

## Conserving Canvas Symposium

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The Conserving Canvas Symposium was held October 14 - 17, 2019, at Yale University in New Haven. It was sponsored by the Getty Foundation with support also provided by the Avangrid Foundation. Just under 400 conservators and conservation scientists attended from around the world.

Because this conference was very significant, the first to address the many topics of the conservation of canvas since the 1974 Conference on Comparative Lining Techniques in Greenwich, there was more information than just one reviewer could cover. Therefore, seven reviewers were commissioned to cover one session each. The subject matter of each session varied, and thus the way it is reviewed.

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### Session 1. History, Principles, and Theory

Chair: Ian McClure

The opening session of the Conserving Canvas Symposium, as the title suggests, reviewed the history, principles, and theory of structural painting conservation in a variety of conservation communities around the world.

Stephen Hackney opened with the keynote address titled "Understanding Structure, Changing Practice." He began by acknowledging what became a touchstone in the Yale conference, the 1974 Conference on Comparative Lining Techniques in Greenwich.

Until Greenwich, there was little published on these topics, and the conference made clear the need for further research. Many avenues of inquiry grew out of this call to action as well as a stepping back from intensive treatments as a community. Hackney identified other aspects that happened contemporaneously and led to a decrease in linings, in particular, needing to be carried out. Bolstering collections care practices like better crate design and handling, as well as improved environmental conditions in museums fed into this sea change. Hackney also identified areas of still needed research, such as the role of acidic materials and the possibilities of canvas deacidification.

Following the keynote was a paper on recent research at the Canadian Conservation Institute given by Eric Hagan. He delved into "Applied Mechanics and the Structural Treatment of Paintings on Canvas" which in part shared results of the CCI Lining Project. First giving us a review of the mechanics of artist's paints and then how their visco-elastic nature relates to time, Hagan then discussed how these criteria can be manipulated in conservation treatments. Both acrylic and oil paints were examined in these studies.

The next several talks focused on the history of structural paintings conservation in several different countries. First, Mikkel Scharf discussed "To Treat or Not to Treat: That

is the Question," which reviewed the history of structural conservation in Denmark. Scharff reviewed the education of conservators at the School of Conservation in Copenhagen with examples of the methodology of teaching of glue-paste linings, wax resin linings, and the introduction of the suction and vacuum hot tables. He outlined the change from empirical learning to the shift of a science-based education and identified the shift to minimal interventions. Scharff also highlighted the need for more research into current practices and using this moment to review developments of the last several decades.

Next was a comparative paper of the lining practices at the Courtauld Institute and Royal Museums Greenwich titled "Lining at the Courtauld Institute and Greenwich: Past and Present" by Maureen Cross, Sarah Maisey, Clare Richardson, and Camille Polownik. The two institutions have developed a research project that compares the use of a variety of lining adhesives, fabrics, and methods. Each had a shared ethos and had been early adopters of new methods and materials, but had different purposes, i.e. research versus exhibiting institutions. Each had been heavily influenced by the Greenwich conference as well.

A wide variety of materials and methods were outlined for each institution. Case studies were also presented which identified successful treatments and what made them a "success" was outlined. For example, whether the lining was still fully intact with little to no delamination was examined, but also aesthetic evaluations were considered, such as weave interference, staining of the ground layer, or flattened or moated impasto.

An interesting point was noted with a case study of a painting that was lined with high pressure, resulting in weave interference, but was considered a success in its day because it addressed the cupping paint layer. However, today it would likely not be seen as such and a different approach would be taken. Lastly, future areas of research, as it pertained to these two institutions, were also identified.

From England the focus traveled to Italy with Angela Cerasuolo's presentation on "The Lining of Paintings on Canvas in Naples." She discussed the historical investigations into lining paintings that were undertaken over the last 20 years at the Museo e Real Bosco di Capodimonte. Both the paintings themselves and documents relating to the treatments were evaluated. Two conferences in 1999 and 2007 discussed this research and detailed historical methods and materials from as early as the 18th century. This interestingly included a multi-generational family who lined paintings, considered a separate activity from restoration. Cerasuolo also detailed the practice of transferring paintings to new and historic canvases. The 20th-century techniques of Andrea De Mata were also discussed.

Closing out the first session was Anastasia Yurovetskaya presenting on the "Structural Conservation of Canvases in Russia from 1960s Until the Present: Evolution of Methods

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and Approaches." Yurovetskaya discussed the history of Russian conservation practices from the early decades in isolation from the rest of the conservation global community and how this affected change in the Russian conservation practices. After this dynamic period, Russian conservators began to reevaluate the newer, less invasive techniques along with the historical ones. Access to appropriate conservation materials as well as to assuring their quality also provided challenges for conservators. Yurovetskaya also discussed current practices in Russia which dovetailed with a poster presented at the conference.

Pam Skiles

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### Session 2. Present Practice

Chair: Cynthia Schwartz

During the first of the afternoon presentations, Paul Ackroyd of The National Gallery in London delivered a crystalline account of the conservation history and recent treatment of Anthony van Dyck's *Equestrian Portrait of Charles I of 1637-8*.

This is a monumental canvas painting (at 3.7m high and 3m wide), described by the presenter as representing "a potted history of lining at the Gallery."

Just over a decade after the painting of this commanding portrait, the king was executed and the painting was among those that were sold by the Commonwealth to defray costs of civil war conflict and royal household debt. In the first half century of its existence, the *Equestrian Portrait* was rolled and transported many times, traveling as far as Munich and eventually to Blenheim Palace in England in 1706, where it remained until the National Gallery acquired it in 1885. In World War II, it is said that the painting was evacuated in a crate known as "the elephant."

The remarkable historical record of conservation treatment at the Gallery provided important information, which would inform the planning process for the recent conservation intervention.

The conservators understood that the original twill canvas was already lined when it entered the collection and that two glue-paste linings were applied in rapid succession upon acquisition. Degradation of these nineteenth-century linings necessitated further structural treatment by Arthur Lucas in 1952. The account of this treatment was interesting, since it described not only the steps and materials of conservation but also Lucas thinking on his feet as he dealt with buckling that arose during the wax-resin relining process.

Ultimately, this relining failed to achieve sufficient melting and even distribution of the wax-resin adhesive, and the painting was left with distortions and compromised support for the canvas and paint layers. While the size, materials, and history of the portrait likely made these earlier

interventions essential for its preservation, they also left the painting with a legacy of general and acute deformations, abraded canvas, and passages of paint loss and disfiguration.

Next, Ackroyd turned to the current Getty initiative project, which assembled a team of conservators from diverse museums to consider a new treatment plan for the painting. The presentation shared the process of documenting the existing structural anomalies and their mapping on a Melinex template, which permitted the team to locate deformations on the verso during treatment. Turning the portrait face down, they removed it from the stretcher and freed it from the old lining canvas, mechanically removing the uneven wax-resin adhesive. Once old restoration materials had been removed, the team repaired splits and tears, consolidated abraded canvas, and filled losses on the reverse. With the removal of non-original materials, fewer distortions remained, and these were further reduced by moisture treatment of the back, section by section.

It was now necessary to turn the painting. Since the unlined canvas remained fragile, it was turned by attaching a temporary strip lining to the surface of the facing. To do this, a stretcher, fitted with a polycarbonate panel was placed on the back of the painting, and the strip lining was fastened to the stretcher. A second polycarbonate panel was slid beneath the face of the painting and attached to the stretcher, and the whole sandwich was then carefully inverted to present the face of the painting. The facing and temporary lining were then removed, and holes and losses to the paint were addressed before the next stage of work. In a separate work area, the team prepared the lining canvas, a single piece of linen with double warp and weft threads. This was pre-stretched and deacidified.

Because of the painting's history and structural requirements, Lascaux Heat-Seal Adhesive 375 was selected as the new lining adhesive. The back of the lining canvas was sized with a dilute mixture of the adhesive, and both sides were sanded. Six coats of less dilute Lascaux 375 were applied to the front side of the canvas, lessening textile weave and establishing an even bed of lining adhesive. Since the painting was larger than the low-pressure table heat source, an envelope system was planned. This was consistent with the early envelope designs described by the Courtauld Institute presenters at Greenwich in 1974, with modifications in the air- evacuation system, for which the presenter expressed thanks to Jos van Och.

