirements of each charter were accommodated, whilst ensuring a consistency of style for all six charters: cut-outs and built-up supports were incorporated to allow for seals and other features.

This work has demonstrated the manner in which a sophisticated and comprehensive initial assessment allowed a relatively simple but demonstrably appropriate solution to be implemented, using well established and understood materials and methods. Not only did this provide secure and sympathetic frames for the six charters, which catered for the specific requirements of each individual object, but also allowed a versatility should access or different frame aesthetics be required in future. Thorough planning and preparation ensured that the reframing was completed well within time and under budget.

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In 2017, Canada will be marking 150 years of nationhood, resulting in increased requests for the loan and display of a number of our country’s foundational documents that are integral to Canada’s identity, governance, rights and freedoms. Because there are currently no permanent exhibition or display options for these documents at Library and Archives Canada (LAC), their exposure to date has been limited to loan requests from other institutions, prompting the need for a suitable multi-purpose case for storage, transport and display. Over the last 20 years traditional preservation measures have been applied such as filtering UV, lowering light levels, reducing exposure time, and limiting the cumulative light dose. Gradual and irreversible light fading of signature inks has nevertheless occurred.

Recent micro-fade testing (MFT) of the signature inks on a number of foundational documents has verified that the synthetic dyes in the fountain pen inks are very light sensitive. The national significance of the documents, combined with the fugitive nature of the inks, has led to the difficult but common challenge of balancing preservation and access.

Two versions of the Proclamation of the Constitution Act, 1982,–commonly referred to as the “raindrop” and “red-stain” copies due to characteristic water markings from the outdoor ceremonial signing, and the deliberate 1983 activist defacement of the second copy respectively–have been mounted in identical custom-manufactured preservation cases. The cases were recently constructed through a collaborative project between LAC and the Canadian Conservation Institute (CCI). To address both preservation and security requirements for the loan of the documents, a two-part case system was designed: an inner preservation storage case that can be installed in a larger display case that satisfies security requirements.

During the case design process, light fading experiments were also performed on related materials under ambient and low-oxygen environments. The low-oxygen environment showed promise for slowing the rate of fading; therefore, the cases were subsequently developed with the potential for maintaining anoxic conditions for the duration of a typical loan. A particular challenge was accomplishing the design specifications, while also minimising the associated cost. The finished product incorporated simplified elements from related work at the Getty Conservation Institute (GCI), and the National Institute of Standards and Testing (NIST) in the United States.

In response to the findings of the micro-fade testing of the inks, LAC is working to establish national guidelines/standards for permanent, lightfast writing inks to be used for the signing of national prestigious documents and documents of enduring value.

The project underscores the productive collaboration between scientist, collection manager and conservator. The history of the project will be presented along with an overview of the case design elements and the proposed guidelines for permanent writing inks.

Anne F. Maheux, Michael Smith, Eric Hagan, CA

Making the Case: Storage and Display of Foundational Documents at Library and Archives Canada

Anne Maheux*, Michael Smith, Eric Hagan, CA

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Eric Hagan: Canadian Conservation Institute
Condition Survey and Assessment from their Specific Technical Aspects, Damages and Conservation Problems Completed by a Focus on Several Specific Cases

The Musée d’Orsay collection of 350 albums dating from 1850 to 1920 has not been the systematic subject of a general conservation survey. In the past, independent graphic art conservators have however occasionally worked on albums, especially for mounting and dismounting drawings requested for temporary exhibition or loans.

In view of the exceptional nature of the collection and the need to set up a more global conservation policy, it was decided to initiate a study based on the systematic evaluation of the collection in collaboration with curators. A team of two book and two paper conservators was therefore assembled.

We will first present a summary of the creation of the Musée d’Orsay collection of albums. This collection was instigated by the 19th century Musée du Louvre Graphic Art Department. It is the result of the Musée d’Orsay acquisition policy from its creation in 1986 onwards. In addition, a chronicle of the preservation and the conservation campaign set up since the acquisition of graphic works in the public collection will be briefly traced.

To lead such a survey, the use of precise terminology agreed by consensus is required. We will thus propose a technical glossary designed to properly identify the different types of albums (sketchbooks, original albums, factice albums, etc.). The overall results of this survey regarding the collection’s condition and conservation needs will be briefly presented.

The extensive observation of each item of this collection led us to create a methodical analysis grid. This checklist is intended for the conservator, curators and the personnel who have to examine these albums. Each field of the proposed grid and its distinctive features will be explained. Marks of use and the structure of albums and sketchbooks are vital to understand their material, artistic and historic context and must be preserved. What are the significant characteristics of albums? What are their specific forms of degradation? How do they differ from books and single sheet drawings? What are the signs of use that we have identified to make a diagnosis and a judicious treatment proposal?

This checklist is intended to be used on Musée d’Orsay’s album collection in setting up a proper conservation policy. Finally, this endeavour will improve our knowledge about this type of object that can be considered as intermediate means between books and drawings.
Numerous collections of works of art on paper are exposed to high VOC levels either due to the composition of the objects themselves or due to established storage- and presentation-specific conditions that cannot be changed without critical intervention. The collection of drawings and prints of the artist and architect Karl Friedrich Schinkel (1781-1841) at the Kupferstichkabinett Berlin was used as a representative example for comparable collections to investigate the VOC-concentration in its existing storage situation, to identify emission sources and to examine their effect on artworks on paper. Until 2012, the collection was stored inside cabinets made of melamine-laminated chipboard panels and on shelves made of wood. Most of the objects were mounted on historical cardboard and stored in piles inside portfolios.

The air composition in the interior of the cabinets was investigated. It was shown that the concentration of volatile acetic acid was high compared to all other VOCs identified, as well as the concentration of formaldehyde. The concentration of formic acid was not determined due to technical reasons at that point of time.

In order to assess the effect of volatile acetic acid and formic acid on Schinkel’s works, the adsorption behavior of various papers towards these compounds was investigated. It was shown that paper will generally take up volatile organic acidic compounds from its surroundings with a higher concentration in order to establish a concentration equilibrium. The presence of alkaline compounds significantly increases the ability to adsorb volatile organic acids. Further, a high content of lignin and hemicelluloses could also be responsible for an increased uptake of organic acids. It was further demonstrated that the materials previously used for housing the Schinkel collection will accelerate the decay of paper, at least under reinforced climate conditions. A correlation between the amount of emitted acetic acid and the degree of paper degradation was observed. However, the results provide a clear indication that formic acid has a greater influence on paper degradation than acetic acid.

In-situ analysis on original artworks on paper with a high emission potential showed that the accumulation of VOCs is hardly avoidable when storing the papers stacked and inside folders either of archival cardboard or of polyester film. However, the permeability of the folder material seems to have influence on the VOC concentration in the object’s surrounding only in the upper layers of the piles. Thus, the folders made from a combination of polyester film and cardboard did not show poorer results than the folders made of cardboard only.

Based on the results, the Schinkel collection was transferred into a new storage system that reduces the VOC concentration in the artwork’s surrounding, protects them from further mechanical damage and facilitates the handling and viewing especially of objects that are large in format.
A Pair of Ming Hanging Scrolls: from Past Repairs to Present Conservation

Marinita Stiglitz*, Julia Bearman, UK

In 1684 a pair of Chinese scrolls on paper, representing the Earth and the Heavens, was given to the Bodleian Library Oxford by an East India Company merchant. They are thought to be unique surviving ephemeral items probably printed during the late Ming dynasty (1368-1644).

Records show that in 1883 the scrolls were trimmed, patched with transparent paper on the recto and verso and backed with thick cloth. A parchment addition was stitched at the top and a rod glued at the bottom; a solution indiscriminately adopted when rolled items were repaired at the Bodleian. When in 2012 our Curator of Chinese Collections highlighted their unstable condition he was especially concerned about the now disfiguring transparent paper and incongruous mounting style. Wishing to display them in 2015, we discussed the scrolls possible original appearance and proportion guided by historical and aesthetic considerations and the original Chinese paper borders still partially present.

Reflecting on the old intervention and the damage it caused brought us to consider the approach and methods used to take care of a vast and varied collection at the end of the nineteenth century. Of particular interest is a diary of E.W.B. Nicholson, then Bodleian Librarian, in which he evaluates the condition of items that had been overlaid with transparent paper and the material used. In 1898 at the St. Gall Conference he advocated the use of transparent paper for repair. This wealth of information, along with the only past attempt to remove transparent paper at the Bodleian - undertaken in the 1970s with an enzymatic bath - helped us to shape our conservation decisions.

Extensive trials were necessary to tailor methods to remove the components of the old intervention and recreate functional hanging scrolls. A supported humidification allowed the removal of the cloth whilst protecting the fragmentary surface and enabling safe handling. The outer layer of the Chinese paper lining was also removed to avoid old distortions and delamination reoccurring, and to improve flexibility. The first scroll was lined with temporary layers of Rayon and restrained on a Perspex sheet to avoid deformations during the removal of the transparent paper patches. Breaking the strong bond between the transparent paper and the fragile surface of the scrolls required the identification of the adhesive used and experimentation with Albertina Compress and Gellan gum with modifications of temperature, humidity and time. To balance the proportions of the scrolls, extensions were added to what was left of the original paper borders before lining using traditional scroll-mounting techniques. Producing mock-ups to guide our final choices, we have interpreted the Chinese mounting style within a western conservation context.

