

Textiles Working Group Newsletter No. 39 2017 ISSN 1027-1589

Dear Textiles Working Group Members,

Welcome back to our long-delayed newsletter! I was inspired (at last, you may say!) by the Triennial Conference held in Copenhagen in early September. In this edition, you'll find reports on the conference by Assistant Coordinators Christine Mueller-Radloff and Mika Takami and some ICOM-CC news from me.

This issue also has an article written by Textiles Working Group members Hannah Sutherland and Frances Lennard: “ ‘Each to their own’? An investigation into the spacing of laid-thread couching as used in textile conservation.” Sutherland did this investigation for her MPhil thesis at The Centre for Textile Conservation and Technical Art History at the University of Glasgow (Scotland), under the supervision of Professor Lennard.

The Assistant Coordinators and I have discussed this newsletter. Realizing how infrequently we publish it and the many ways that people now find out about exhibits, conferences, and such we have decided that the newsletter will be devoted to conference reports and articles on recent work; reviews of exhibits and/or books/articles might also be in the newsletter. More ephemeral information, such as conference and exhibition notices, which we used to list in the newsletter, will

be posted instead, to our upcoming LinkedIn page. You can also send such announcements to me for posting on the ICOM-CC Textiles Working Group webpage.

Thanks to our authors for their reports and photographs. Thanks to our editor, Rebecca Rushfield for getting this to you. We hope you enjoy this issue and will look forward to the next one later this winter.

With best wishes to all for a very good 2018,  
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**News from the ICOM-CC Triennial  
Conference, Copenhagen, Denmark, 4 – 8  
September 2017**

This was a most successful conference. Over 1,000 people, from 58 countries, attended; 150 papers and 90 posters were presented. This conference celebrated fifty years of ICOM-CC, which began in 1967 with 120 people, from 25 countries. We have indeed grown and flourished! ICOM-CC is the largest committee within ICOM.

While at the conference, I attended a couple of meetings with the Directory Board (DB) and other Working Group Coordinators. There were some important pieces of information presented that I pass on to you here:

The most exciting news is that the *Preprints* from the 2014 Melbourne and 2011 Lisbon Triennial Conferences are now available online! You can find these at: <http://icom-cc-publications-online.org/>  
The Copenhagen *Preprints* will be available on the site from January 2018. Happy reading!

The DB also reported that eight earlier *Preprints* have been digitized and will be appearing as funds and permissions make this possible. See immediately below, for how you can help.

The DB is working to get all ICOM-CC Triennial papers published online. In order to do this, each author must sign a permission form. You can find the form here:

[http://www.icom-cc.org/54/document/author-permission-form-for-icom-cc-publications-global/?id=1511#.Whx\\_WUqnE2w](http://www.icom-cc.org/54/document/author-permission-form-for-icom-cc-publications-global/?id=1511#.Whx_WUqnE2w)

Even if you signed a permission form when your paper was published for a Triennial, you need to sign this form. The original form gave permission for publication in the original format-- not online. Please help us get all our papers online by downloading and signing the form. If you have colleagues who are no longer members, but have published in a Triennial Preprint, please send this link on to them.

Once the *Preprints* are online, it will be time for publications from the various Working Groups to go online. To that end, the DB has

asked each Working Group to compile a bibliography of their publications. Newsletter Editor Rebecca Rushfield has graciously agreed to create this list. Stay tuned for requests from her for help in discovering the Textiles Working Group publications from the early years.

The conference ended with the announcement of the location for the next ICOM-CC Triennial Conference: Beijing, September 2020. We begin planning soon!

In the meantime, we – the Textiles Working Group Assistant Coordinators and I – are developing plans for this Triennium. As noted above, we will be starting a LinkedIn page (with thanks to Assistant Coordinator Mika Takami), assembling a bibliography of our past publications, continuing this newsletter, and.....stay tuned. We have just submitted our plans for the Triennial to the DB; we'll share plans with you once we've gotten DB approval.

Deborah Lee Trupin

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**ICOM-CC 18th Triennial Conference,  
"Linking Past and Future" -  
Copenhagen, 4-8 September 2017  
TEXTILES WORKING GROUP  
PAPERS:**

Julia Brennan, N. Pianprasankit, and L. García-Alonso, "Before they are gone expanded: Capturing traditional textile preservation knowledge in Southeast Asia and Latin America"

Julia Carson, "A sticky situation: A different method for removing adhesive from an early 17th-century carpet"

Mie Ishii and A. Shimura, "Developing fabrics made with traditional techniques for textile conservation within the cultural property preservation policy in Japan"

Anna Javér, M. Hacke, C. Thays Delgado, and K. Thuresson, "Paracas textiles – Colour and condition. Investigation of the mordants and state of degradation of the Paracas textile collections in Peru and Sweden"

Viola Nicastro, M. Jordan, and I. Gibb, "Adhesive removal using gels for the conservation treatment of the valances of a Queen Anne throne canopy"

Maj G. Ringgaard, "Dyes and the analysis of archaeological textiles: What do we see?"