Knowing the painting's conservation history, the team anticipated the risk of deformations arising upon partial heating of the canvas during relining, allowing them to minimize some risks and to react to problems as the treatment proceeded.

Once the painting and lining canvas were sealed in the envelope and once the required vacuum pressure was achieved, the temperature of the table was set at 70°C, treating local deformations with spatulas once

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45°C had been reached (the temperature was measured using thermocouples along the edges of the painting). Supplementary warmth sources and insulation, including domestic heated blankets, foil sheets, and fan heaters, were deployed to reduce the temperature differential between the areas being treated and the rest of the painting, with the overhanging portion being supported on adjustable props.

Once the adhesive temperature reached 68°C, the envelope was repositioned to heat the rest of the painting. As slight deformations arose during the process, the team responded by managing the proximity of the painting to the heat source using the adjustable props and by creating an air gap above the table with strips of polyethylene foam. Following lining, the painting was removed from the heat source to cool under pressure, and they determined that a successful bond and even lining had been accomplished.

This presentation gave a beautifully clear explication of a conservation treatment, the process by which the team studied and evaluated the physical character of the painting, and the way that they anticipated the needs and behavior of the painting during each stage of the project.

The second presentation of the afternoon, from the Stichting Restauratie Atelier Limburg (SRAL) was given by Joanna Strombek and Kate Seymour and co-conceived by Jos van Och, who could not be present, but who has refined this technique over the past several decades.

Their paper, "De-Mystifying Mist Lining" described their approach to this technique, which originated in methods presented by Vishwa Mehra at Greenwich in 1974. During the summer of 2019, the SRAL studios welcomed an international team of 16 conservators to study mist lining as part of the Getty Conserving Canvas initiative. This presentation, along with the workshop, a separate workshop in Russia in early 2019, and a handbook and video that will be released soon, forms part of an effort to share this technique more widely. While acknowledging in the presentation and questions, that this is just one of numerous structural conservation techniques that the SRAL students encounter- they expressed their hope that the faces of those conservators in the slides and video represent "the next generation of mist liners."

The presentation commenced with the rhetorical question "why do we still line?" followed by the recognition that is it sometimes just unavoidable where original materials are excessively compromised. At SRAL, when lining is considered necessary, the conservators strive to minimize potential adverse impact by identifying the specific needs of each painting, finding "individual solutions to individual problems." They aim to appropriately pre-treat the painting, then to deploy lining methods that gently support the painting while changing it as little as possible. Importantly, they also work to manage clients' expectations so they do not expect the painting to emerge from treatment "as flat as a board."

To reduce deformations prior to lining, the studio deploys various tensioning systems, from strip or edge linings to point attachment strips and clamps, typically together with moisture treatments. They sometimes use tape strips and paper tensioning systems over low friction films and emphasize that their approach is generally quite low tech and low cost.

For structural repairs prior to lining, the SRAL conservators use thread-by-thread tear repair techniques and local reinforcement with woven or non-woven textiles. Where the canvas is differentially or excessively degraded, they may consolidate fibers or apply weak protein or cellulose ether sizing, and they sometimes use deacidification solutions. Tensioning a painting on a frame during this work permits both sides to be monitored at any time.

While the elimination of heat is often considered to be a benefit of mist lining, the controlled use of warmth at relatively low temperatures, via heating elements or heat pads set below 40°C, may be useful in the preparatory treatment for the reduction of deformations and during consolidation.

As the painting is being studied and pre-treated, the optimal textile is selected for the lining. Their preference is for open woven, non-stiff canvases of natural and synthetic yarn. Occasionally, the needs of a particular painting require stiffer fabrics such as polyester sailcloth (they often use Claessens Belgian linen canvases and Trevira CS polyester fabrics). An interleaf of Hollytex may also be included between the lining and the original.

The lining canvas is typically stretched onto a working loom, attaching it in a specific sequence so that tension accumulates incrementally and evenly. The canvas is sanded to enhance the nap, and acrylic dispersion adhesive (pH adjusted Plextol K360 and D498, 70:30) is then sprayed onto the canvas with an HVLP spray gun. The number of coats of adhesive depends on the particular needs of the painting, and the edges of the lining canvas are masked to prevent adhesive build-up here.

The lining envelope is constructed with two thicknesses of HDPE plastic sheeting. The thicker sheet is usually stretched onto the working frame or onto a flat surface. Fabric may be included over this sheet to aid the evacuation of the air in conjunction with a perimeter of fabric-covered perforated pipes, connecting to the vacuum tubing and pump.

The lining canvas is placed in the envelope with the adhesive side face-up, followed by the painting and the upper, thinner, plastic sheet, before moderate vacuum pressure is applied. This procedure is typically rehearsed in a dry run prior to activation of the adhesive, to check that the envelope functions well.

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If necessary, the envelope may be constructed so that it is moveable, and the clear sheeting allows the conservator to see the painting during the treatment.

The choice of solvent depends on the desired swelling of the adhesive and the condition of the original painting, and typical solvents include ethanol, mineral spirits or xylene, or combinations thereof. The solvent is introduced into the package on a piece of cheesecloth the size of the painting, which is folded and rolled up. The solvent, usually approximately 60ml/m<sup>2</sup> is injected into the roll, which is then unrolled and placed below the lining canvas before the envelope is assembled and the air is extracted.

The package is typically left intact, under moderate vacuum pressure of approximately 150-200 millibars (which- I think- is 2.17 psi to 2.9 psi), for an hour and twenty minutes, the pressure and duration being adjusted depending on the sensitivity of the particular painting.

In cases where a varnish is to be preserved, a solvent can be selected to activate the lining adhesive without disrupting the varnish on the surface of the painting.

At the conclusion of the talk, Kate Seymour described how the process is applicable for a range of paintings and can be tailored to work for old masters or modern works with impasto. A study resource, in the form of deaccessioned canvases and older materials allows the team to test both lining and pre-treatment processes and to evaluate their performance, including the important de-lining process which is a major measure of the suitability of such treatments. These tests lead the team to believe that the procedure successfully achieves a nap bond which enables the lining to be readily and cleanly peeled away if necessary in the future.

Matteo Rossi Doria is recognized internationally for his practical approach and deep knowledge of conservation methods rooted in traditional practice. His terrific curiosity has nevertheless meant that he has developed a remarkably open viewpoint. In this presentation, he acknowledged the merits of traditional methods and discussed how he has sought to identify precisely what it is that lasts well in a good treatment. At the same time, and particularly in his engagement with the thinking of Vishwa Mehra, he is also an advocate for the thoughtful consideration of non-traditional techniques.

In "Linking Past and Future: 40 Years a Liner in Italy," Matteo accounted for the genesis of his approach, saying that the circumstances of the Italian work environment required him to develop an approach that would be "simple, sustainable, and flexible," and to eschew dogmatic, over-complicated, or secretive practice.

During decades of work, the presenter has treated and observed the condition of thousands of paintings. In some

cases, removal of linings was extremely difficult or the old restoration seemed to have fostered mold growth or infestation. In many instances, however, old linings were expertly applied and well preserved. They protected the paintings effectively, and both the lining canvas and adhesive remain readily removable.

Matteo demonstrated this, by showing a slide of a 1776 lining, by Giovanni Principe, which remains securely attached to the painting and, when viewed in raking light, reveals no deformations whatsoever. Principe's father in law, Domenico Michelini, established a dynasty of lining "engineers" that lasted for centuries and lined some of the most important paintings in Rome's churches and museums. These treatments included Caravaggios at the Villa Borghese whose linings, according to the presenter, remain in very good condition. The material choices and application methods of these linings and wooden backings, evidently contributed to the continued preservation and good re-treatability of many of these paintings.

Although, as Westby Percival-Prescott wrote in the foreword to the 2003 Greenwich publication, alternative methods and materials, such as the exploration of PVA adhesives, had been adopted at a relatively early date in Rome, the paintings that Matteo encountered throughout his career predominantly reflected Rome's established conservation tradition. It was in this context, that Matteo entered Rome's ICCROM library to consult the accounts of the Greenwich conference, a study that would lead to him eventually meeting Vishwa Mehra and Gustav Berger "the humanist and the engineer."