We will reflect on how we were guided by past interventions, present ethical considerations and scientific analysis. We will finally discuss the experience gained treating two scrolls with almost identical problems, honing the treatment of the second scroll after the experience gained during the treatment of the first.

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The Islamic Department at the Louvre Museum opened its new exhibition areas in 2012. Among its collections, the miniature paintings represent around 500 items. This collection gathers the miniatures of the previous department of the Oriental Antiquities of the Louvre and of other museums such as the Union centrale des Arts-Décoratifs and the Musée Guimet. These works of art represent important examples of Islamic painting.

A miniature painting has a complex structure: it is made of different paper layers, which have received a surface treatment, and of different paint layers. Specific conservation problems like planar distortions, high sensibility to humidity and fragile paint layers recur and are a priority. Traditional Middle Eastern paper receives a surface treatment: it is sized and burnished to provide a smooth surface for calligraphy and painting. The process of burnishing the fibres creates important alterations. In addition, miniature paintings were frequently mounted as albums pages on cardboard where several layers of different decorated papers are pasted out. Most miniatures contain iron gall ink for calligraphy and verdigris for painting. Both media are corrosive, and excessive humidity can reactivate the corrosion process, so it may cause difficulties when mending, lining and flattening. The traditional technique of miniature painting consists of a superimposition of paint layers. Each layer is burnished to create different thicknesses and to have a glossy or matte layer. Unfortunately, this technique reduces the paint layer cohesion and the adhesion between the layers. They are often weakened by cracks and flaking.

In order to find an answer to these different conservation issues, we have adapted results from conservation research and have focussed our interest on iron gall ink. This approach helped us to use several techniques of humidity control for flattening and mending. For example, for mending paper corroded by verdigris and iron gall ink, we use the remoistenable tissue technique. For relaxing before flattening we use a strictly controlled 75% RH humidity chamber.

Our experience in conservation of the miniature paintings leads us to use several conservation methods for flattening, like drying in tension or between woollen felts. Sometimes, because the paint layer is very fragile, it is necessary to use low humidity. In this case, we flatten the miniature two times. Media consolidation is a specific treatment of miniature conservation. We have to keep in mind that general humidification helps to improve internal cohesion of the paint layer. When the paint layer is unstable, weakened by cracks and flaking, we have to consolidate using well-known techniques such as local application of gelatine or isinglass solutions with previous application of ethanol.

We have worked on this collection for around seven years with frequent discussions with curators. The department regularly asks for advice about loans and for new acquisitions. This conservation work on the Louvre miniature paintings collection is the result of the ongoing combination of experience and research.

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Several studies about suitable nanotechnologies for conservation and restoration purposes have been conducted in the past decades. Regarding the large number of paper-based graphic documents and artifacts, whose integrity and permanence could be influenced by conservation and restoration interventions, researchers have been introducing nanoscale materials to improve particular treatments, such as calcium hydroxide nanoparticles for paper deacidification. The superior effectiveness of nanostructured materials is mainly due to their reduced size (at least one dimension is in the range of 10⁻⁹m), their increased surface area per unit volume, and their enhanced chemical properties. Considering these qualities and the intrinsic compatibility with the starting material from which the nanomaterials are obtained, the approach introduced in this work, aims to develop innovative conservation and restoration methods based on nanocelluloses: cellulose nanocrystals (CNC) and cellulose nanofibrils (CNF). To obtain CNC, cellulose fibers are subjected to acid hydrolysis. The polymer’s amorphous regions, which are less stable, are degraded, and the more stable crystalline regions remain. To obtain CNF, however, fibers are disaggregated into smaller structures through mechanical methods. Both nanomaterials show promise in enhancing certain conservation practices and methods, namely spot casting and paper coating.

The innovative papers were developed by considering the fundamental components of the paper pulp, which is traditionally applied to conservation tasks. The cellulosic matrix is associated with sizing agent, plasticizers, fillers, and pigments. Traditional cellulose fibers, usually provided by reprocessed commercial papers, were replaced by cellulose nanocrystals or cellulose nanofibrils. Several formulations were studied. Analytical techniques as pH measurements, X-ray diffraction, Fourier transform infrared spectroscopy and tensile testing allowed properties of the new materials to be measured and evaluated, and compared with those of traditional paper. Accelerated aging was also performed.

Results show that CNC has an average crystallinity index (CI) higher than 70%. CNF and cellulose fibers, otherwise, have CI in the range of 40 to 60%. As the calculated index indicates, CNC has significantly superior chemical stability than cellulose fibers. In other words, this method could offer a high durability when applied to fill lacunae and losses on paper. On the other hand, although CNF possesses a similar crystallinity index to cellulose fibers, it has greater tensile strength (load to fracture is up to ten times higher than that of traditional cellulose paper) and plasticity, because of its higher aspect ratio (very small diameter and long length). These enhanced mechanical properties could allow this nanomaterial to improve the strength of treated papers, in coating procedures, since CNF pulp is easily applied without needing adhesives. The readability of the consolidated surface is ensured. Concerning the presented new development, not only the traditional guidelines, materials, and methods of application were considered, but also the inherent need for durable, compatible, and effective interventions. Therefore, the purpose of this innovative nanotechnology is to enhance practice without replacing the traditional approaches, but instead allowing optimization and improvement.

References
The study focuses on a series of twelve polyorama panoptique viewing slides from la Cinémathèque française, which are a major step in more than three centuries of inventions that led directly to the Lumière brothers’ Cinématographe. By changing the orientation of the light (from reflected to transmitted light) inside the display box, an illusion of day and night and changing scenery is created in front of the viewer’s eyes. These objects are made from two layers of paper, attached to a wooden frame.

The principal problem arises because some of the slides have large tears and losses, which interferes with their correct viewing under the two light orientations, and for the conservation of the slides (handling problems). Research to find materials/adhesives to mend the tears was instigated, aiming for a system that would offer appropriate transparency in transmitted light, combined with good stability and compatibility with the original materials. Five adhesives and four very thin papers generally used for the treatment of translucent papers, such as tracing papers, were tested.

These materials were compared to a new material: nanocellulose. One kind of nanocellulose was tested: microfibrillated cellulose (MFC). This novel material had not previously been applied to the field of conservation. However, it shows some promising intrinsic qualities, which lead us to test it: it consists of pure cellulose (from wood or plants cellulose, from which lignin and hemicellulose had been removed), with long and very thin microfibrils, a dense structure, and, importantly, transparency (as transparent as a polyester plastic film). However, its ageing behaviour had not been tested.

Different types of films of MFC (simple and composite) were made in the scientific laboratory of the French National Library, using different methods, concentrations of microfibrils, volumes of solution, and the most suitable was selected on the basis of these required qualities: transparency, no colouration, regularity of the film, fineness and flexibility. The most suitable MFC film was then compared to the four thin papers by different tests: measures of colour and luminance before and after light ageing, and mechanical resistance after thermo-hygrometric ageing. The MFC film was the most transparent of all the materials, the most stable to light ageing and one of the most resistant to mechanical stress, while being the thinnest material (a hundredth of a millimetre in thickness). Klucel G® in ethanol was the adhesive the most suited to this material and had good results in the tests.

The results show that this new material is well suited to the problem. It was used during conservation treatments to mend the tears. After the treatments were carried out with MFC film pieces, the slides can now be viewed in transmitted light without any visual interference. Nanocellulose film is an innovative material, which is very stable and which offers many new possibilities: it could be used on other kind of artworks, such as tracing papers, photographs or plastics, widely represented in the collections of the whole world.

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During my last year of studies to obtain a master degree in paper conservation at the Institut national du patrimoine (INP), I worked on an original album from the Musée Condé de Chantilly of 120 drawings (graphite, ink and watercolour), made by the French artist Félix Philippoteaux during a trip in Algeria in 1840. The comprehensive project consisted, after an historical study, in a scientific study around the conservation issues of the album, before performing treatments. The aim was, after removing the drawings, to proceed to the washing of the yellowed paper with lots of foxing stains, in order to improve the environment of the drawings.