Annemette Bruselius Scharff and L.B. Jørgensen, "Evaluating transmission electron microscopy as a method for assessing the condition of archaeological wool"

Julie H. Wertz, A. Quye, D. France, P.L. Tang, and L. Richmond, "Authenticating Turkey red textiles through material investigations by FTIR and UHPLC"

**ICOM-CC 18th Triennial Conference, "Linking Past and Future" - Copenhagen, 4-8 September 2017**

#### **TEXTILES WORKING GROUP POSTERS:**

Jocelyn Alcantara-Garcia, T. Pearlstein, and M. Nix, "The use of textile swatch books to study the Norwich dyeing industry"

Helen M. Hughes, F. Hayes, H. Watkins, C. Jamieson, D. Featherstone, and J. Crossan, "Banner Tales of Glasgow: Working with

the tangible and intangible natures of social history banners"

Elitsa Tsvetkova, K. Frangova, and T. Peneva, "Wet felting tradition in Bulgaria. Ornamented woolen wedding carpets: Function, technology, techniques of production and conservation issues"

Thank you to all the authors who contributed to this conference! The full text with images of all of the papers and posters from the Copenhagen Triennial Conference will be available on the ICOM-CC website in January, 2018.

#### **Two views of the ICOM-CC 18th Triennial Conference, "Linking Past and Future" - Copenhagen, 4-8 September 2017**

1. Mika Takami, Conservator, Historic Royal Palaces, UK

I was able to attend the 18<sup>th</sup> ICOM-CC Triennial Meeting in Copenhagen, thanks to the generous CPD grant I was awarded by the Anna Plowden Trust and The Clothworkers' Foundation. It was very exciting to attend this international conference having missed two previous meetings and serve as a session chair for the Textiles Working Group for the first time.

The program was full. In conjunction with six Plenary Sessions, 150 peer-reviewed papers and 100 posters were presented in five separate group sessions run in parallel for 21 working groups. Deciding in advance which sessions to attend was challenging, and swiftly moving from session to session during the day kept the pace frenetic, but it was well worth the effort.

The Textiles Working Group sessions were concentrated over the first one and half days. It

was great to meet and catch up with Deborah, our Coordinator, and Christine, Assistant Coordinator, after my six years' absence from attending an ICOM-CC Triennial conference and to work together for the group's program. To our surprise and delight, each of the three Textiles Working Group sessions attracted a large audience beyond the capacity of the room, so many people ended up either standing or sitting on the floor along the walls. We should ask for a bigger room next time. The Textiles working Group business meeting had a productive group discussion bringing about some great ideas for our interim meeting and events (to collaborate with ICOM-Costume and link with ICOM 2019 in Kyoto) as well as for enhancing our newsletter content. In a separate session, the members also had the opportunity to speak with Mary Brooks and Dinah Eastop, the editors of '*Refashioning and Redress: Conserving and Displaying Dress*'.

The Plenary Sessions set the scene and gave us critical perspectives for the conference. They provided us with the opportunity to think about our future and the challenges ahead as part of the bigger picture. First, in the General Assembly the ICOM-CC Directory Board delivered fantastic news that the ICOM-CC Preprints for the 16<sup>th</sup>, 17<sup>th</sup> and 18<sup>th</sup> Triennials are now online without restriction. This information is now available to all. Amongst the presentations and panel discussions we had in the Plenary Sessions, the following two keynote presentations particularly resonated with me. **Kathleen Dardes**, who gave the opening presentation lecture, celebrated the growth of the community from the initial 100 members in 1967 to the current 2800 members, listing the key figures and their contributions which have shaped our profession, ethics and practice. While it offered me a valuable insight into the scope and impact of the ICOM-CC's work over the past five decades and across the world, the challenges ahead she planned for "linking past and future" (the conference theme) were rather

overwhelming. These included increasing material/media diversity in conservation, climate change and growing expectations for engagement and promotion using technology. Her closing advice was "be audacious".

**Salvador Muñoz Viñas** addressed the ever-growing challenge of expressing our value in conservation in terms of financial figures, which he called "Excel thinking". The fact is that the value of conservation is difficult to convert into economic output or "money-making" facts and figures. Thereby, it is also difficult for us to demonstrate immediate usefulness. Referring to his presentation title "A Darwin Approach" he threw in a question: Will we "adapt or die" to the environment we are in? He reasoned that we would need to make different kinds of efforts in explaining conservation in order to create a real difference from information-sharing which we often do nowadays if we are to satisfy the growing demand for instant, constant and 'likable' updates from the digital audience of today. He suggested that we need to consider emphasizing quality and evaluating the non-financial value to add meaning to our work. Our storytelling is a tool to transmit the excitement of traditional first-hand experience of discovery. Although we exercise soft leadership by adapting to Excel-thinking, we gain authority through powerful storytelling and increased visibility. There were a good deal of questions from the audience as to how to achieve this, but I believe the solution was left to each of us to think over and devise!