This appetite for research and data, particularly with regard to water-based adhesives, continues through his studio work and collaboration with ICOM CC materials working group to undertake scientific examination of components of glue-paste lining materials (as described in a poster at this meeting, outlining the tested performance of different types of canvas and adhesive).

In response to his observations, Matteo has assessed and adjusted the material components of his practice, allowing him to manage stiffness and relative flexibility of adhesive films and fabrics, to reduce reactivity potential in the lined painting, and give support tailored to the particular needs of each lined work. It also helps him to minimize potentially adverse effects of treatment on the fabric of the painting. Over the years, Matteo has come to prefer open-weave canvas of different densities.

He confessed that it was a more involved process (and took a lot of cooking) to come up with a preferred basic paste mixture. Traditional paste combinations incorporating a filler (flour), adhesive (usually animal glue), and a plasticizer are widespread across Europe and elsewhere, but there has been a relative paucity of scientific study of these adhesive mixtures in comparison with industrial products.

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The physical and working properties of glue paste mixtures is the subject of the working group's investigations. To this end pastes, with different flours and combinations of constituents, were prepared, aged, and tested to characterize the softness, stiffness, gel strength, adhesive strength, re-solubility, etc.

Through these studies, the team determined that the most suitable starch/protein content was achieved by combining one higher and one lower gluten content flour, yielding a somewhat stiffer and less RH fluctuation-responsive paste. This is combined with animal skin glue, in a much lower concentration than traditional recipes, along with acrylic dispersion, Plextol B500. This replacement of protein glue with the acrylic dispersion enhances flexibility in the film and reduces wetting of the painting. It is tackier from the outset, speeds up drying, and diminishes the risk of biodeterioration, while remaining readily reversible.

Matteo also sometimes pre-treats deformations prior to lining using a metal tensioning frame. This step can effect a reduction in the pressure and temperature levels needed for the overall lining process, and this flexible tool can also be used to control the tension of the canvas during lining.

He then went on to describe his lining processes which include using both hot and low pressure tables in the studio and hand irons, set at a relatively low temperature of 45-50°C when working on site. In addition to working with glue-paste and dispersion adhesives, the presenter also uses Beva 371, sprayed onto a lining canvas for water-sensitive paintings and oversized temperas, including 19 oversized cartoons from the Barberini collection that were treated this way.

At the end of his presentation, Matteo concluded by showing an example of a delicate, centuries-old, unlined canvas with a strip lining and lamented the difficulty of removing the strip lining. As an alternative, he suggested the idea of developing a "soft lining" with very low adhesion, while still providing support and protection for the painting.

In their presentation, "Customised Methodologies Developed For Large Format Paintings," Barbara Lavorini and Luigi Orata described the relining of a 30m<sup>2</sup> painting by Alessandro Allori. The painting had developed serious structural problems after enduring a hostile display environment and spending decades in storage on a folded stretcher. Its condition was further damaged during the Florence floods.

Theirs was an account of a specific treatment but they, too, began by stating that they deploy different methods for different situations, quoting Sergio Taiti and Umberto Baldini's words from the Greenwich conference; "it must and will be for the painting itself to impose a careful choice between the various methods and materials." Here, the presenters went further, to state that treatment decisions are the outcome of a thorough preliminary study of the painting

and evaluation of the various treatment options. They also stated that their guiding principle is "minimal intervention" and shared their specific articulation of that term whereby "minimum" pertains directly to the needs of a specific painting, but it must be enough to solve fundamental problems, slow down degradation, and delay the need for further treatment in the near future.

The painting had been lined with glue paste in the early 20thc. and had then been repaired with patchy impregnation of wax resin around seams after the flood. It also had many holes and tears, huge deformations, passages of cleaving paint, and mold damage. The challenge for the conservators would be to find a way to treat these problem conditions while preserving the broadest range of possible future conservation interventions. The surface character, a lean and matte oil color, was an important factor. The conservators carried out extensive consolidant tests to identify one that would secure the paint without adjusting the surface finish.

As they embarked on the search, the conservators studied the materials and condition of the painting closely, measuring the surface pH, measuring the polymerization degree of the cellulose in the canvas, and testing the strength of yarns of the canvas. These comprehensive tests informed their decision as to whether and how to reline the painting.

The team determined that their preferred consolidant was Aquazol 500 in acetone, followed by a second application using a more dilute solution of Aquazol in acetone and water. After the removal of mold and surface dirt, old retouching and fills, a Kozo tissue facing was applied with extra fine rabbit skin glue. The painting was de-lined, by separating the old lining with the aid of polystyrene rollers, and then removing adhesive residues mechanically and with agarose gels.

Once the painting was free of old restoration materials, they repaired tears, re-sewed seam splits, added a polyester/BEVA 371 film strip lining, and reduced deformations using repeated humidification and tensioning.

The lining adhesive, applied with a spray gun to the lining canvas, was a mixture of Plextol B500 and Plextol D360. The lining was carried out in a vacuum envelope of silicone mylar, with the painting face down over a fabric cushioning layer and with the lining canvas positioned above the original in the envelope. The thermoplastic adhesive was then activated using a moveable plastic pool enclosing water at the required temperature (70C). The 1m<sup>2</sup> pool was left in place for ten minutes before moving on to the next area. After lining, the painting was stretched onto a new expandable stretcher before going on display at the Medici Chapel in Florence.

The treatment of one the Boston Public Library's Puvis de Chavannes murals was the subject of the next presentation

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by Gianfranco Pocobene. The paintings were commissioned by the library and are the only mural cycle by Puvis outside France. When they arrived in Boston in 1896, the canvas paintings of the mural cycle were adhered directly to the wall with a lead white in linseed oil adhesive but, by 2014, it was determined that the paintings were endangered. Significant portions had since become detached owing to infiltration of water and soluble salts within the wall, and large pieces of loose plaster were also pushing against the back of the paintings.

In 2016, *Philosophy*, was removed from the wall and conserved. The treatment was the subject of this presentation. This was a challenging process, in part because of the display conditions, but also as a result of the delicacy and brittleness of Puvis' very lean and thin paint and ground layers. Treatment commenced with facing of the painting using Kozo paper and an emulsion of Golden MSA UVLS varnish with mineral spirits and water. This was followed by a structural facing support of strips of linen added with the same adhesive strengthened with BEVA gel. The painting was removed from the wall with a modified slate ripper and mallet- anchoring the linen facing to a wooden support structure as they moved up the painting.

Once free from the wall, the extent of water infiltration could be assessed, and it was determined that the paintings should be attached to a separate panel and not returned directly to the wall following conservation. An aluminum panel was selected as the preferred support option. For the lining, the back of the painting was prepared with dilute, warm BEVA 371. A Belgian linen interleaf was stretched onto a frame and prepared with a coat of dilute PVA, followed by a coat of warm BEVA 371. This canvas was then tacked to the back of the painting with a hand iron before adding a further coat of BEVA 371 to the back of the interleaf. The aluminum support panel was also given a coat of the same adhesive. Next, the painting was turned so that the canvas facing could be removed, while leaving the paper facing in place.

For the lining, the heat source was a temperature-controlled silicone rubber heated sheet. The painting was to be placed under vacuum pressure in an envelope and heated in sections, using insulation sheets to retain warmth in the treated area. Unfortunately, despite the extensive preparations, new deformations arose during the heating of the initial section, and the conservators were forced to stop the treatment. Upon investigation, it was determined that the aluminum skins of the support panel had expanded and delaminated from the structure upon heating.

The conservators' challenge now became the removal of the 4ft section of the painting that had been partially marouflaged to the failed panel. To effect a safe reversal, they determined that the painting would have to be rolled carefully away from the solid support. This was achieved by re-heating the painting and rolling it away from the

damaged panel on a large curved form (described as being like a section of a 12ft. diameter Sonotube). As the painting released from the support, the adhesive cooled, causing stringing, which significantly increased resistance, and the adhesive strings therefore had to be cut during the process.

Once the painting had been successfully removed from the faulty panel, the conservators had an opportunity to reflect on the challenges and to consider modifications to the treatment plan.

Working with the panel manufacturer, they determined that the weak part of the panel had been the attachment at the edges and joins of the panel. They identified an epoxy resin adhesive that would tolerate temperatures around 80°C and replaced the poplar and Medex seam and edge supports with aluminum internal supports. In addition to this, the major seam was supported by a 3 inch honeycomb Hexcel plate, all of which measures rendered the panel stiffer and more stable. The manufacturer also made mock-ups of the new configuration and tested them before the new panel was used on the painting.