The aqueous cleaning aims to extract the soluble degradation products formed by hydrolysis or oxidation reactions, so the paper is chemically stabilized. The common washing methods (immersion washing in water, float washing on water bath, damp blotter washing, or suction table washing) present some inconveniences that we wanted to avoid such as, according to the particular method, a sudden water intake in the paper, a risk of irregular cleaning, or many manipulations of the wet and thus weakened paper. Thus, with the help of the scientists from the chemistry laboratory of the National Library of France, we developed a series of experiments in order to find the best way to perform the paper washing on the album pages. We conducted a comparative and critical study of washing techniques, recently developed: the Paraprint OL60 and a rigid gel, gellan gum. We have compared them to immersion washing which remains the most practiced technique in conservation studios. For our tests, we used a paper with similar characteristics to that of the pages of the album (same type of fibres, thickness, and sizing with rosin in mass and starch on the surface). We have tested two different ways to use Paraprint OL60: capillary unit and Paraprint washing1, and three different concentrations of gellan gum. To evaluate the effectiveness and impact of the treatments on paper, we carried out various measurements: the pH of the paper, the weight gain of the samples (to evaluate the amount of water absorbed), colorimetric measurements and mechanical tests before and after aging.

Our results, which we will describe in the presentation, were very interesting and surprising in many ways: they took us to eliminate the use of Paraprint OL60 in our case, and to choose to treat the pages with gellan gum slabs at 3% for two hours. We achieved very acceptable results: washing allowed us to extract a satisfactory amount of coloured compounds, and the improvement is clearly visible; yellowing is attenuated, as are the foxing stains. Here, scientific evidence was decisive in choosing a better way to treat the paper, and reminded us of the importance of understanding the effects of treatments that are applied, hence the importance of experimentation and research.

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Copper ions and acids lead to enhanced degradation of the paper carrier. Stabilization treatment of documents with pigments such as verdigris and malachite should therefore include addition of alkalis to combat acid hydrolysis of cellulose and antioxidants to retard oxidative degradation catalysed by copper ions. The paper reviews present approaches for stabilisation of green copper pigments. Furthermore, two recently proposed treatments containing tetraalkylammonium bromide antioxidants and alkali are evaluated. The first treatment is based on interleaving of paper samples containing malachite or verdigris pigments with papers, impregnated with alkaline buffer and antioxidant at elevated relative humidity and applied pressure. The second one is based on the use of non-aqueous suspensions of nano calcium carbonate and/or magnesium oxide particles and tetrabutylammonium or tetrapropylammonium bromide. Size exclusion chromatography is used to monitor the extent of degradation of samples during accelerated ageing, while colour changes of pigments are determined using colourimetry. Results demonstrate that effective stabilization of paper samples can be achieved with tetrabutylammonium bromide and calcium carbonate containing interleaves at 90% RH. When non-aqueous immersion treatment is applied, tetrabutylammonium bromide at a concentration of 0.09 M in combination with calcium carbonate nano particles had the most beneficial effect on the paper as well as on the colour of the copper-based pigments.
Artists have been aware at least since the Middle Ages that the green pigment known as verdigris is subject to color change, especially in thin washes or glazes, turning greener and sometimes becoming muddy-brown; verdigris is also known to often cause disfiguring degradation of paper and parchment substrates.\(^1\) Nevertheless, verdigris remained an important pigment throughout the 18\(^{th}\) century and found special popularity among map and book colorists, who could achieve transparent green color washes that would not obscure the printed lines. Due to its changeability, precise identification of verdigris pigment in works of art remains difficult. First of all, verdigris exists in different chemical compositions based on copper acetate, which fall into two groups: neutral and basic verdigris. Second, verdigris has a propensity to alter into phases that are hard to characterize due to subtle differences in composition and the often amorphous nature of naturally aged verdigris. Therefore, verdigris is often identified in historical works solely by the presence of substrate degradation in the vicinity of a green pigment and the presence of copper, although this is not a sufficient means of attribution. To add to the confusion, analytical identification of verdigris is hampered by inconsistent descriptions in the literature, including discrepancies in the stated colors of neutral and basic verdigris. In fact, the greener color of basic verdigris, versus the distinctive greenish-blue tone of fresh neutral verdigris, is confusing in terms of whether the latter variety was used by artists as a green pigment. Consequently, it is not well understood whether artists routinely altered neutral verdigris through yellow admixtures or yellow-toned media from the outset, especially when used in landscape features, as recommended by Cennino Cennini.\(^7\)

This predicament has led to an in-depth investigation at the Library of Congress (LC) into the material and chemical properties of neutral and basic verdigris pigment using complementary X-ray diffraction (XRD) and Raman spectroscopy. This paper focuses on characterization of neutral verdigris (Cu(II)\((\text{CH}_3\text{COO})_2\cdot\text{H}_2\text{O}\)) and its alteration phases formed during natural and artificial aging. Results clarify and build on the conflicting body of information that exists on this artists’ pigment. Results furthermore highlight differences in stability between neutral and basic verdigris where the former is far more reactive, converting to basic copper salts, including a previously unidentified type, as well as forming organo-copper complexes. In addition, our laboratory results suggest that the importance of neutral verdigris as a pigment has been underestimated, since commercially available verdigris throughout its heyday was most likely dominated by the neutral salt. Our results thus not only aid in the proper identification of verdigris, but shed new light on the understanding of verdigris instability and treatment studies that employ neutral verdigris in model samples.


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Verdigris, copper acetate, is produced by reactions of metallic copper with acetic acid in the presence of oxygen. The use as a pigment has been known since antiquity. Production and application are described in numerous manuals for painters and in a vast number of references. Verdigris has been used in manuscripts, early printed books, on maps, prints and drawings until the availability of a wider range of synthetic green pigments in the 19th century. Organic colorants were frequently added to temper the initial blue-green colour to yellow-green tones or to achieve dark-green shades, as described in the manuals of Theophilus Prespyter and Boltz von Ruffach. There are occasionally historical references that state that vegetable dyes improve the colour stability of copper pigments. Barkeshli assumes that saffron can serve as a pH buffer and thus has a stabilising effect on verdigris (Barkeshli 1999, 2002, 2013).

As part of the verdigris-project at the Austrian National Library funded by the Austrian forMuse program, reference samples of vegetable green colours and verdigris mixed with different plant extracts were prepared on handmade rag paper. The preparations followed historic manuals and recipes. Organic colourants were added as juices of fresh plants, ground dried particles or commercially available green and yellow colourants. The colours were prepared with different binding media and different additives as described in literature. A selection of samples was submitted to accelerated aging at 80°C and 65% RH. A separate batch of samples was aged under light. Aged and unaged samples were visually compared with green coloration in manuscripts and printed books from the 15th to 18th century. For the precise analysis of original organic additives rather a large amount of destructive sampling from originals has to be performed. The evaluation was therefore limited to visual comparison with and without magnification.

The visual comparison showed that organic colourants seem to have been frequently added to verdigris. In particular, the addition of yellow and green organic colourants to verdigris resulted in colours comparable to those found in a selection of manuscripts and printed books at the Austrian National Library. In the objects studied, mixtures, pure colourants as well as organic colourants could be distinguished. The distinctions were made on the basis of visual characteristics like the presence of particles or the appearance of the coloured paper surface. Under magnification verdigris crystals can be distinguished from green plant particles and areas uniformly coloured with a plant dye like saffron.

The effects caused by accelerated aging on the reference samples gave insights into the long-term stability of organic colourants and their mixtures with verdigris. Some colours mixed with verdigris show good colour stability, for example saffron. Others like mixtures of sap green, Rahmnus catharticus, with verdigris can turn brown after aging. Additives like vinegar, tartaric acid or alum can lead to strong discolouration. It seems that brown discolouration of originally green areas in miniatures and coloured drawings, is not only caused by copper ions in verdigris but can also be the result of the aging behaviour of certain organic colourants and additives.
The blackening of lead white pigments is a well-known degradation phenomenon, which previously has been reported for paintings, murals, collections of prints and illuminated manuscripts. This color alteration can be attributed to two different mechanisms of degradation: a reaction with atmospheric hydrogen sulphide (H\textsubscript{2}S) by which lead white (mainly basic lead carbonate) is converted to lead (II) sulphide, also known as galena (PbS), and a lead white oxidation process, which concerns the formation of lead (IV) dioxide (PbO\textsubscript{2}) known as plattnerite.

A recent discovery of lead white having darkened within the last 10 years, in the graphic art collections of Statens Museum for Kunst in Denmark (SMK), led to systematic surveys at SMK and in a variety of collections at the Danish Royal Library. The surveys revealed many occurrences and degrees of damage on artist drawings, lithographs, and historic photographs.

In the presentation, various aspects of this problem will be discussed including possible sources and decay mechanisms. Since formation of lead (II) sulphide is more expected, particular focus will be placed on the possible impact of cardboards and papers, which have proven to contain sulphur, this being able to react with the lead white pigment.

Model samples of lead white water color paint on various base materials - paper, parchment, and photographic prints – have been monitored for blackening while exposed to natural (galleries and storage areas) and artificial (elevated doses of H\textsubscript{2}S under laboratory conditions) atmospheres. In addition, the impact on artworks and model samples of direct contact with papers and boards being used in the collections as well and framing materials are being investigated.

The level of H\textsubscript{2}S in collections areas of the Statens Museum for Kunst, and The Royal Library (both located in Copenhagen city center and with many visitors) are being monitored for one year.