For the remaining days after the Textiles Working Group sessions, I focussed on attending the sessions of the working groups most relevant to the areas of responsibility I hold in my current role including Murals and Stone, Preventive Conservation (their sessions overlapped with our Textiles sessions), Theory and History, and Education and Training. The papers which I found insightful and thought-provoking were: on the challenges faced in conserving the wall paintings at Sacro Monde de Varallo (by **Francesca Pigué**), on setting

microfading parameters to use in discussions with curators and designers for exhibitions (by **Bruce Ford**), on analysing the samples of a group of eight paintings by Frans Hals in Haarlem that had been meticulously stored from the past restoration treatments (by **Mireille te Marvelde**); on describing the challenging conservation decision making influenced by the community engagement for two performance-based artworks by a Portuguese artist (by **Rita Macedo**), and two papers addressing values placed in objects and the varying approach to conservation. One of these, by **Jonathan Ashley Smith**, questioned the use and need for a code of ethics/conduct and challenged whether we need to reconsider and prioritise the values placed on objects in an ever changing world. The other paper, by **Sarah Scaturro**, introduced a material and value based approach which the Costume Institute at the Metropolitan Museum of Art adopted for the conservation and desirable display of fashion. Hearing these two presentations and a good deal of debate amongst delegates which followed each paper (and occasionally joining in myself), was one of the main benefits of physically being there at the conference and it was all hugely stimulating.

Two papers discussing some of the essential conservation materials used in textile conservation-- silk in Japan and Japanese papers-- may be worthy of your special attention. **Mie Ishii** provided an overview of the history and techniques of the traditional sericulture that was once a major industry in rural Japan but now is fast disappearing and spoke of efforts working with one expert practitioner to preserve this intangible cultural property. Mie illustrated the traditional techniques of rearing of silkworms and hand-reeling cocoons and wowed the audience with the silk fabric sample she brought in spun and woven by this traditional process. It was thin, soft, pliable and non-slippery and clearly very different from silk habutai we normally purchase and use in our conservation treatment. **Mizumura** and **Moriki** introduced the history of

modernisation in Japanese paper making (and the inevitable decline of the handmade Japanese paper washi industry) and differences between hand-made and machine-made washi, summarising them in the useful classification table for washi and its uses for conservation. **Mizumura** advised us to find out exactly what washi you are using, including its ingredients and the chemical process it had undergone, and not to rely on natural or common names used for different types of washi.

2. Christine Müller-Radloff,  
Museum für Völkerkunde, Dresden,  
Germany

This year's ICOM-CC Triennial Conference took place in Copenhagen, Denmark. This was the second time in the 50-year history of ICOM-CC that Copenhagen hosted the Triennial Conference. The conference was under the patronage of Queen Margrethe II of Denmark, who attended the opening ceremony. Nearly one thousand attendees from all parts of the world attended the conference, which included 150 presentations. In addition to three plenary sessions, 21 working groups presented papers. The ICOM-CC working groups cover topics that are relevant to all conservators, such as preventive conservation and documentation, and also more specialized topics such as textiles or modern materials and contemporary art.

The conference took place in the Tivoli Hotel and Conference Centre, with presentations in a large central room and four smaller rooms around it. The “trade fair” exhibitors and poster displays were in the foyer of the hall. During working group presentations, there were generally five sessions running at a time. Luckily, the short distances between the spaces and the fact that moderators kept presentations to the published times made it easy to move between lectures in different Working

Groups. The layout also made it easy to meet colleagues.

In the first plenary session, Kathleen Dardes gave a history of the past 50 years of the ICOM-CC, which was founded in 1967. One of her key points was that the importance of ICOM-CC is its working groups. She felt that ICOM-CC is a very democratic organization. She reviewed the text of “The Conservator-Restorer: A definition of the profession”, published by ICOM-CC in 1984. Dardes said she feels it is still a good statement of our values, but that it could use updating to include the more diverse types of cultural heritage that conservators now address.

In the Working Group sessions, I was especially interested in reports on the handling of textile objects from different regions of the world. As an Assistant Coordinator for the Textiles Working Group, I was honoured to lead the group's first session. In this session, Anna Javér's talk, "Paracas textiles- colour and condition. Investigation of mordants and degradation state of Paracas textile collections in Peru and Sweden" investigated the effects of differences in past treatments, display, and environmental conditions between part of a collection that had been repatriated to Peru (from Sweden) and part that had not. Most interestingly, she concluded, to quote from her abstract: “Results suggest that colourants and their auxiliaries, such as mordants, cause greater differences in condition than past storage environments or treatments. “ Because I have been working with pre-Columbian textiles for more than 35 years, I was particularly interested in this paper.