The challenges that Gianfranco and his team had faced when trying to overcome the strong adhesive bond during the treatment reversal also prompted them to reconsider the use of BEVA 371 for the new treatment. They therefore produced their own version, using the dry BEVA 371 resin mix, dissolving it according to the manufacturer's guidelines and adding varying percentage portions of their own selections of microcrystalline wax. Through these tests, they were able to produce an adhesive that would adhere at a lower temperature (below 60°C between the panel and interleaf and below 54.4°C on the surface of the painting). These combinations were then studio tested on mock-ups, and a mixture with 10% added paraffin wax was selected as the optimal adhesive for this application.

Finally, following the comprehensive tests and production of the new panel, the painting was successfully re-lined, maintaining a surface temperature of 54.4C in the envelope during lining. It was then filled, inpainted, and returned to display at the library. Beyond the positive outcome of the treatment, the conservators should be commended for working through the challenges they encountered and for sharing the re-engineered panel and adhesive solutions with the professional community.

Julia Brandt of the Bayerisches Landesamt fuer Denkmalpflege described the conservation treatment of a damaged nineteenth-century painting by Engelbert Zimmermann from the small community of Wasserburg am Inn. The painting, approximately 2m in height, had been stored for decades in the unconditioned environment of the attic of the city museum. In 2012, the covers protecting the painting were removed as part of an inventory, and it was discovered that the painting had developed a large tear that had rolled over and set into a fixed deformation.

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A conservator had evaluated the painting and turned it on its side so gravity would assist the preservation process, and Julia Brandt was engaged through the Technische Universitaet Muenchen to assist with the treatment.

Upon examination, the canvas was determined to have an uneven plain weave, with threads being considerably thicker in one direction than the other. Unusually, the artist had also sized the canvas with a generous application of mastic prior to painting.

The inherent unevenness of the structure and the weakness of the canvas imposed limits on how fast and how far the treatment could proceed and meant that the deformations could only be pulled out of the canvas in one direction (presumably in-line with the thicker threads) with the help of gentle warming and tensioning. These limitations prompted open dialogue with the client so that the expectations of the conservation treatment remained realistic.

In this case, the degradation of the canvas rendered conventional tear mending impractical because of the advanced brittleness of the resin-soaked threads. The decision was made to line the painting, but it needed to remain visually consistent with the other paintings in the group. Also, the adhesives for the tear support and lining should be able to tolerate warm temperatures in the storage attic. They wanted to avoid disturbing the resin in the painting, so needed to avoid alcohol in the lining and other adhesives, and they wanted to be able to remove the lining in future without compromising the tear repairs.

To these complex ends, they repaired the tear with Stabiltex polyester and Plexigum PQ 611. For the lining, a linen canvas was selected and an adhesive adapted from the SRAL mixture was prepared (Plextol D540 and Dispersion K360, in a ratio of 7 parts to 3 parts, flocked onto the lining canvas).

Since the painting had never been removed from the stretcher, but a good portion of the edge had become detached, it was possible to feed the lining beneath the original and attach it to the stretcher without removing the remaining tacks. The lining and canvas were bonded with warm spatulas and irons, and, beyond the structurally important top of the painting, which was firmly anchored to the stretcher, the intent elsewhere was to achieve a moderate level of support while tolerating slight undulations across the surface.

Following the conservation treatment, the owners were sufficiently pleased with the outcome that the painting went on display instead of back into storage. The conservator noted the incomplete adhesion between the lining and the Stabiltex tear repairs but overall, the treatment was considered a successful and moderate intervention to support and slow degradation of this painting.

In the final presentation of the afternoon session, Elke Oberthaler spoke about structural issues in relation to paintings in the Kunsthistorisches Museum collections in Vienna. The gallery and the collection, distributed across numerous satellite venues in addition to the main museum, was founded in the seventeenth century, when Archduke Leopold Wilhelm transferred his collection to Vienna. The newest museum site is the central storage facility, into which approximately 2000 paintings and 800 frames were moved in 2011.

The move and preparatory work which preceded it allowed the museum's conservators to observe the condition and storage situation of many paintings and to review old temporary treatments that had long since ceased to be temporary, including provisional wrapping and facings. The presenter warned young conservators about the risk of returning faced paintings back into storage (she had faced one of the paintings early in her career).

Another issue of concern during the move was how to reduce risks from pests as works were transferred to the new building. Bread beetles were found to have infested some paintings, apparently feeding on adhesive in the widespread starch paste linings. Paintings going into the new storage were therefore fumigated to prevent infestation in the new facility. Storage is monitored with traps and attractant lights and they have an anoxic chamber. The last line of defense is an army of minute parasitoid fairy wasps, which destroy the eggs of the target pest.

The collection move and recent conservation projects also provided an excellent opportunity to study the linings on the paintings, many of which remain in good condition. An example of such a lining on a prominent painting is the canvas that had been attached to the back of Titian's *Ecce Homo*, which was signed and dated 1774 by a Mr. Hickel. Such linings were typically executed using a coarse and open-weave canvas, and they have generally performed well to this day, typically only requiring intervention near the edges.

One of the examination and treatment examples presented in the talk was a painting by Salvator Rosa with one of the starchy linings that are so attractive to insects. The edges of the painting were very frayed and when the painting was removed from the stretcher for conservation, widespread evidence of infestation was discovered. This painting had a densely woven lining canvas and a thick and glue-rich lining paste layer.

The conservators considered the removal but determined that the original canvas had been sanded and was not in sufficiently good condition for the removal of the existing lining. Around the edges, the lining was peeled back and the adhesive was removed with agarose gel. The edges were then strip lined, using Lascaux 498HV to adhere the new edges to the painting and then folding and adhering the lining edge back over the new strip lining.

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For a decorative painting by Johann Franz Greippel from the president's office at the Hofburg, a similar lining was observed to that on the Rosa. In this instance there was no pest infestation, but the painting were poorly tensioned and required on-site attention to tears and other condition problems. Again, the lining was retained and the tears was repaired by lifting a patch of the lining, mending the tear with sturgeon glue and BEVA 371 film bridges before sewing the lining back together and injecting starch to readhere the lining.

In Vienna, linings today are done with a veneer press instead of irons, allowing the process to take place without heating the painting. In this practice, a faced and newly lined painting is placed into the press and placed under pressure. The felt and fabric cushions around the painting are changed regularly to promote drying at the desired rate.

The next case concerned the recent treatment of an unlined seventeenth-century still life by Gottfried Libalt, from the Kunstkammer collection. Requested for display because it depicts a bust of Archduke Leopold Wilhelm, the unlined painting had been reformatted at some time by folding the left and the right sides over and by the addition of several strips of canvas- all of which make its unlined condition all the more remarkable. The painting also had many deformations and an overall length of tears that added up to 5m.

To gain a clearer understanding of the original format of the painting, the conservators examined the structure of the painting carefully and also checked it against the Archduke's 1659 inventory of the collection, which gives accurate descriptions and dimensions of the paintings. Although the canvas was torn in a number of places, the conservators considered it strong enough for them to treat by mending the tears and adding inserts. Distortions were reduced with weights in a humidity chamber, and the repairs were made using starch paste and sturgeon glue. To recover the original format, in addition to revealing the original sides, the non-original addition at the top of the painting was folded over a modified, rounded upper stretcher bar. The treatment successfully honored the integrity of the original materials while gently providing the necessary level of support for responsible display.

The afternoon session was distinguished by an extraordinary diversity of cases and treatment techniques in a rich spectrum of traditions and approaches. Perhaps one of the great benefits of the meeting was the candid sharing of considerable quantities of specific information about the processes and what was successful and what was not in given situations.

The afternoon ended, appropriately, with Matteo Rossi Doria calling for the type of flexible approach that will allow a conservator to be nimble and to deploy treatment measures from more than one tradition "...but you have to get rid of these strict rules. Also, try to forget strong words- "never," "ever," "always," etc."

Nick Dorman

### Session 3. Open Questions and Research

Chair: Mikkel Scharff

The second day of the conference began with "Open Questions and Research." The methods for tackling those open questions varied considerably from presentation to presentation, but what became clear over the course of the morning was that the speakers were going far beyond a "more research is needed" conclusion that ends many a conservation talk.