An understanding of the possible pollutions sources and degradation mechanism will help us to take precautions and optimize the exhibition and storage conditions to prevent further loss of aesthetic value and in some cases even avoid misinterpretation of the graphic works of art and photography.

This project is ongoing and results are forthcoming. The Danish Ministry of Culture supports the project financially.


Birgit Vinther Hansen*: David Buti, Niels Borring, Johanne M. Nielsen, Morten Ryhl-Svendsen, Anna Vila, DK

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Fifty Shades of Grey: Darkened Lead White in Graphic Art – Sources and Decay Mechanisms.

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The library of Opera de Paris (Bibliothèque-Musée de l’Opéra, Bibliothèque nationale de France, Paris) hosts a collection of 2500 theatre set models and 2700 models dated from the 18th to the 20th century. Models showing extensive lead white discoloration were brought recently to the Graphic Documents and Models conservation lab for treatment. The lead white gouache was used by decorators to indicate where the lighting should be emphasized for the re-alisation of the actual set on stage. Sometimes model designs have been painted in grey monochrome and lead white became the main element of the set. It constitutes an essential technical indication and is often applied on large areas. The treatment of these damaged areas has been discussed, since the information carried by the model is totally altered by lead white discoloration and could result in misinterpretation. However, it is neither easy nor common to apply the lead white conversion methods on such large areas. The standard method (hydrogen peroxide in ether applied with a brush) or more recent methods (peroxide gel, Goretx®) sounded inappropriate. Indeed, direct methods of application present a high risk of damaging the gouache without homogeneous result and Goretx® does not allow a close control. In addition, we considered the health and safety risks associated with the use of an ether solution and the difficulty for the conservator to work in a fume cabinet for a long period.

The basis of our investigation to find a new approach for treating lead white discoloration was the popular belief in the whitening effect of the morning dew. This phenomenon has been later explained by the formation of peroxide and ozone in the air. In this paper, we present the excellent results obtained by nebulizing a peroxide solution on a corpus of models. To assess the efficiency of the treatment each step is carefully documented (macro and micro photographs). We adjust the treatment by varying parameters: peroxide concentration, number of applications, pH, temperature, etc. To evaluate the impact of the treatment on the document, samples of paper are submitted to peroxide mist following the same method as for the treatment and are then analysed. The strength of this method is that it does not require direct contact with the gouache, and allows the conservator to control the process. This work enables us to develop a protocol of treatment for the rest of the collection.

In conclusion, this research on lead white conversion treatment shows that experience gained from popular belief (morning dew as a bleaching agent) and previous conservation treatments (efficiency of peroxide for lead white conversion) can inspire the conservator to find appropriate solutions to a particular case and to assess the process of turning experience into evidence.

1 Victor HUGO, Les Contemplations, Livre XIV, Pauca meae, Aujourd’hui 1843-1855.
When it comes to removing discoloration from paper, washing may not be sufficient, and the highly invasive process of bleaching is then considered to achieve the desired visual improvement. Among the available bleaching agents, hydrogen peroxide (HP) is a versatile choice that has many advantages: rather low toxicity and easy handling, to name but two.

However, the well-known radical formation when in contact with iron or other transition metal impurities in paper might seriously impair the outcome of a HP treatment. Cellulose degradation and colour reversion might occur after only few months subsequent to treatment. Thus, the question arises if and how HP can be applied in a safe way when the precise iron ion content in the paper remains unknown, while available literature data suggest that all historic papers contain iron ions. The available body of research from paper conservation, and from the pulp and paper industry, can serve as a matrix for decision-making with the aim of lowering the risk of iron-catalysed cellulose degradation during HP bleaching in the paper conservation context.

Several strategies are viable in the use of HP bleaching. All of them follow the idea that successful bleaching is embedded in a prescribed treatment sequence that includes a “metals management” strategy that borrows its terminology from the pulp and paper industry but adapts its methods. While pulp and paper industry mostly rely on complexing and solubilising metal ions by ethylenediaminetetraacetic acid (EDTA) or diethylene triamine pentaacetic acid (DTPA) or acid treatment to remove iron ions from the pulp system, paper conservation choses from similar approaches to complex metals, foremost by complexing iron ions in phytate complexes that mostly remain in the paper in an inert state. This approach is well established in the treatment of iron gall ink documents, but no comparable data are available on the potential benefits of the calcium-phytate treatment in the bleaching context. First results on papers impregnated with different molarities of iron ions to trace the effects of simulated HP treatments on molar mass, carbonyl group content and colour suggest that the iron phytate complex is sufficiently stable to sustain HP bleaching and thereby keeps the iron ions successfully from the reaction system.

The study also throws light on the fact that even though almost all historic papers contain iron ions, a better understanding of iron contaminants present may in the future improve HP bleaching, and improve aqueous treatment protocols for iron-contaminated paper in general. So far, one can say that the majority of historic papers can be bleached with HP, provided that a comprehensive metals management is followed, because not only the amount of iron ions, but also their accessibility, influences the bleaching result.

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The clamor of colors in Paul Gauguin’s oil paintings are familiar to most, but less studied are his quieter, more subdued graphic works and their relationship to the rest of his œuvre. Based on an understanding of 19th century artists’ materials, and careful visual examination of the artist’s prints and drawings, we know that the appearance of Gauguin’s watercolors, papers, and hand-colored prints has changed over time. This study focuses on 25 graphic works from the collection of prints and drawings in the Art Institute of Chicago. These technically intriguing and complex prints, produced by the artist between 1893 and 1894 as part of his *Noa Noa* series, are a compilation of images and text meant to augment his written descriptions of his Tahitian experiences. These unique multiples, printed from ten separate blocks, document several states of each carved image and employ a range of papers and media from watercolor to encaustic.

In preparation for an online scholarly catalogue and a 2017 exhibition entitled *Paul Gauguin: Artist as Alchemist*, a number of wood-block prints and sketchbook sheets were selected for analysis to inform catalogue entries and technical essays. In order to establish a basis for comparison with works from the Art Institute’s collection, we were afforded the incomparable opportunity to study masterworks from the Musée d’Orsay at the Musée du Louvre, Département des Arts Graphiques, the Institut National d’Histoire de l’Art and the Musée du Quai Branly in Paris. Passages of pristine material found in these national treasures became the standards against which we judged the fidelity of the colors found in their Chicago counterparts. Analysis of the Art Institute’s collection was carried out using X-Ray Fluorescence spectroscopy (XRF), Fourier Transform Infrared spectroscopy (FTIR), Raman spectrometry, Surface Enhanced Raman Spectroscopy (SERS) and pyrolysis - gas chromatography coupled to mass spectrometry (py-GC/MS).

Pigments, binders, and organic dyes that were degraded as a result of photo-oxidation were identified. Conservation treatments were carried out on many works in order to dampen the visual noise generated from age, light exposure and use. Digital re-colorizations of two works were then created based upon the results of treatment, visual comparison with unfaded works and pigment analysis. These re-colorizations inform the works’ narrative interpretation, and provide insights into the ways in which Gauguin intended his pictures to translate across cultures and through time.
The pastels by Jean-Etienne Liotard (1702-1789) in public and private collections in Switzerland are undergoing a conservation project, which will take place over several years. The artist mostly executed the pastels on vellum, but also sometimes on paper, silk and wood-panel. When the relative humidity decreases, the nail attachment along the edge of the wooden stretcher can fail. Tearing and planar distortions are observed on several of these works. The presentation will focus on a slow re-tensioning of the vellum support with the help of pneumatic control.

The second part of the presentation discusses the housing and display of pastels with sound conservation materials in a manner that is historically sensitive. The method was developed in response to the traditional practice of mounting pastels by the edges under tension. The pastel and mounting materials are assembled as a secure package with neutral materials for positioning in a frame with minimal handling.
The degree of intervention is discussed in three unusual case studies to highlight the benefit of treatment in contrast to the ethical framework of the objects. Possible changes of appearance due to the conservation work needed to be evaluated, as well as economic time management in the context of large numbers of objects.

The consolidation of works of art by Miriam Kahn was desperately needed to handle and to mount the pastel drawings on paper. Miriam Kahn executed her artwork only with blue and black pigments and does not use any kind of binding media. The expressive drawing shows multilayers of loose, powdery and unbound pigments. Due to the lack of any binding media the pigments are widely distributed everywhere, even at the back of the artworks. The art dealer asked for stabilization to be able to mount the pieces. The surface was consolidated with a 1% gelatin solution, applied with a partulizer. The edges, to a distance of approximately 5 cm, were consolidated to a greater extent to provide a better-protected handling area. The surface and the colour impression changed to a minor extent, because pigments were dislocated and shifted. A binding medium was applied which automatically lead to a change of appearance.

A gum bichromate print from Heinrich Kühn, a master of this early photo technique, showed damage in the form of an overall craquelure. The whole gum Arabic layer image consisted of cracked pieces, which adhered to the support board. The image was still readable. However, due to the craquelure the image showed a kind of grey haze. Single lacunas were detectable in the outer areas. The edges of the neighbor lacunas were consolidated with fine synthetic brushes (00000) and 1% gelatin. The reason for the overall cracking of pigment-gum Arabic layer is not known. However, the dried gum Arabic is very stiff and yellowish. The consolidation can only be a local treatment because it is not justifiable to consolidate the whole photo image due to preventive strategies.