On a completely different topic, Stephanie de Roemer, from the UK, presented "Accession and documentation of *Pretty*

*much every film and video work from about 1992 until now,"* as part of the Working Group on Modern Materials and Contemporary Art session. In her impressive presentation, she showed how a room-filling installation with many monitors and video recorders was installed for an exhibition and later documented and systematically dismantled for archiving in the storage area. During the conference, 90 posters presenting new research results and conservation projects were displayed the rear section of the large lecture hall. The authors were available to discuss their work during the coffee breaks. I was especially impressed by the presentation of "Material and light in the Damascus Room Dresden" by Jessica Hensel from the Netherlands, who had worked with the restorer Dr. Anke Scharrah in the Japanese Palace of the Museum of National History of Dresden. Over the past twenty years they have restored the original wall surfaces from a room of a noble house of Damascus. (cf.: <https://voelkerkunde-dresden.skd.museum/ausstellungen/damasku-szimmer/>)

Wednesday afternoon, as usual for ICOM-CC conferences, was reserved for Technical Visits-- with more than a dozen options offered. I had signed up for the visit to the Open-Air Museum on the outskirts of Copenhagen. Despite the rain, we toured the museum -- it felt like a trip to the past 300 years! The museum has houses from different regions of Denmark. The houses, built with native materials, showed how well they were adapted to the Danish environment. At one point we encountered a group of children in traditional clothes who were shown by a museum worker how to work with a scythe.



Interior view in an old Danish house in the Open-Air Museum

The celebrations on the 50th anniversary reached a first high point on Tuesday evening with the solemn reception in the festival hall of the city hall of Copenhagen. Kristiane Strætkvern, the Chair of Directory Board, made poignant remarks. The attendees were treated to drinks and pancakes. On the penultimate evening, the festivities culminated in a banquet in the National Museum, where participants from all continents gathered in a very friendly atmosphere. Singing a song written specifically for this day to the tune of "That's Amore", gave everyone a lot of joy.

After a last coffee break on Friday, the excitement increased, as we all awaited the presentation of this year's ICOM-CC medals and the announcement of the venue of the next Triennial Conference. The 2017 medals went to three very committed conservators and ICOM-CC members: Thea van Oosten, of the Netherlands, Ian Macleod of Australia, and Mikkel Scharff from Denmark. Each awardee was announced with a beautiful introduction by a colleague and each made an emotional speech of thanks for the awards.

Finally, the site for the 2020 Triennial Meeting was announced: Beijing. The invitation, made by the vice president of ICOM, An Laishun, was joyfully received.

These notes are just a few of the significant events of the Copenhagen conference. Participants received the Preprints for the papers and posters on a USB stick. But, as with recent past conferences, the Preprints will soon be accessible to all ICOM-CC members on the ICOM website. ([www.icom-cc.org](http://www.icom-cc.org))

For more information, please visit: <http://www.icom-cc2017.org/>. I hope to see you in Beijing in 2020!

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Coordinator's Note: For further information about the Triennial Conference, see On Board. News and reports from the Directory Board, Volume 14, No.2, 2017 at <http://www.icom-cc.org/54/document/on-board-vol-14--december-2-2017-icom-cc-newsletter/?id=1522#.WkF-uWinE2x>

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Hannah Sutherland and Frances Lennard's paper, " 'Each to their own'? An investigation into the spacing of laid-thread couching as used in textile conservation," begins on the next pages.



## **“Each to their own”? An investigation into the spacing of laid-thread couching as used in textile conservation**

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### **Introduction**

Laid-thread couching is a common stitched technique within textile conservation. It is used to support damaged fabrics onto a stronger support material. This research project aimed to investigate the impact of varying the spacing of laid-thread couching in textile conservation treatments. This work is built upon that of Benson (2013), who investigated different stitching threads used for laid-thread couching. Benson stitched natural fiber samples with both natural and synthetic threads. These samples were subjected to a fixed-load experiment for a period of two weeks, after which they were examined using high-magnification images and scanning electron microscopy (SEM). Benson’s fixed-load experiments showed a

different response to strain from staple and filament yarns. Many areas of further research were indicated, including stitching layouts and stitching technique.

The use of traditional hand sewing techniques, such as laid-thread couching, has been a core element of textile conservation. Despite long-standing use, little research has been undertaken to quantify some its “known” characteristics. This project was completed over 12-weeks as part of MPhil dissertation research at the Centre for Textile Conservation and Technical Art History, at the University of Glasgow. It was born out of an interest in the various ways in which decision making, specifically regarding laid-thread couching, can be taught. A literature review revealed limited quantitative analysis regarding laid-thread couching and only a few published case studies with reference to laid-thread couching variables. A detailed discussion of one particular treatment is given by Berkouwer (2014). The work of Ballard (1996), Ellis (1997) and Nilsson (2015) were also highlighted as pertinent to the research questions in hand.