The speakers all focused on tackling the overwhelming number of variables needed to understand complex composite objects such as painted canvases attached to adhesive coated, woven fabrics. In this session (as in the ones that preceded and followed), as a treating conservator I appreciated the emphasis on treatment and the respect given to the empirical knowledge that comes from preforming treatments.

The wide-angle views in this session were provided by Christina Young of the training program at the University of Glasgow and Matthew Cushman of the Winterthur Museum and University of Delaware. Young began the session with the appropriately titled "Complexity of Canvas." After outlining many factors that can contribute to the behavior of painted woven fabric (fiber type, yarn characteristics, weaving and finishing processes, tensioning, the addition of subsequent layers, and environmental conditions) she proposed ways to determine which factors were the most practically important for solving treatment problems.

To determine how a canvas will behave during a treatment or to understand what has happened as a result of a past treatment, conservators can perform experiments on mockups. To understand canvas behavior, we can also look at the modeling from industry, in this case the research coming out of polymer mechanics and the smart fabrics fields. (A brief google search on the uses of "smart textiles" astonished me the way 3-D printing did a decade ago!)

Finally, conservators can examine empirical evidence from treatments with epidemiological studies across a collections. (Terrific examples of which were presentations by Elke Oberthaler on the history of lining at the Kunsthistorisches Museum in Vienna and Nicola Costaras' history of canvas conservation at the Victoria and Albert in London). Young ended her talk with suggestions for future research directions, including the manufacture of specific fabrics for artists and conservators and the creation of simple studio techniques to assess treatments.

The example from Young's presentation that I particularly enjoyed as a resident of Northeast Ohio was that of the Caravaggio *Crucifixion of Saint Andrew* at the Cleveland Museum of Art whose original size had been explored with a mockup. If we do not understand canvas complexity, we can misinterpret the evidence. Young explained that a

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## Conserving Canvas Symposium, continued

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master weaver had produced a huckaback canvas sample similar to the Caravaggio support. It was then determined that when stretched, this unusual weave type was more stable than plain weave canvas and therefore less prone to cusping.

In “Historical Terminology and Current Classifications of Structural Treatment of Paintings on Fabric Support,” Matthew Cushman pointed out that since the Greenwich lining conference (which produced a handbook of terms), terminology to describe the structural treatment of paintings had become inconsistent. He argued that this had implications for describing what painting conservators do and for evaluating success, and he made two ambitious proposals.

The first was the formation of a working group to update and formalize current and historical treatment terminology of materials, processes, and intent. Cushman argued that the focus should be broad and not prioritize traditions from the English speaking world. The second proposal was to find a method to disseminate information about actual conservation practice, and he suggested the periodic publication of treatment work in institutions and private practices summarizing methods and highlighting successes and failures.

The next three presentations were more specific than the first two, focusing on a new technique to determine canvas strength, the institutional history of wax resin linings at the Smithsonian Museum of American Art, and the history of Spanish glue-paste linings.

“A Novel Technique for the Determination of the Strength of Canvas and its Correlation with the Degree of Cellulose Polymerization” by Theresa Bräunig, Anna von Reden, Dirk A. Lichtblau, and Christoph Herm came out of recent research from the conservation training program at the Academy of Fine Arts in Dresden. The technique could be an example of what Christina Young had in mind when she proposed simple studio methods to aid treatment considerations. The paper also underscored the level of scientific research coming out of the European conservation training programs, something we saw repeatedly during the symposium.

According to Bräunig, the only analytical method for estimating the state of preservation of canvas was capillary viscosimetry, used to determine the degree of canvas polymerization. However, no test existed to relate a degree of polymerization value to a canvas’ mechanical properties until now. Bräunig and team adapted a testing method from the paper industry to test the tensile strength of a single yarn. They were able to get reproducible results from a range of artificially aged and historic canvases.

They then used capillary viscosimetry on the same yarns and were able to show a direct correlation between the

degree of polymerization and the yarn strength. The new technique is considerably faster and easier to perform than capillary viscosimetry and requires very small sample size. The result of this painstaking research, of course, is that the new test can be performed quickly with a sample from an actual painting to help guide treatment choices.

Amber Kerr, chief conservator at the Smithsonian Museum of American Art, presented ongoing research into wax resin linings at American Art. The co-authors of the talk were Gwen Manthey and Keara Teeter. The research began when it was noticed that a number of the wax resin linings were beginning to fail. Especially alarming was delamination of lined paintings that had traveled extensively or had been on view for extended periods. These paintings had been allowed to travel and remain on exhibit because their linings made them appear stable, impervious to environmental changes and buffered from mechanical stresses.

Kerr and her team set about studying the types of wax resin linings performed since the establishment of the conservation department in 1965 by examining treatment records, conservation notebooks, and oral histories. With this information they created a database of historic wax resin recipes and application methods, allowing mockups to be made for study and testing. The hope is that the mockups can be used to anticipate which types of linings, under which conditions, will be prone to which type of stresses and therefore can provide collection care guidelines for the wax lined paintings.

Julia Betancor and Ana Calvo presented “‘Gacha’ Lining Treatment Viability: the Spanish and European Glue-Paste Adhesive Used since the 17<sup>th</sup> Century.” Their co-researchers were Ana Macarrón and Rita Gil Macarrón, and all four are connected to the Universidad Complutense in Madrid. In Spain, as in Italy, there were many variations on a lining recipe whose ingredients were wheat or rye flour, animal skin glue, water, and possibly some additives to improve working properties. Until the middle of the 20<sup>th</sup> century, most linings in Spain were gacha, and the technique is still used on occasion today.

According to the speakers, these linings have held up well. Their research involved finding or extrapolating historical recipes from archival records, manuscripts, invoices, and the lined paintings themselves. As in the previous presentation, the information was used to create a database and make mockups of different recipes on both open and closed-weave linen canvases.

Unlike at the Smithsonian, however, the aims of the project were broader. One was to record Spanish lining techniques across three centuries. A second was to determine if differences in the strength of adhesion or susceptibility to bio-deterioration could be accounted for by particular recipes. A final goal was to promote gacha linings as a viable practice, especially on the grounds of the materials’ sustainability, affordability, and lack of toxicity. It was also

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## Conserving Canvas Symposium, continued

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argued that these traditional materials were more compatible with traditional European painting materials.

One of the great strengths of the conference was allowing plenty of time for discussion after each session. With so many experienced paintings conservators from around the world attending, the discussions were informed, informative, and thought provoking. They were also respectful. Depending on an audience member's experience, different threads may have stood out. I did not know, for example, that wax resin adhesives were made up in bulk and then could be reheated multiple times until a batch was used up, with implications for the adhesive's strength.

There was a lively discussion on the merits of and issues with both glue paste and synthetic adhesive linings. A question was asked about open-weave canvases used in glue paste linings, and Mikkel Scharff referred the audience to a poster by NYU conservation student Emma Kimmel on the traditional use of open-weave canvases in Rome. Kimmel found these fabrics to be more flexible and less responsive to environmental changes because they held less glue.

Gianfranco Pocobene wondered if the water in glue paste could disrupt paintings with chalk grounds, making them appear overcleaned. Amber Kerr worried about the proprietary nature of BEVA and the difficulty of reversing BEVA linings.

Christina Young pointed out that it was simplistic to split adhesives into "natural" and "synthetic" categories, favoring one over the other simply on this basis rather than evaluating them on their properties. Having had on occasion discussions about the inherent goodness of "natural" materials with conservation students trained abroad, I was happy to hear Young's clear commentary.

As the world continues to change in response to the global climate and environmental crises, I think that Matthew Cushman's comments at the end of his presentation on the need to consider the environmental impact of material and treatment choices will also become increasingly relevant.

Wendy Partridge

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### Session 4 Research Continued and Case Studies

Chair: Christina Young

Tuesday afternoon proved to be a particularly interesting session. Jim Coddington presented a survey tracking the history of suction tables early in the afternoon. The talk was interesting and provided not only historic information on the evolution of the suction table and resulting "minimal interventive" treatments that grew in popularity with them, but also provided fantastic historic images.