The third case study looks into draft design drawings for commercial textile prints. These design drawings are multilayered and are reworked with any kind of drawing and painting materials. These draft designs never tend to be single art works. However, they are valuable and a testimonial in the development of textile prints and need protection. In the past, they were treated with no care and show heavy losses of pigment layers. They are stored between sheets of silicon release paper. These prints were treated either with sturgeon glue (2%) or with Medium for Consolidation (MfK, Lascaux); this is an aqueous natural resin, which develops strong adhesive bonds. The Medium for Consolidation was applied with brushes or with aerosols (AGS 2000).

All three case studies required thorough decision-making, because a shift of colour was either not completely avoidable or all usual consolidation media were not effective. When dealing with consolidation, there is normally no technical solution to redo or extract an applied consolidation media in any way. Therefore, it is most important to choose carefully the application mode as well as the consolidant in the context of consolidation.

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During condition assessments in archives and libraries, mechanical degradation has repeatedly been identified as one of the most frequent types of damage and one of the highest risks for physical collections. Within collections, mechanical degradation occurs almost unnoticed, starting with folds or small tears along the edges, until it becomes very apparent, when parts are missing. Evidence is clear, and experimental research has been carried out, but a good understanding of how mechanical degradation occurs and accumulates in the real setting of collections is still missing. This is in part because until now no framework has been used for the identification of the factors contributing to mechanical degradation and, more importantly, for the evaluation of their relevance in the deterioration process.

In order to learn more about these factors and their relevance, an observational study (survey) of archival materials (loose and bound) has been designed, based on reliability engineering concepts. This is a mixed (qualitative and quantitative) approach to the failure of complex systems. When mechanical degradation is understood as failure of objects, reliability can provide a framework for the study of the degradation process in archives. Reliability provides, for example, a classification of failure causes which divides the causes by factors prior to use (design and manufacture) and factors during use (maintenance and usage).

We developed a set of properties of records to be assessed during the survey. These consist of physical and chemical properties (such as size, weight and type of physical protection; and pH, tensile strength and presence of lignin) as well as metadata (such as date made available to the reading room or frequency of use). The collected data have then been statistically analysed to find correlations between the variables and to evaluate their relevance in relation to the observed mechanical failure in the surveyed collections. The survey has been conducted in the collections of the Amsterdam City Archives.

The aims of this research are the identification of the most relevant factors involved in mechanical degradation of archival collections and therefore the identification of the type of objects/collections most vulnerable to this type of degradation. Furthermore, this research aims to develop a better understanding of how mechanical degradation accumulates over time.

This approach greatly relies on the evidence provided by real objects in actual collections, an area of growing interest within the heritage science. The outcomes of this research will benefit the conservation community by providing data to be used in risk assessments, informing practitioners on how to evaluate the data collected during condition surveys and, consequently, contributing the reduction of the potential interpretational bias in surveys and assessments when practitioners rely solely on their experience.

This research project is conducted as part of the MRes Science and Engineering in Arts Heritage and Archaeology, Institute for Sustainable Heritage, University College London.

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With over one million digitized copies, the Bavarian State Library offers a large number of its copyright-free books anytime and anywhere, all free of charge for the public. Among them are thousands of medieval manuscripts, incunabula, and rare books of the 16th century. Offering digital copies further ensures the protection of the original books. This is most important in the case of unique written cultural heritage. Once a book with text and illustrations is digitized, it offers a full range of new opportunities.

The most lavish medieval books are bound in covers set with enamels, jewels, and ivory carvings, which can only be handled by specialists like conservators. The library has been carrying out digitization since 1997, and since then numerous mass digitization projects have been realized, even including valuable objects. These projects represent close collaborations between the conservation department, the Institut für Bestandserhaltung und Restaurierung (IBR) of the Library, and the digitization department.

First, this presentation gives an overview of the role of the IBR in the digitization projects of the Library. In the very early planning phase the IBR starts with a general survey of the types and materials of the objects to be digitized. The next step involves checking the condition of each item in the lab. This is followed by decisions about the necessary treatment (in-house or external) and the requirements for the scanning process (with or without conservator, opening angle, etc.). In the course of past projects, some tools have been developed, e.g. an online condition check-list that bundles information on each item and serves as a reference point for curators, conservators and scan operators.

Second, this presentation reports on the experiences gained in the Choir book digitization project. For this project, 130 Choir books and manuscripts from the 16th and 17th centuries have been scanned. A total of 27 manuscripts showed severe damage by ink corrosion, and a high risk of loss of substance. Therefore, a special strategy was required in order to digitize these manuscripts. This presentation describes the conservation treatment method and technique that was applied. Using acrylate coated Gossamer Tissue, our so-called Munich Tissue, we were able to prevent further damage by moisture-induced migration of acids and iron ions. The technique was initially developed, subsequently evaluated and has continually been enhanced by the IBR since the 1970s. Reactivation by heat allows a secure and successful application, even on large degraded areas. Following the principle of minimum intervention only the brittle parts of deteriorated cellulose with cracks or losses in the ink are stabilized. Due to this restriction the manuscript remains delicate for handling and storage. Therefore, the entire scanning process is guided by conservators; storage conditions are climate-controlled.

Minimum interventions with the Munich Tissue make it possible to digitize even severely damaged objects. Employing heat reactivation can be considered a secure conservation treatment method that avoids the risk of migration and distortion. This technique can be easily adopted by experienced paper conservators.

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Iron gall ink corrosion is a challenging issue for written heritage conservation. Yet the chemical mechanisms underlying this degradation remain, in their details, poorly understood. In an acidic environment, acid hydrolysis is often considered as the main cellulose degradation pathway, but it can be combined with iron-catalysed oxidation via Fenton reactions that most probably predominate in mild alkaline conditions\(^1\). These considerations rely on the fact that hydroxyl radicals are experimentally evidenced under mild alkaline conditions\(^2\) but not under acidic ones and paper degradation significantly increases at low pH\(^3\). However, a recent study of the behaviour of papers impregnated with acidic iron gall inks showed that oxygen was an essential component of chain scissions\(^4\), questioning the role of oxygen for cellulose depolymerisation in acidic conditions.

Based on these findings, this work aims at getting a deeper insight into the chemical mechanisms involved in Fe(II)/Fe(III) induced cellulose degradation. To simplify the system under study, we focussed on cellobiose to model iron-catalysed cellulose degradation. Cellobiose is the repeating unit of cellulose and consists in a disaccharide composed of two glucose molecules linked by a $\beta\ (1\rightarrow4)$ bond. This model molecule was chosen because of its solubility in water, which allows the use of different analytical tools to follow bond breaking and identify degradation products. In particular, cellobiose dissociates upon acidic hydrolysis into glucose units that can be identified. Therefore, aqueous solutions of cellobiose and Fe(II)/Fe(III) sulphate were prepared in different conditions of temperature, pH and eventually under oxygen bubbling. The evolution of cellobiose and glucose concentrations versus time was monitored using capillary electrophoresis. Simultaneously, Fe(II) and Fe(III) concentrations were monitored by UV-visible spectrophotometry. Degradation of the model molecule required both oxygen and iron II. The results indicated that acidification of the solution during the formation of iron oxide-hydroxide was a key parameter that can explain glycosidic bond cleavage.

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Near-Infrared Spectroscopy as a Characterization Tool for 19th and 20th Century Chinese Paper

Natalie Brown, Tom Fearn, Dirk Lichtblau, Matija Strlič, UK

Many institutions across the globe hold large Chinese library and archival collections, however to date there has been no systematic scientific study of the material properties of modern Chinese papers. Building on the body of research where near Infrared spectroscopy (NIR) has been used on collections of Western paper\(^1\) and Islamic paper\(^2\), material properties such as pH, degree of polymerization (DP), lignin content, tensile strength properties, and date were determined for a reference collection of 126 19th and 20th century (modern) Chinese papers. Due to the low grammage (mass per unit area) of many of these papers, some standard methods of testing have required significant modification, both in technique and in interpretation, specifically methods of mechanical testing. Using multivariate calibration and classification methods, the analytical data was compared with the NIR spectral data and quantitative non-destructive methods of material characterization were developed and applied to unknown Chinese paper collections.

It has so far been established that papers from the reference collection do not follow the acidity distribution patterns typical of modern Western paper, which indicates the prevalence of traditional methods of papermaking well into the late 20th century, and probably leads to higher chemical stability of such paper. The broad distribution of DP may well reflect the different (and unknown) environmental histories of the reference collection.


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During preservation and conservation treatments, we try to improve the condition of an item. Not only the recent state is important, we also want to know what will happen to our item in the future. Conservation treatments very often influence future changes. Therefore, it is very important to keep information about the intervention for our colleagues who may work with the item in the future.