Several different spacings of laid-thread couching were evaluated using fixed-load testing and digital image correlation (DIC).



These were subsequently examined using both quantitative and qualitative techniques. The wider project also recorded current approaches towards the spacing of laid-thread couching through a questionnaire sent out to practicing textile conservators. It is hoped that gathering this current collective knowledge will be of benefit to future conservators.

Research questions were formulated to allow the development of quantitative data, which could be used to understand the relationship between the spacing of lines of laid-thread couching and the effectiveness of a support treatment. These questions were:

- Does the spacing of laid-thread couching affect the strength of a treatment overall?
- Is there a “best practice” way of considering the spacing of laid-thread couching?
- Is it possible to use DIC to understand the strain in an area of laid-thread couching?
- How can conservators effectively communicate about laid-thread couching treatments?

### **Questionnaire**

A questionnaire was sent out to practicing textile conservators to investigate current opinions on laid-thread couching.

Participants were presented with a mock treatment situation, a cotton infant’s gown (later used for actual testing), and asked to suggest what threads and spacing they might use in a similar situation. Responses were used to help decide on variables for the experimental phase of the research. The questionnaire also collected opinions on why laid-thread couching treatments were not often published and if participants felt they used a standard spacing when carrying out stitched treatments. In total 51 completed questionnaires were received, covering 12 different countries of work, and a mixture of both private and institution based practice. A total of 13 variables were recorded as impactful on the decision to use a particular spacing, including the size of loss, desired aesthetic and type of stitching thread. Most respondents agreed that these variables were often considered simultaneously based on previous experience – the gut feeling. All spacing measurements given in the questionnaire were between 2mm and 10mm, with 5mm being most popular. This tight range indicated that, to some degree, there is a standard range of spacing values. Lace-weight cotton thread was the most popular thread choice for this treatment, with fine polyester a close second.

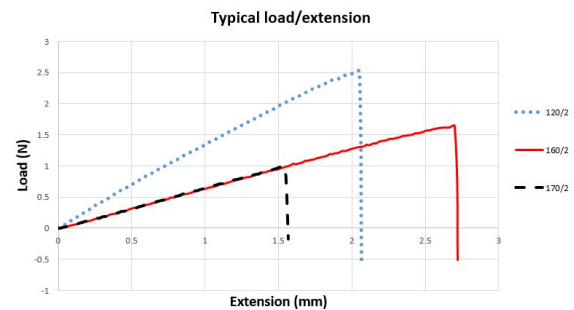
## Preliminary Testing

Following the results of the questionnaire, cotton thread was selected for the stitching of test samples. As a first step, the physical properties of cotton stitching threads were examined. Three different weights of “lace-weight” cotton were tested: Thread A - 120/2, Thread B - 160/2 and Thread C - 170/2, where the higher the first number the finer the thread. Warp yarns from the infant’s gown were also tested as they would be under the same stress as the stitching threads. Fifteen replicates of each stitching thread, and of the warps, were subjected to testing. This large group was chosen to allow for the assumed heterogeneous nature of the naturally aged cotton warps.

Following British Standards (1996), a Constant-Rate-of-Extension (CRE) machine was used to conduct the tensile testing. The CRE machine was set to extend at 10mm per minute, using a static load cell of 100N. Individual threads and warps were adhered to paper frames to ensure each was positioned into the clamps under the same tension.

Several results were recorded and examined. Maximum load at break data was as predicted: the gown warps were the weakest, with the stitching threads gaining strength as

they got thicker. Tenacity at maximum load was also as expected: the gown warps had low tenacity, while the stitching threads all had very similar, considerably higher, values. Both of these results for the stitching threads are due to their all being new and made from long-fibred Egyptian cotton. Importantly, the tensile testing phase highlighted the potential differences between different manufacturers’ threads for stitching.



**Figure 1**

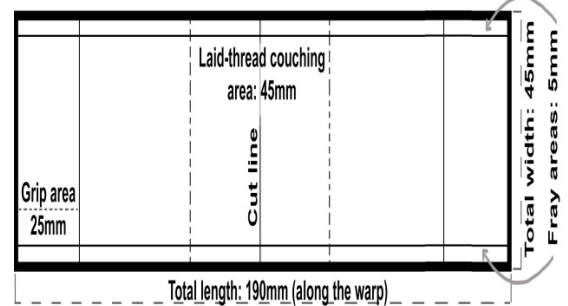
Figure 1 shows how Thread A (120/2) reveals a different pattern of extension from B (160/2) and C (170/2). Thread B and C are from the same manufacturer, whereas thread A is produced by a different company. This alone is a useful finding of the project. It suggests that a particular weight thread from one manufacturer may have different physical properties to the same weight thread from another manufacturer. Further research is required.