Following on Jim's paper, Cecil Krarup Anderson's paper focused specifically on Vishwa Mehra's development of

his lining approach. This paper was detailed, specifically dissecting Mehra's reasons for why certain choices were made in the development of his lining techniques. This paper was placed well in the conference as it presented a historical account of choice making and shifting opinions falling under the historic umbrella of minimal intervention. As with Jim's paper, this presentation provided detailed information and good historic images.

In an interesting contrast to the two papers preceding, Lynne Harrison presented on a recent glue-paste relining treatment done at the National Gallery, London on a portrait by Artemisia Gentileschi. This lining was done by hand, with an iron, as opposed to a hot or cold table, using a historic glue-paste lining technique.

The choice to do this technique by hand was briefly discussed, posing an interesting question regarding how treatment choices are made; whether based on the technician's skill and knowledge, available equipment, or best practice at the time of treatment. Several of the tables mentioned by Jim in his paper remain at the National Gallery, London which was mentioned in the Q&A session.

An especially interesting talk followed the coffee break. This talk was given by Kathryn S. Tarleton and Charlotte Hamlin and described the treatment of the history and fabric of the New Bedford Whaling Museum's 1300 foot long *Grand Panorama of a Whaling Voyage*. This talk was presented by a textile conservator which brought in a unique perspective on the issue of structural treatment of canvas paintings. This project was collaborative between textile and paintings conservators. It drove in the basic point that canvas is a textile and working with our textile conservation colleagues can be greatly beneficial in developing treatments, especially for complex objects such as this one.

Cynthia Schwarz followed this by presenting on the treatment of another large painting, a 12-foot round ceiling painting by Edwin Austin Abbey. Cynthia and the team at the Yale University Art Galleries developed creative and innovative solutions for dealing with such a large work of art. The treatment was clever and the results were beautiful.

The last two papers presented treatments of historically important but uniquely challenging collections. The first paper presented by Emilie Desbarax described the difficulties she encountered when presented with a collection of modern African paintings from the Royal Museum for Central Africa in Belgium. This paper posed larger questions of intervention on paintings produced with materials that have their own inherent vices and historic condition issues, such as damage due to travel or other unique reasons.

Claudia Garza's paper following Emilie's presentation, was a personal favorite. Her focus was on the treatment of a

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collection of 18<sup>th</sup>-century canvas paintings of New Spain. This paper tracked the history of the actual canvas used as support for the group of paintings the team treated. Canvas stamps and other marks were traced and revealed the fabric to have been used as storage sacks on ships, prior to being repurposed as canvas supports for painting.

Tuesday afternoon proved to be a fabulous session at the conference. The first part of the afternoon session focused on tracing the history of modern treatment tools and their influence on treatments used today. Many of the talks focused on choice making and innovations building on historic techniques and creative solutions for challenging projects. The second part of the session really brought everything back to the canvas itself, its historic context, and life as a textile.

Laura Hartman

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### Session 5. The Adhesives Question

Chair: Stefan Michalski

The morning of the third day of the conference turned our attention to "The Adhesives Question," chaired by Stefan Michalski. There were four presenters on topics that gave us insight into nanocellulose which is being tested as a possible consolidant for canvas, the aging of current synthetic lining adhesives, and new ways of getting familiar adhesives efficiently and effectively to where we want them whether it is to join thread to thread or to join larger surface areas. This grouping of presentations covered a lot of data, mechanical terminology, interpretation, and discussions of ongoing and future avenues of research. It is fair to say that given the complexity of the variables and the need for the practitioner, like myself, to put the time into comprehending these topics, I will not be able to fully convey the material to you in any depth. Many of these presenters already appear in published literature with further publication planned, therefore I encourage you to search their work out individually to learn more.

Adeline Lenotte's 2014 study, "The Reversibility of Synthetic Linings: Peeling Tests" was carried out at the Coatings Research Institute in Belgium. Her study builds upon earlier tests conducted by Cecile du Boulard in 1999. Boulard conducted peel tests on synthetic adhesives Plextol B500 and Lascaux 360 HV. Lenotte's study both returned to Boulard's 15-year-old samples as well as expanded the adhesive study with a look at Lascaux 498 HV and BEVA 371 film. As peel tests are only useful in comparison to one another Lenotte modeled her sample preparation and testing on du Boulard's earlier work.

Lenotte prepared and tested samples as follows. Three were based on Plextol B500, with one mixed in xylene and sealed while wet, one thickened with methylcellulose and reactivated with xylene, and another thickened with methylcellulose and reactivated with heptane and acetone. The Lascaux 498 HV samples were reactivated with xylene

or a mix of heptane and acetone. The BEVA 371 film samples were heat set on a low suction table at 65°C and 70°C, and the Lascaux 360 HV samples were heat sealed at 45°C. Samples were tested with a tensiometer at 15 days and three months. The angle of the peel test was 180°, the speed was 2mm per minute, and the distance was 8mm.

Lenotte's results were presented in charts that indicated what type of rupture occurred and if there had been adhesive residues left behind or fibers broken. The resulting bonds were graded for 15 days, 3 months, 3 years, and where the older samples were available 15 years. The bonds were graded from too low, low, minimum, moderate, intermediate, suitable, high, and too high. Publication of this data would allow a more proper analysis of the results, but the general trend appeared to be that most of these synthetic adhesives were increasing in bond strength as they aged such that many of them were considered too strong upon aging.

This in turn made the audience of practitioners somewhat anxious to point out that the reversal of a lining is typically not done with force alone but aided with heat or solvent, a fact that Lenotte was well aware of. This age-old conflict between models of study and practice is a good reminder that these studies provide us with information that we continually need to contextualize and juggle alongside other factors as we try to do a risk analysis. Other general conclusions of Lenotte included a recommendation that mist-linings be considered to reduce the amount of adhesive applied, the use of Plextol B500 and Lascaux 498 should be reconsidered for producing bonds that were too high, and that BEVA 371 film was the adhesive considered the most acceptable in the study.

Mona Konietzny presented her work with collaborators Karolina Soppa and Ursula Haller in a paper called "Reliable Adhesives in New Shape: Canvas Bonding with Self-Supporting Adhesive Meshes." The author's work was based in Bern Switzerland at the University of Applied Sciences with the aid of adhesive company APM Technica AG and the Dresden University of Fine Arts. The adhesives employed in the study included methylcellulose, sturgeon glue, and butyl methacrylate all cast out into thin adhesive meshes whose cell openings were honeycomb in shape, and whose cast film was about 0.25mm thick and weighed about 30g/m<sup>2</sup> dry. These dry films could then be easily cut into shape and inserted between layers in the painting structure, for example between a historic lining and the original support, to then be reactivated so that a discontinuous adhesive bridge could be made.

Konietzny reviewed the protocol under development for producing adhesive meshes using a silicone mold onto which the adhesive is applied with a spatula, excess is scraped off, and the glue is allowed to dry so that the dried mesh can be lifted off the mold with tweezers. She then went on to present some case studies that illustrated the activation methods for situations in which the adhesive

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mesh was readily accessible and for those in which the adhesive mesh was inserted between layers to be bonded and as a direct result was not easily accessible.

The example of an accessible activation was demonstrated with a strip lining using a non-woven synthetic support as the strip lining. The adhesive mesh was set down onto the strip lining support and misted with water from a sprayer and allowed to absorb the moisture. The strips were then set in place along the tacking edge and weighted to dry. Alternatives for application of the solvent or water could be a brush or an even finer mist with a nebulizer for example. Once the adhesive mesh was inserted into the structure of the painting and as a result not accessible, then non-woven capillary supports were used placed under the adhesive mesh and the solvent wicked in from the side. After the adhesive was activated, the capillary fabric had to be pulled out and the area weighted while drying. Here a separation in an old lining, at a turnover edge, was shown as an example.

The benefits of such adhesive meshes were reviewed. These included amongst other things a uniform distribution of adhesive without the solvent or water accompanying low concentration glue solutions, less penetration of the adhesive into the structure, increased permeability given the discontinuous nature of the honeycomb mesh, and due to its rigidity in its dry state a greater ease in application into narrow gaps allowing the conservator an easier application process. Future avenues of research will focus on creating a reliable method for producing the meshes, producing larger meshes, developing additional activation methods, and studying both the bond strength and long-term behaviors of these meshes.