At the National Technical Museum in Prague, this issue was discussed and dealt with in relation to the collection. There are more than 66,000 catalogue numbers in the collection. In many cases, one number represents a group of related objects, so the quantity of unique items is even higher. All of the objects are digitally registered in our own system called “Imbus”. When an object needs conservation, the curators can very easily create a request with just one mouse-click using this system. This immediately sends the request to the conservator. Afterwards the conservator creates the conservation report in another application, which cooperates with Imbus. The system is very flexible, so it can work for all of our items, from small daguerreotypes to huge locomotives. It can be also edited when necessary. If a material analysis is necessary, the chemist also enters the results in this application. The reports are accessible to all colleagues in the museum – conservators, curators, scientific researchers and others.

It is very useful to keep all our information in a digital form, but we are also aware that this type of record can be lost or become inaccessible very easily. Although our evidence and conservation application is very helpful, face-to-face contact with our colleagues and the exchange of new ideas remain essential for making right decisions during the conservation treatment.
MRT (Movement, Reserve, Transport): Solution to Keep Le Brun’s Cartoons Glued to Canvas Unframed

Valentine Dubard, Bertrand Le Dantec, Éric Dorée

MRT: Movement, Reserve, Transport.
This is a simple protective frame, typically made of wood, allowing for easier handling, access to and consultation of large-size 2D collections in storage. It protects works during crating and transportation, in particular when loaned works are hung up for exhibitions. This system was developed for collections of large contemporary paintings, which are particularly susceptible to dust, fingerprints and rubbing.

Conservation professionals from both the private and public sectors, a museum registrar, preventive conservation specialists, and an industrialist worked together to devise an MRT adapted to the surface of Charles Le Brun’s cartoons in black and white chalk. This MRT offers an alternative to framing and wrapping as preservation methods for cartoons glued to canvas; it also provides a practical means of exhibiting these works in Spain, and of preserving as much as possible of their original function as preliminary sketches—as per the Drawings and Prints department’s wishes.

New aesthetic and technical constraints soon arose during the development phase. Very early, its weight and modularity made aluminum the logical choice of material. The development of various models and prototypes followed.

How can we manage the risk connected to the static electricity generated by the commonly used protective coverings? Can they remain transparent and avoid this risk? With what new materials can this be achieved? How can we make these protective covers reusable and effective? How can we limit the transmission of vibrations to works placed in the MRT? Should we plan on handles? How can we limit the amount of floor space taken up by MRT in storage? How can we manage the risk of deterioration of these aluminum frames during handling—rubbing in particular? How can we ensure their structure is rigid, light, and aesthetic? These were the questions that guided us during the development of the new MRT.

The director of the Department of Drawings and Prints decided that the cartoons would be shown in their MRT in order to facilitate the installation and dismantling of exhibitions and to prevent the works from being touched. Once removed from their transport crates, the MRTs were therefore placed on metal shelves in display cases, with braces securing the upper part and glass protecting the surface of each work.

Changes and improvements continue to be made to the MRT developed for this exhibition—with other collections, constraints, degradation factors, and functionalities in mind.

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The album is a part of the so-called Wilanów collection, consisting of prints and drawings, which in turn is a part of the Wilanów Library, now stored in the National Library in Warsaw. The collection is noteworthy because of its substantive content, as well as its distinctive manner of mounting. Part of the drawings from the Wilanów collection are pasted on a two-ply mount, consisting of a single-ply rag paper backing sheet and a front sheet – whole or consisting of four strips of paper around the drawing. The front sheets are made from very smooth crème or beige paper or coarser blue or pink paper. The drawings are bordered with decorative paper tapes, usually in deep blue and gold – the latter with relief patterns. The edges of the mount are embossed all around, with decorative motifs in corners. The progress of mounting is well documented, and can be placed between 1832 and 1845.

Although the manner of construction of the plates is not uniform for the whole collection - the album, which is the subject of conservation work, shows four types of mounts on only six plates.

All drawings are made in black carbon and iron gall ink technique. Three drawings were evidently remounted. There are remains of old backing cardboard on the back of the drawings, showing that the drawings were removed from a previous mount. The 19th century margins are pasted along the edges. The thickness of the backing cardboard was not uniform, causing deformations of the drawings. It was decided not to remove the whole cardboard, but unify its thickness – by removing some parts and filling others with thin layers of paper pulp sheet. The double-sided drawing was pasted to the mount with an upper edge. There were remains of previous mounting paper, hiding part of the drawing from the back. The upper edge was strongly deformed. During conservation the drawing was dismounted, remains of paper removed and, after flattening, the drawing was adhered again to the mount with Japanese paper hinges. The most popular type of attaching drawings to a mount – by pasting overall - required only a minimum of conservation treatment. The original mount was removed in the past by cutting along the edges of the drawing. The backing paper was removed and the drawing was pasted on thick cardboard. The three margins of the mount and the fragment of back paper with pencil handwriting were stored separately. The conservation treatment concentrated on the reconstruction of the mount, including the original parts. All the drawings and mounts were deacidified using a non-aqueous method (barium hydroxide in methanol). The problems with pressing – because of the 3D structure of mounts - were solved by using a combination of soft and hard dividers and a moderation of weight. As the plates were already dismounted, due to previous exposition needs, it was decided not to bind them into the album again.

The main consideration in the conservation process was concentrated on “what to retain, what to remove, what to restore”, to balance the proper preservation of drawings and maintaining the historical manner of mounting.

Katarzyna Garczewska-Semka: National Library, Warsaw, Poland; kgarczewska@wp.pl
The development of conservation practice and research are closely linked at the British Library, and this provides a solid foundation for the work of the conservation department. This is possible due to the close working relationships, which have developed between the various different areas of specialism, including treatment-based conservation, preservation, conservation science and analytical imaging. Research may be driven by formal internal processes, such as treatment reviews, by the requirements of specific objects or work programmes, or through the development of larger scale projects based around known areas of interest or concern. By ensuring that the practical requirements of conservation are central to any such work, the resulting research will have direct beneficial outcomes rather than simply being of abstract interest. Equally, by ensuring that a formal research discipline is applied to the development of novel techniques, it is possible to robustly demonstrate the benefits of the work and to fully explore methodologies and outcomes.

Treatment reviews allow current established practices to be evaluated, taking into account new developments in materials and techniques, evolving conservation philosophies, and the procedures of other similar institutions. The reviews are supported by internal research to assess the relative merits of current and alternative methods, and as such require both a good understanding of existing practice and an ability to objectively judge other options. Past treatment reviews have included the use of adhesives, wash methods and iron gall ink treatments. Research driven by concerns associated with particular objects often brings to light coincidental links between different issues, with the result that smaller scale projects can cross-fertilise and organically develop into broader research. An example is provided by the ongoing work on iron gall ink, with separate research strands looking at historic recipes, the interactions of inks with the underlying substrates, methods of recovering lost or faded text, and the development of novel treatment methods. Each research originally arising from the need to address different and particular problems, but naturally coming together in such a way that progress in one area informs developments in the others. Similarly, work on different aspects of housing, display and storage methods has provided a valuable body of knowledge about the most appropriate ways of dealing with different types of objects. Investigations have included methods of rehousing vulnerable materials, the formation of microenvironments within storage systems, environmental responses and buffering effects, and the use of acid scavengers, as well as general testing of novel materials to ensure stability and compatibility.

This close evidence-based collaboration is of particular value when demonstrating the benefits of a particular conservation treatment to other stakeholders, and, perhaps more importantly, when justifying why particular approaches or methods are not appropriate. In general, the ability of conservation practice to inform conservation research, and vice-versa, ensures that new developments are relevant, practical, robustly tested and sympathetic; this kind of cooperation means that individual areas of expertise are utilised to the full, and encourages ongoing involvement and learning.

The use of gilding in the collection *Drawings of Birds Chiefly from Australia, 1791-1792*, attributed to the Sydney Bird Painter had raised questions about the likelihood of an artist working with these materials in colonial Australia. Curatorial research uncovered a complex copying story between the Sydney Bird Painter’s work and convict artist Thomas Watling’s, and this along with materials research into the paper stocks in the collection connected the drawings back to the Australian colony. Portable X-ray fluorescence analysis identified the gilding as gold but did not offer the resolution required to distinguish between the gold leaf, pigments and paper substrate. To be able to see the elemental composition of each material, high resolution X-ray fluorescence mapping at the Australian Synchrotron was required. Fly scanning of the watercolours using the Maia 384A detector created individual maps of the distribution of each element. The gold leaf was characterised as 100 parts gold to 1 part copper making it highly refined. For the first time it has been possible to identify individual pigments used in colonial Australian watercolours. Inorganic pigments based on iron, mercury, arsenic and lead have been identified. The scans also allow their application to be visualised independently, revealing the artist’s technique. The presence of organic blue, yellow, green and black colourants can be deduced from the lack of data in the scans corresponding to their use. The dates of these drawings precede both the discovery of gold in Australia and the development of a commercial art materials market. The materials therefore must have come out from England with the colonisers or were purchased on en route to the colony. The purity of the gold demonstrates that just because artists in the colony had limited materials available to them it does not mean that they necessarily had low quality materials. The identity of the Sydney Bird Painter is still a mystery but the quality of their work and the materials that they used has been amplified by the elemental mapping of these exquisitely fine drawings.