From this initial testing thread C was chosen to be the most appropriate for use in fixed-load testing. This is because it was suitably weak, whilst also demonstrating classic cotton tenacity. Due to its fineness, it would have also been the author's choice should tensile testing have been unavailable.

### Fixed-load Testing

The second stage of tensile testing was to carry out fixed-load testing of several conserved samples. The cotton infant's gown, purchased for the testing, was chosen as it was known to have been worn, washed and handled regularly, whereas new fabric would have had different properties from a typical 'object'. Twenty conserved samples were prepared for the experiment: five replicates of each of four spacing variations. The chosen spacings were 3mm, 5mm, 7mm and 9mm - covering the range given by respondents to the questionnaire. All necessary fabrics and thread were left in the room where the experiments were conducted prior to hanging, to allow them to reach equilibrium with the room's ambient conditions. A pattern, based on that of Benson (2013) and British Standard (1996) guidelines, was drawn up to ensure that each sample set followed the same basic size and shape, see figure 2.

Figure 2



The 'damage' on each sample consisted of a single horizontal cut from one side of the sample to the other. Rectangles of a new, plain weave, cotton were cut and placed behind the damage. Lines of laid-thread couching were worked with a curved needle. Each stitched sample was hung in position with bar magnets from a magnetic notice board, see figure 3.



### Figure 3

Several undamaged, unconserved strips of gown fabric were also hung as a control group. The samples were all weighted with 30g weights and left to hang for 21 days.

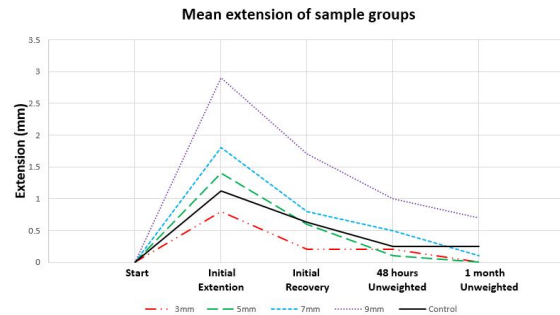
In order to use the data effectively, four stages of measurement were chosen during the experiment:

1. Initial extension: On the final day of hanging (day 21) the overall length of each sample was taken.
2. Initial recovery: Immediately after removal of the weight overall length was taken.
3. 48 hours unweighted: After the weights were removed, samples were left horizontal for 48 hours. Overall length was taken again.
4. One month unweighted: As above after one month.

All measurements were taken with a ruler to the nearest 0.5mm.

### Quantitative Results

Prior to testing it was hypothesized that the wider the spacing (and therefore the fewer supporting lines) the greater the extension would be. General results matched this expectation.



### Figure 4

See figure 4, which plots the mean extension values for each set of data.

All samples were 140mm long at the beginning of testing. This was used as a baseline for calculating extension. The largest initial extension, 4mm, was found in the 9mm spacing group. The smallest initial extension was to be found in the 3mm spacing group, where one sample recorded no movement. All samples returned to within 1% of the original length (1.4mm) after 48 hours of being horizontal (unweighted). The four sets of conserved samples followed the predicted pattern, with a slight overlap between the 48-hour recovery of the 3mm and 5mm spacing groups. The data set which did not fit with the pattern is that of the control group. This group had greater extension than the 3mm spacing group, whereas a smaller extension would have been expected. This is likely due to the high density of laid-thread couching.

Figure 4 also shows that as the samples recovered they all moved back towards the same point regardless of initial extension: the groups which extended the most, also recovered the most. Standard deviation of all samples at each stage confirmed this: it was much lower, indicative of a tighter data-set, after one month of recovery, than after initial extension. This is a reflection of the nature of cotton fibers (in the stitching thread) to stretch slightly and recover (Cook, 1984).

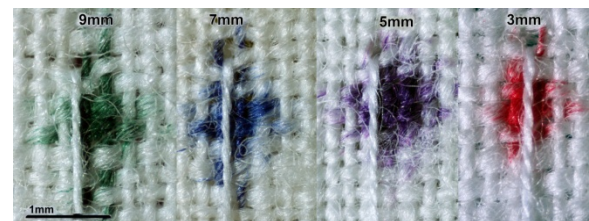
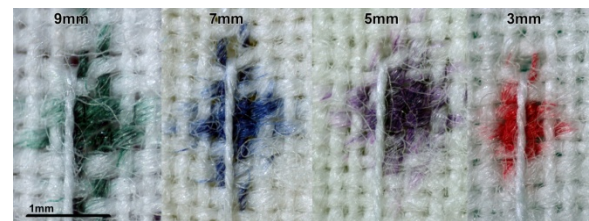
Further statistical analysis, using *p-values*, was carried out to confirm that the wider the spacing, the greater the extension (the hypothesis), see table 1. A *p-value* equation measures the confidence in a value statistically. Working on a *p-value* of 0.01 = 99% confidence in the hypothesis, all results here can be concluded as agreeing with the hypothesis.