Hanna Flock presented her PhD work on adhesives for thread by thread tear repair methods alongside technical lecturer Petra Demuth, both from the Department of Restoration and Conservation of Paintings, Sculpture, and Modern Art at the Cologne Institute of Conservation Sciences. Flock and Demuth's paper was titled "Thread by Thread Tear Mending Method: New Insights into the Choice of Adhesives and Their Application." Many of us, over the years have taken workshops on thread by thread tear repair, an approach pioneered by Winifried Heiber, but it is good to be reminded that research and refinement continues.

Flock began her presentation with a review of what made a good adhesive for this type of repair including amongst other characteristics the ability to arrive at a minimal amount during application, good optical properties, mechanical balance with the fabric's properties, a high Tg around 40-60°C, moderate to high viscosity, ability to reopen the join, neutral pH, and compatibility with other materials. She reviewed past studies published in 2010 and 2011 of adhesives that included a wide variety of synthetics like EVA and PVAc dispersions and epoxies alongside sturgeon glue.

Flock then turned to current work in which the focus is on those adhesives that in the ensuing years had proved to be the most successful. Four adhesives mixtures were presented including: Lineco, a pH neutral EVA dispersion, mixed with 5% cellulose ether gel Methocel A4C; Mowilith DHS S1, a PVAc dispersion, with the addition of 5% Methocel A4C; sturgeon glue at 20% mixed 1:1 with a solution of 13% precooked wheat starch paste; and finally sturgeon glue at 25% mixed with cellulose fibers Arbocel BBW 40 in a 20:1 ratio.

These adhesive mixtures were tested in four configurations including butt join, butt join with bridging threads, overlapping joins, and overlapping joins with intermingled threads. Samples of joined canvas strips were then tested by applying a uniaxial force and the maximum tensile force for each glue mixture in all four join configurations, with the exception of the sturgeon glue with the Arbocel which was only tested in butt joins, was represented in a bar graph.

Of interest to the researchers was a difficulty in reproducing the bond strength results that contributed to a scattering of the data. It was concluded that this was inherent in the technique given the various formation of the joins, the penetration of the glue, and the individual structure. They cautioned that both the worst case and the best-case outcomes for maximum tensile force should be considered in the decision-making process.

Amongst the preliminary findings of the research, which will be published, BEVA 371 and Evacon-R were found most suitable for bridging threads. For overlapping joins with intermingled threads the Mowilith and Lineco glue solutions were stronger than the sturgeon glue and wheat starch paste, although it should be understood that greater strength may not be the goal. And finally, for creating a strong butt join sturgeon glue with cellulose fiber was the best but that the length of the fiber provided was vitally important. Too long (300µ) or too short (40µ) did not produce the best results but rather the intermediate lengths.

The presentation finished with the introduction of a new tool that developed alongside the research to aid in the application of many of these adhesives that gel quickly when not warmed, making the process of the thread by thread tear repair a finicky task. The "Winnie" as it has been christened in honor of Heiber, is a small unit that holds and gently warms an insulin-sized syringe of warmed glue, keeping it fluid to the point of contact with the threads being joined.

It is sold by Star Tec Products in Germany. It can be purchased as a kit with a small hot needle, several alternative tips, and a unit that controls the heat. Theoretically the manufacturer suggests that both the Winnie and the needle can be heated from the same unit with a splitter, but this appeared to give less control in practice and the needle seemed to get too hot. The Winnie does keep the glue workable if one takes the time to do some practicing. I am told that an illustrated guide to using the Winnie is in the plans.

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## Conserving Canvas Symposium, continued

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The final talk addressed in this review was actually the first talk of the morning but it seemed best to end this summary by taking a look at new horizons in the field of adhesives for canvas paintings. “Nanocellulose in Painting Conservation: The Introduction of New Materials for Canvas Consolidation and a Novel Multiscale Approach for their Assessment” was presented by Alexandra Bridarolli with her team of collaborators including Marianne Odlyha, Oleksandr Nechyporchuk, Krister Holmber, Marta Oriola, Cristina Ruiz-Recasens, Manfred Anders, Aurélie Chevalier, Romain Bordes, and Laurent Bozec.

Bridarolli began by reviewing how the Greenwich lining conference in 1974 set the stage for looking for alternatives to lining and presented nanocellulose as a material that when used as a consolidant showed “promising mechanical, optical, and barrier properties.” To understand their potential Bridarolli laid out four steps in a process of assessment. The first was to understand the impact of humidity on the materials of canvas paintings, highlighting their viscoelastic nature. The second was to describe the properties of commonly used consolidants. The third was to introduce the newly developed nanocellulosic materials while the fourth was to test the materials on both artificially aged cotton canvas and then on some actual paintings.

The nanocelluloses introduced ranged in their method of production and their morphology. They were studied both individually, as part of a composite solutions, and employed in a “multi-layered particle structure.” These new materials were judged on their appearance, their ability to consolidate or reinforce, their response to humidity, and their stability upon aging. The canvases were studied both before and after consolidation treatments with a variety of surface imaging and tensile testing as well as dynamic mechanical analysis with cycling relative humidity.

To get a better idea of the results of the assessment thus far I suggest that you refer to the readily available publications online for a more complete and a more rigorous discussion. Some general advantages of these materials noted included the overall low weight of the consolidants added to the original structure and the provision of reinforcement to the canvas that was maintained after accelerated aging. While the concerns ranged from the amount of water that some of the nanocelluloses required for application and an observation that some of them increased the reactivity of the canvas to humidity.

As these materials present the ability to be finely tuned by functionalization and have a built in affinity to the canvases being treated, the researchers hold up the possibility that these materials could help us overcome the shortcomings of our traditional lining adhesives. They could perhaps even lead to structural treatments that would help reinforce weakened canvases without the addition of a secondary support.

Finally, in summing up this session I would be remiss if I did not mention the energy in the room as this group of presenters gathered on the stage for the discussion. Given the larger societal discussions of gender parity and representation in fields well beyond conservation, it was empowering to see the female panel.

The Greenwich Lining Conference of 1974 so frequently invoked in the Conserving Canvas conference included 23 papers with 2 women and 22 men listed as authors. Conserving Canvas had roughly 43 presentations with approximately 88 authors listed, 60 of whom were women. While it took 30 years to see the Greenwich Lining Conference in print, I hope for the sake of this research that we will see the results of all this hard work sooner than that so it can inform our collective decision making.

Heather Galloway

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### Session 6. Interventions and Collections

Chair: Elke Oberthaler

Jill and Rob Proctor started the session with the evolution of minimal interventions they have adopted and adapted over the years to correct canvas issues. Particular attention was given to tear mends and building upon the thread by thread repair technique pioneered by Winifried Heiber. Details included: the use of a suction platen for mending, consolidation, and correcting distortions; gentle heat provided by a reptile mat; temporary removal of a stretcher bar to access and repair damage; and attaching twill tape to a watch glass in order to maneuver and provide pressure on the reverse of a canvas. Nuanced decisions were explained regarding the reinforcement and modification of original supports, rigid inserts, and padded backing boards. Custom solutions were devised for specific needs.

Emily Mulvihill et al also focused primarily on adaptation and additional reinforcements to tear repairs based upon the Heiber technique, designed to withstand the fluctuating environments of private collections. The challenges presented by large contemporary works painted on cotton duck were a particular focus. These modifications included weaving in Gore-Tex sutures across the break, padded backing boards, Japanese tissue reinforcement, and applying acupuncture needles to the reverse of a tear mend.

Renate Poggendorf outlined the history of structural interventions and the lack thereof in two 19th-c collections in Munich. Most of these works are unlined and have held up quite well over the years. The conclusion presented was these works have aged very slowly and that less treatment has proven to be a better approach and has left much original information and intention well preserved.

Claire Gerin –Pierre et al presented the complex history of a large group of 17th-c paintings at Versailles. Extreme fluctuation of environmental conditions had resulted in

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a long history of linings and transfers. The presentation explored the analysis of historical transfer techniques and also modern approaches to complete transfers, using synthetic materials such as nonwoven polyesters and Plextol acrylic dispersion adhesive.

Chiara Merucci delivered a presentation which examined the history of colla pasta lining at the National Gallery Rome. Her conclusions and recommendations included the following; older unlined paintings should be preserved in that state. Older linings (18th-c) should also be preserved for the information they contain. The Barberini Collection includes some failed linings which can also be important to study to better understand why some old linings fail. Examining the early history of the National Gallery collection shows a history of minimal interventions in the late 19th-c, including patches, tear repairs, and edge lining.