Kate Hughes, Daryl Howard, David Thurrowgood, AU
Iron gall ink-based graphic documents are especially difficult to restore. Among the rare stabilization treatments proposed for this type of document, calcium phytate treatment is one of the most promising.

During the last two decades, the different laboratory studies on artificially aged test papers allowed the conclusion of the effectiveness of the calcium phytate treatment and its innocuous nature on paper cellulose. Nevertheless, in France, this treatment is still not used as a curative on altered documents, even on documents undergoing aqueous treatments during their restoration. This hesitation is probably related to possible changes in appearance of the documents but also to an almost cultural fear of new practices.

The selected document is a handwritten reproduction of a score manuscript from the Library of Vienna. Music scores are unusual amongst the rare manuscripts, as they can be easily found in multiple copies (orchestral scores) made at the same time with the same components. Lines (scores and notes) are wide and thick and the amount of ink is higher. These strongly inked areas are favoured areas of corrosion, which will facilitate future observations of damage caused.

The leaves of the studied volume have been treated with three protocols (water wash, deacidification and complete phytate treatment) in order to estimate the benefits directly related to calcium phytate treatment. The book after restoration is returned to the Department of Music collections to be stored.

The evolution of the document is followed by photographic images (in a light controlled environment) and analysis (pH measurements, colour measurements); we planned a measurement campaign every four years.

The first aim of this study, started in 2011, is to assess the benefits of calcium phytate treatments in the long term when a document is naturally aged. However, behind the obvious necessity to validate a technical protocol, there is the will to give an impulse to the use of phytate treatment in the conservation department of the Bibliothèque nationale de France (BnF).

Olivier Joly, Stéphane Bouvet, Emilie Le Bourg, FR
Preserving Stained Glass Cartoons at the Corning Museum of Glass: A Humidification Technique to Aid in the Batch Treatment of Archival Collections

Natasa Krsmanovic, Nicole Monjeau, CA, UK

In the summer of 2015, Nicole Monjeau and Natasa Krsmanovic interned at the Corning Museum of Glass’ (CMoG) Rakow Library. Held jointly by CMoG and West Lake Conservators, the internship focused on the treatment of stained glass cartoons by Whitefriars, a stained glass company based in London, England from 1834 to 1980. The Whitefriars Collection, gifted to CMoG by the Museum of London in 2008, contained about 1800 rolls, which housed approximately 10,000 individual objects. Developing a standard treatment protocol for future conservation and preservation of this vast archival collection was explored.

This poster outlines the successful use of a modified Gore-Tex humidification technique explored during the internship at the Corning Museum of Glass to do batch treatment of the Whitefriars Collection. The project revolved around the conservation treatment of Whitefriars stained glass cartoons, most of which were oversized. The purpose of the conservation treatment was to safely unroll, flatten, and stabilize the cartoons so they could be digitized and made available online to the public. Although treatment was minimal, the size and condition of the rolled objects posed handling issues. The rolls contained a variety of substrates, including machine made paper, waxed linen canvas, tracing paper, Kraft paper, and silver gelatin photographs. Media included ink wash, pen and ink, watercolour, graphite, and charcoal. Many of the objects were tightly rolled together, rendering the assessment of volume of the material and exact condition issues difficult. Thus, applying a humidification technique that would safely accommodate the range of condition issues, size, volume, and available lab space was of utmost importance.

The method explored in this poster could be adaptable to meet the needs of large archival collections, allowing for the treatment of multiple objects of varying size, media, and condition issues. The humidification technique used during the internship increased workload speed tenfold, when compared to chamber humidification, allowing Monjeau and Krsmanovic to safely unroll and treat 100 individual objects in three months. The method can be easily adjusted based on the space and collection size of a particular institution, and allow for effective workflow during the batch humidification and flattening of tightly rolled archival documents. In addition to being successfully used for the treatment of oversized rolled objects, this method can also be used for the batch treatment of smaller objects. This would allow numerous objects to be safely humidified at the same time. Overall, the use of Gore-Tex to humidify a large collection of objects allows conservators to plan their workflow in an efficient manner, making it easier to perform batch treatment of archival objects.
In France, digitization has been increasingly promoted over the past couple of decades. The conservation work needed for documents going through this process is more and more demanding for conservation departments. We also face heavily damaged documents such as transparent papers that may be quite difficult to treat. Because of their fragility, they often present numerous small losses, which are very time-consuming to infill by hand. The amount of documents to be treated and short deadlines compel us to find solutions to continue to produce high-quality work.

Die-cutting machines are new tools, which have now been used for a few years by people practicing arts and crafts. Initially, these machines were able to cut shapes that had been generated on a computer. Gradually the machines have evolved, and we can now find ones equipped with a scanner, which opens new possibilities for conservation practice. Thanks to their advanced options, these machines can help the conservators in some of their tasks. We can use it to scan the losses of the documents (previously transferred on a tracing paper or a polyester film) and cut the infills, exactly the shape of the loss. We can also add margins to those infills, which are regular and adjustable. The device can be used to cut and make small housings or supports for books and other small items. These can be drawn on the computer and then transferred into the machine where they can be stored and customized.

The machine is delivered with two blades which allow to cut various kind of materials: laid and wove paper, Japanese paper, cardboard, parchment, pared down leather, transparent paper, canvas, polyester, non-woven polyester or foam. The touch screen on the machine allows work to be carried out easily and quickly. The cutting mat provided can go up to 30x60cm, allowing work on large areas, which are usually more difficult to cover. It also incorporates a universal pen holder in which you can put any tool you want. Therefore, you can use an awl to make featheredge cuts on Japanese paper. Each cutting process takes only a few minutes, which is very helpful when you have to deal with large quantities of documents. Various options allow the work to be organized in order to waste as little material as possible, or to avoid a particular area on the material you cut.

We see these machines as a new kind of tool, helping the conservator in producing the large quantity of work needed for digitization. This kind of work is usually minimal, allowing the digitization operator to handle the documents without further harm done to them. It is not, in numerous ways, the best treatment solution. However, this machine allows us to provide a better treatment than the one we would usually be able to provide, whilst respecting the same deadlines.

This tool does not replace the work of a conservator, as we still carry out our infills by hand for single items, but it helps us to reach our goals.  

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The damaging effect of iron gall inks on paper has long been acknowledged as one of the major threats to library and archival heritage. Although a large number of studies have been carried out to elucidate the chemical and physical degradation processes, practical outcomes of value to preventive conservation are still limited. In order to bridge the gap between the large body of scientific evidence and prediction of fitness for use of iron gall ink paper, the effect of iron gall inks on the degradation of paper support was investigated analytically through a series of accelerated degradation experiments using 10 sacrificial historical samples. Experimental evidence suggests that during natural degradation of paper, the presence of iron gall inks does not change the major degradation mechanisms and hydrolysis was found to be dominant.

The dependency of degradation rate of paper containing iron gall inks on temperature was proven to follow the Arrhenius law. Rate constants were compared for paper with and without inks, and a proportionality was established, suggesting that inks constantly increase the degradation rate of paper by 65% across various material compositions. This revealed the potential for the development of a generic model to describe ink induced degradation of paper based on the established kinetic model for paper. The contribution of each deterioration factor, such as temperature, RH and acidity was further quantified using the data obtained from naturally aged historic paper samples containing iron gall inks through non-destructive collection survey. This generic model can be applied to predict the fitness for use of iron gall ink collections, examine various environmental scenarios and evaluate the probable outcomes of preventive conservation approaches. This will help collection managers to prioritize controllable parameters and treatment options in conservation practice.

1 Centre for Sustainable Heritage, University College London, UK, 2013. Collections Demography.

Predictions of Iron Gall Ink Induced Degradation of Paper

Yun Liu, Nancy Bell, Matija Strlič, UK
The poster will concentrate on a few chosen aspects connected with the conservation and restoration of an artistic herbarium made in the 19th century by the famous Polish writer Eliza Orzeszkowa. The extraordinary form of this herbarium and the selection of various materials used to create it, including dried plants, resulted in many issues during conservation. Before any decision was made, accelerated aging tests on model samples were carried out. This allowed the most suitable and stable substances to be chosen for strengthening the very fragile dried plants in the herbarium. It also enabled to verify if deacidification of the paper materials in the object was safe. Repairing the damage to the herbarium's construction was possible thanks to the empirical experience gained by preparing a copy of the Eliza Orzeszkowa herbarium, which was very helpful for understanding the object's technical composition.
There are large-size graphic works in the collections of many Russian museums. In general, they can be classified into several groups:

1. Printed graphics: posters and maps

2. Original graphic works created in different techniques: watercolour, gouache, charcoal, sanguine or tempera

3. Works of contemporary art made in non-traditional techniques.

Often, large-format works come to our workshop after a former restoration treatment: lined and stretched on a frame or plate. Large formats often consist of several pieces glued together.