### Qualitative Results

Slight deformation was noticeable along the upper end of each line of laid-thread couching. This was most apparent on the 9mm and 7mm group, where the wefts below the anchor weft were also slightly deformed. The 3mm group showed the least deformation. This indicates that where the load is spread over more lines of laid-thread

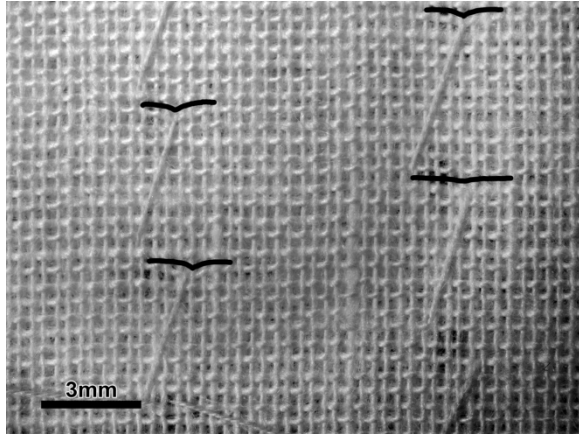
couching, the impact of the load is less per line. Although all samples recovered overall, the deformation to individual wefts was not much improved through removal of the weight, as shown in figures 5 and 6.

**Figure 5**



**Figure 6**

Deformation was also noticeable on the support fabric, particularly the 7mm and 9mm spacing groups, see figure 7.



**Figure 7**

The support fabric was of a more open weave than the object: 26 wefts and 22 warps per 10mm, rather than 32 warps and wefts per 10mm. This difference is important to note as the loose or tight nature of a weave will impact how that fabric reacts to localized stress.

### **Digital Image Correlation**

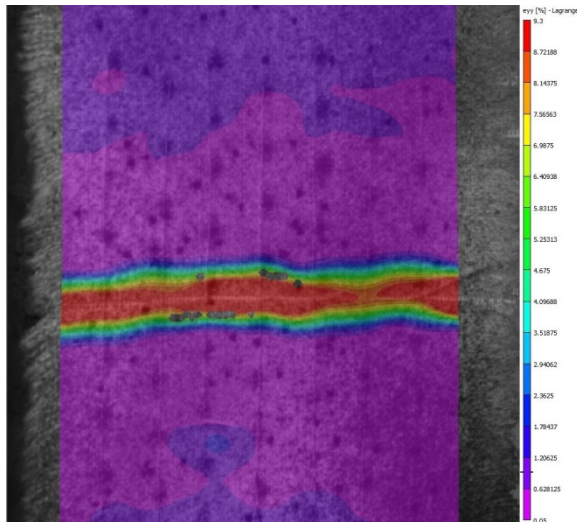
Digital image correlation (DIC) is an imaging technique which tracks the changes in surface geometry of an object through correlation of a deformed surface with its undeformed state (Dulieu-Barton et.al., 2005). It works by comparing digital images of a material at different stages of deformation. The movement required to superimpose the comparison image onto the starting image is what is measured as strain. The starting image and the comparison image are read by the correlation algorithm

as a pattern of grey scale. To assist the computer software in identifying grey scale, a speckle pattern is applied to the surface of the material to be tested (Bossuyt, 2013). The measured deformation can be processed to give further information; the impact of a specific load on a material or the effect of environmental conditions such as temperature or humidity. DIC is, in principle, non-invasive and non-destructive which makes it particularly suitable for use with historic objects. Unfortunately, the need for a speckle pattern is a draw-back for some object observations, although success has been had observing strain in tapestries, where the texture of the weave can be used as a speckle substitute (Lennard et.al, 2011).

DIC analysis was carried out in partnership with the School of Engineering at the University of Glasgow. Various speckle patterns were attempted including the use of ink pens and matte spray paint. Due to time constraints only two spacings were tested, 5mm and 9mm. The small number of replicates tested meant that, although interesting observations were made, further research is required to produce conclusive results. Areas of high strain were noted particularly around the area of damage; see red-colored areas in figure 8.



**Figure 8**



This strain then quickly dispersed well before the ends of the lines of laid-thread couching, see purple areas in figure 8. It had been expected that some strain would have been noted around the tops of each laid-thread line, as these are the points carrying the weight of the treatment. No high strain was apparent there.