Dominique Martos-Leviv et al shared the impact of a major flood on relined and transferred paintings from the museum in Montargis, France. After analyzing the range of materials and restoration treatments involved, different protocols were established to re-stretch, stabilize, clean, and conserve this collection and the range of materials used in previous restorations. Particular attention was given to dealing with an older transferred painting with a water sensitive ground layer.

Anil Dwivedi spoke about the challenges of retreating a large group of paintings in a museum in Rajasthan, India. Lack of climate control and previous treatments using unstable materials has had a deleterious effect. Water damage, insect infestation, and bat droppings had seriously compromised the condition of these paintings. A survey of the environment and past treatments led to extensive retreatment and recommendations for archival storage and display.

Mark Lewis

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### Session 7. Modern and Contemporary

Chair: Jim Coddington

This conference was not for the faint of heart. It was a deluge of information spanning historic lining and conservation techniques to contemporary materials.

"The Use of Digital Imaging Techniques to Monitor Changes in Canvas Paintings as a Result of Lining and Deterioration" by Dale Kronkright. Dale always presents a lot of content, and this talk was no exception. Dale outlined the use of several imaging techniques, the most notable and perhaps unfamiliar to conservators are UV luminescence and transmitted IR. These techniques have the ability to monitor crack proliferation within the paint layers and the presence of salts perhaps before eruption. Dale also described laser doppler vibrometry, a technique that has been used to detect vibrations of paintings within crates.

"Structural Repair of Contemporary Paintings" by Mary Gridley. What I found most fascinating about this talk was Mary's discussion about how the marketplace and seeing contemporary art as an investment commodity has informed treatments. Since the artwork is seen as an investment, there is a tension between authenticity and intervention. At times treatments by living artist are seen as financially preferable as they seem more authentic to the market place.

Mary chronicled her career conserving contemporary art stating that in the beginning treatments for contemporary art did not differ from traditional treatments such as wax linings but the influence of new materials and especially the marketplace has caused treatments to evolve. She also stated that she has found that repairing cracks in contemporary paintings on cotton duck with acrylic grounds (and sometimes acrylic paint) can be successful because the materials remain more pliable than linen and rabbit skin glue.

"Differences in Conservation Approaches between Korean and Western Traditions" by Yujin Kim. This talk was a fascinating description of the preparation steps used to make a Korean support. Mulberry paper is applied on a stretcher in many layers and creates a drum like surface. I think this technique should be explored for stretcher inserts.

"Wax Extraction Traction on a George Braque Still Life" By Desirae Dijkama and Bradley Epley. This talk described the reversal of a wax resin lining and the experiments conducted to determine the best method for wax extraction. The original lining was performed in 1961. As the lining process created a very dull waxy surface on the painting, it was decided to remove the lining and extract as much as the wax as possible.

A wide range of methods and materials on samples of linen were impregnated with a wax resin mixture similar to the original. The heat and pressure during extraction, solvent mixture, and application of solvent were all tested. Samples were weighed before and after extraction trials to determine the success of each method. There was a maximum weight loss of 30-35% after extraction indicating a significant amount of wax was removed from successful samples.

The solvents used were Shellsol OMS and xylenes applied with Evolon CR (which was very effective at wicking the wax away from painting). After extraction the painting only lost 14% of weight ( but the samples were unpainted and did not have the weight of the paint layers figured in). The quantifiable methods for wax removal developed by this team will be really useful moving forward, and I would recommend contacting the authors or reading the published paper prior to embarking on any wax extraction projects.

"Local Treatment of Cupped Cracks in Contemporary Paintings and their Appearance After 20 Years" Mary Piper Hough and Stefan Michalski. This paper described research on several tear and crack repair

## Articles You May Have Missed

techniques at CCI. The sample paintings of cotton duck with acrylic ground and lead/zinc oil paint were all cut to have uniform tears. Several types materials and methods were used to repair the tears including epoxy infused threads, stainless steel pins, and BEVA. Some of the samples were keyed out and others were allowed to age under slacker conditions. After 20 years the samples that looked the best were the cracks mended with stainless steel pins that had not been keyed out indicating that tighter paintings can aggravate surface deformations associated with local repairs.

Nina Roth Wells

And finally (as if the preceding weren't enough) some general thoughts.

It needs to be said that the organizers did an excellent job. They had originally expected about 150 participants. When the number became 380 (with people from every continent except Antarctica) they managed to find a comfortable and convenient larger location, and kept the price to \$125. All of the sessions and tours went smoothly, in all a real accomplishment.

The moratorium on lining may have meant that far fewer linings were done in museums, however the many conservators in private practice who regularly encounter paintings with severe structural damage continued to perform them. The result has been the development and adaptation of effective and sometimes elegant techniques to do linings that are consistent with minimal treatment standards.

The development of the suction table as a tool that allows for control and versatility in treatments cannot be overemphasized.

During the discussion of the various glue paste lining methods, the issue of exposure to water was linked to the possibility that water may initiate the lead soap formation cycle. This needs further investigation.

A number of surveys of large, sometimes very large collections, to determine what linings have survived well, were described. This information could provide another level of significance if the storage / housing / environmental conditions of the paintings were correlated with the condition information. In the coming decades, as the resources to support conservation are eroded by necessary responses to climate change, knowing what survives in less than optimal conditions will be important.

And in that same vein, just as Greenwich marked a change in how lining was considered, this may be the time that criteria for minimal treatment be re-considered, due to the increasing uncertainties of climate change.

Carolyn Tallent

**“In a Conservation Triumph, a 15th-Century Tapestry Highlights the Age of Chivalry,”** *The Art Newspaper*, 10/30/2019

French conservators spent a year stabilising and reweaving the Tournament Tapestry of Frederick the Wise (from around 1490) before it traveled to the Metropolitan Museum of Art in New York.

Lent by the Musée des Beaux-Arts de Valenciennes in France, the tapestry figures prominently in *The Last Knight: The Art, Armor and Ambition of Maximilian I* at New York's Metropolitan Museum of Art, an exhibition billed as the most comprehensive loan show of European arms and armour in decades.

That the tapestry was able to travel was a triumph for French conservators, who spent a year restoring the work in Aubusson, France, starting in April 2018. Over the centuries the tapestry had become grimy and structurally degraded. Its silk threads were particularly damaged, its metal threads were tarnished and the borders were worn, including a galloon, or braided strip, that was not original to the tapestry.

The tapestry had undergone restoration numerous times; reweaving in some areas was rough and visually distracting, although this did not affect the work's overall structural integrity. Some seams had weakened and the work was held together chiefly by its lining.

Conservators removed the lining, allowing them to see the original dyes more clearly. They also removed the hanging system and the non-original galloon before reweaving the borders. Considerable stitching was needed to stabilise the tapestry and a new lining was added to the back. The tapestry underwent a vacuum cleaning because it was considered too fragile for a wet treatment.

**“Australian Innovation Adds New Sheen to Old Masters,”** *CSIRO*, 10/30/2019

Masterpieces by Rembrandt and van Dyck housed at the National Gallery of Victoria have been restored to their former glory and protected for years to come thanks to a special resin developed by Australia's national science agency, CSIRO.

The new varnish resin is the result of a collaboration between Australia's oldest and most visited gallery, the National Gallery of Victoria (NGV) and CSIRO. The product has now been commercialised by Melbourne chemical manufacturer Boron Molecular, a former CSIRO spin-out.

The synthetic resin, called MS3, is the latest generation of a synthetic varnish that was designed specifically for conservation and cultural heritage applications. After extensive testing at the NGV, the resin will now be trialed by conservators working in several of the world's major art institutions.

CSIRO's Leader of Materials for Energy and the Environment, Dr Deborah Lau, said using the emerging technology of 'flow chemistry' allowed the team to develop the resin in a safer, cleaner, more efficient way than traditional chemical manufacturing. This in turn delivered improved colour, chemical stability, and consistency between batches.

Carl Villis, Senior Conservator of Paintings at the NGV, said that MS3 has been warmly received by the international paintings conservation profession because an earlier and much loved version, known as MS2A, had gone out of production in 2015.