**Stages of conservation:**
Several methods of removing of the old lining and of separating the artefact into its different parts will be described on the poster. Particular attention has to be paid to problems associated with the cleaning of large-size graphic works.

Despite the fact that each specific artefact requires an individual approach, there are several lining techniques used in our practice for large formats:


2. Lining on cotton cloth (calico)

3. Lining on canvas.

4. Lining by application of adhesive through gauze

An important aspect of working with large-formats is the problem of subsequent installation, storage and display. Different ways of mounting and storage will be shown with examples from leading museums in Russia.
The Collection Preservation Division of the National Library of the Czech Republic has devoted special attention to the care of the so-called modern library collections, which contain books and documents created over the last two centuries, beginning in the year 1801. These collections record the development of Czech culture and national identity - they have invaluable historical, art, social significance, and principal informative value. Unfortunately, the material composition of documents produced after 1845 - lignin containing paper, plastics - as well as changing technologies and materials, result in poor durability. A number of degradation factors, principally external factors, increases this low durability: ambient temperature, relative air humidity, pollution in the environment, light, biological pests, etc. The large number of such items in the collections exacerbates the poor quality of materials of modern book collections: in the National Library CZ, they represent up to 96 % of book collections, and their numbers continue to increase. In term of care, modern collections contain a variety of materials. The poster focuses on methods of nondestructive analyses of composition, chemical structure and physical state of modern library collection exemplars.

The physical condition of modern library collections were investigated using the SurveNIR measuring system, and a microfadeometer; the obtained data were collected in “The Central knowledge base RD”. The SurveNIR system compares measured near infrared (NIR) spectra with an extensive spectral library (database) of known samples of paper, for which various measurements were recorded: pH, degree of polymerization, content of lignin, proteins and rosins, tensile strength, tensile strength after folding, and presence of optical brighteners. This database is used for chemometric calibration of a purpose-built NIR spectrometer to characterize the degradation rate of paper. The microfadeometer is an instrument for determination of light stability and sensitivity. It is used to develop exhibition strategies. The poster describes the methods of examination and the use of databases and statistical data from examinations.

Nowadays, care for modern library collections in the Czech Republic consists principally of preventive conservation, or setting climatic conditions and methods of storage, or conservation interventions, such as bookbinding work, disinfection, and in some case deacidification, in order to decelerate degradation reactions of materials. Within the scope of the project NAKI DF13P01OVV004 „Survey, conservation, and care for modern library collections – materials and technologies“, procedures are being developed for preservation and restoration of bindings particularly of modern book collections. New more stable materials are being developed for bookbinding and repairs. The results of research and testing of interventions should make care for these rare books more efficient, extend their lifetime, and preserve them in good physical condition for readers – the main objectives of all activities in this project is functionality of bindings and their preservation.

Petra Vavrova, Magda Souckova, Jitka Neoralova, Lucie Palankova, Tereza Kastakova, Kristyna Boumova, Tereza Sazamova, CZ
On March 3 2009, almost the entire building of the Historical Archive of the City of Cologne collapsed into the subway tunnel underneath, causing a great loss of valuable documents and taking two lives. About 30 shelf kilometers of numerous important collections of records lay among sand and rubble, buried between 12 and 28 meters below street level. This emergency case brought together firefighters, archive staff members and volunteer citizens to work hard to salvage these documents.

The archive housed 1,000-year-old records, among those about 65,000 charters on paper and parchment, and 2,000 manuscripts. The salvage procedure was successfully completed in August of 2011; an estimated 15% of our objects were slightly damaged, while 50% sustained medium damage and 35% were heavily deteriorated. Damage varies from small scratches on paper or parchment to huge holes in entire books.

As an ongoing disaster recovery process, we are currently developing and improving conservation and preservation measures in a temporary off-site building established after the collapse. A team of more than 50 conservation technicians and 20 international conservators work on these projects, closely with archivists and process analysts.

Typical daily tasks include identification, registration, condition report, dry cleaning, quality control, categorization (depending on the possibility of direct or indirect use), digitization, and rehousing. These are the main steps in the recovery process. The procedures are still evolving, using feedback from co-workers to improve our system. In our case, the term “conservation” describes a course of action that, considering the need to treat very large amounts of material, does not aim to restore aesthetic appearance, but instead aims to stabilize documents so that they can go back into use, be it in their original or in digital format. We also use all the opportunities and possibilities that this specific situation offers us, taking advantage of the newest technology as well as the large pool of co-workers. In addition to conservation challenges, we are facing the constraints of the legal framework of a recourse.

A considerable project in which every conservator is currently involved is the development of conservation documentation software, in collaboration with software programmers. The aim is to write our documentation for each object we treat in a database. Faced with the large number of objects we treat and document every day, we decided to develop a way to collect the data and take advantage of this great amount of information. The software will allow us to assess the quantity and quality of damage. It will help us to define conservation procedures and the treatment needs of objects. Finally, it will allow us to calculate the time we spend on the disaster recovery process.

Coordination of many different projects in an “after-disaster” context is challenging, and requires some non-conservation specific skills, of which communication is of primary importance. Every choice must be the result of a balance between budget options, material/time availabilities, and effective management of personnel.

Marion Verborg: Stadt Köln, Historisches Archiv, Heumarkt 14, 50677 Köln, Germany; Marion.Verborg@stadt-koeln.de
A simple conservation treatment of three 16th century bindings (entitled ‘SEXTUS DECRETALIUM LIBER’, 1573; ‘DECRETUM GRATIANUM’, 1573; and ‘DECRETALES GREGORII POINT MAX’, 1573) printed in Antwerp, the Netherlands, uncovered some extraordinary boards. The removal of the pastedowns presented boards, which were completely made of single, and double leaves revealing incunabula and manuscripts of the 15th Century.

The advantages and disadvantages of separating the boards into single leaves for research or keeping them pasted in their original state were deliberated with experts of the manuscripts division of the State Library in Berlin as well as with book conservators.

In addition, if separated into single leaves the decision had to be made whether they should be returned into their original state as boards or housed as single leaves and kept with the bindings.

The decision was made to separate the six boards into single and double leaves. Therefore, a combination of three methods (‘Gore- Tex-sandwich’, warm pads and steam/mist) were used to perform the separation. Ninety-nine leaves were found. They were replaced with archival board in the three bindings.

Conservation treatment on the single leaves was carried out on fragile areas. Regions of insect deterioration were treated with Japanese paper and wheat starch paste to stabilize and reinforce edges. The leaves were documented, photographed (both recto and verso) and rehoused in acid free folders.

The decision-making process and the complex conservation treatment involving unusual equipment for the separation of the leaves will be discussed. The final storage solution separate from the books will be presented.
The State Hall – the so-called *Prunksaal*, literally “splendid hall” – of the Austrian National Library is a baroque architectural jewel and represents a significant historic ensemble. It ranks among the world’s most beautiful baroque libraries. The *Prunksaal* was built between 1723 and 1726 as a universal public library, central storage for books and reading room. It now houses about 200,000 printed books dating from 1501 to 1850 kept on wooden shelves along the walls of the State Hall on two floors. Today the hall no longer serves as a reading room. However, the *Prunksaal* remains a representative room and a storage area. It is open to the public as museum and it has gained the additional function of an exhibition hall for changing exhibitions.

The *Prunksaal* is 77 m long; it is divided into a front and a rear part by a central oval rondo roofed by a cupola of 29 m height. Originally, the natural light entering the high windows between the shelves and the windows in the cupola was the only light source for the hall and still evokes a distinct ambience, which is part of the architectural overall impression. The *Prunksaal* is not heated; its climate undergoes seasonal fluctuations. Direct sunlight, climatic fluctuations and air pollutants are risks that need to be observed and controlled. Over the last 15 years, efforts have been made by the Library’s conservation department to improve storage conditions for the books in the baroque hall while respecting its historic interior. Compromises had to be found with curators, librarians and technical departments as the *Prunksaal* is a multifunctional room used by many different people. With cleaning projects, the level of dust could be reduced. The condition of all the books has been assessed. In an ongoing, large-scale digitization project in cooperation with Google, Austrian Books Online, the majority of the books are being digitized. In the course of this project – while the books are in the digitization process – consequent cleaning of the bookshelves reduces the level of dust. In preparation for scanning, books with minor damage are conserved and books in more fragile condition are registered for future treatments. The conservation concept was based on the premise of quick and consolidating treatments. Dust covers and slip cases are made; loose parts of the books are fixed with hinges or strips of dyed Japanese paper. Programs monitoring insects and microorganisms on a regular basis have been put into practice. New shades have been installed for the windows along the hall.

The poster will show details of the experiences gained in the project of monitoring and putting into practice preventive conservation in the particular circumstances of a baroque library hall.
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Albert Einstein, Ideas and Opinions