### **Discussion**

The results of the practical experimentation back up information provided by practicing conservators in the questionnaire.

Understanding how “strong” or “weak” an object, or a treatment is, is a skill built through experience and observation and is not necessarily something which can be taught quickly. The apparent lack of published information on the application of laid-thread couching is appropriate as

conservators do not routinely look for these details in published sources, reflecting their reliance on their intuitive understanding of the technique rather than a learned approach to laid-thread couching.

It is valid to note that the most popular spacing measurement – 5mm – did very well in testing, being most similar to that of the control group. It also took less time to stitch, and inflicted fewer stitch holes, than the 3mm spacing group. The “ideal” treatment is very much a balancing act of multiple requirements. This experiment showed that an overly high density of stitching can make the supported area less elastic than the rest of the object. In this experiment, the conserved samples with the most stitching (3mm group) were less elastic than the samples which had no damage at all. This over-stitching restricted the movement of the conserved area. When a conserved area reacts very differently to an unconserved area, for example when under strain, this can cause tensions between areas, eventually leading to further damage. The suitability of a particular density of stitching has to be judged on a case-by-case basis.

This project trialed the use of DIC to investigate the conservation of a textile other than tapestry and it asked many more



questions than it answered. The success of DIC, for textile conservation purposes, relies on the inclusion within the project team of an engineer who understands the results of the tests and can accurately interpret them. Taking images and processing them is simple, if time-consuming. Taking the resulting strain-maps and relating them back to the original sample is difficult without a good grasp of the technology and the algorithms upon which the technology is based.

### Further Research

Several areas were highlighted for future research. This project indicates that the choice of thread has a considerable impact on the long-term success of a treatment. A wider study, covering a variety of stitching threads and spacings, is recommended. Further investigations on how DIC can be used to understand strain across stitched support treatments would also be beneficial. Research into the appropriate and accurate application of speckle patterns for DIC would also be of benefit.

Spacing	Mean extension at each measuring point			
	Initial extension	Initial recovery	48 hours unweighted	1 month unweighted
3mm	0.8m	0.2m	0.2mm	0mm

	m	m		
5mm	1.4m m	0.6m m	0.1mm	0mm
7mm	1.8m m	0.8m m	0.5mm	0.1mm
9mm	2.9m m	1.7m m	1mm	0.7mm
	$p=$ 0.008	$p=$ 0.007	$p=$ 0.008	$p=$ 0.008

**Table 1:** Mean and  $p$ -values for each data set

### Conclusions

This research project aimed to examine one variable in a treatment which has many. Overall, this project has provided some solid data to back up intuitive elements of textile conservation work:

- Over-stitching can restrict the natural movement of an object fabric, potentially causing further damage.
- Under-stitching can cause gapping and deformation around the treated area, potentially causing further damage.
- Thread-choice and spacing need to be considered and balanced in order to ensure a treatment is strong-enough, without being too strong.
- Different manufacturers' threads can have different mechanical properties, even if they are the same fibre and weight.

The novel use of DIC proved some success, but further research is needed to fully uncover all of the technology's potential within textile conservation. This project only investigated one parameter - hanging textiles with laid-thread couching.

The higher the density of laid-thread couching lines, the stronger the treatment. It is the role of the conservator to individually assess where on this scale of "weak to strong" is appropriate for the object in question. From the point of view of the emerging conservator, sharing reflections on successful and, perhaps more importantly, unsuccessful stitched treatments will help equip the next generation of textile conservators with greater knowledge at the start of their careers. It is hoped that this discussion will continue, to allow wide-reaching reflection on the impact of laid-thread couching treatments on the objects they support.

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<https://gupea.ub.gu.se/handle/2077/40524>.

## Materials:

Cotton Threads:

Claire's Lace  
85 North Poulner Road  
Ringwood  
BH24 3LA  
England

Fil au Chinois Egyptian Cotton 120/2  
[http://www.claireslace.co.uk/shop/index.php?id\\_product=391&controller=product](http://www.claireslace.co.uk/shop/index.php?id_product=391&controller=product)

Egyptian Cotton (Flemish) 160/2  
[http://www.claireslace.co.uk/shop/index.php?id\\_product=318&controller=product](http://www.claireslace.co.uk/shop/index.php?id_product=318&controller=product)

Egyptian Cotton (Flemish) 170/2

[http://www.claireslace.co.uk/shop/index.php?id\\_product=319&controller=product](http://www.claireslace.co.uk/shop/index.php?id_product=319&controller=product)

## Captions

Figure 1: Graph showing typical load/extension curves for three cotton stitching threads

Figure 2: Basic pattern used for each test sample

Figure 3: Samples hanging during experimental phase

Figure 4: Mean extension and recovery for each sample set

Figure 5: Micrographs taken immediately after weight removal

Figure 6: Micrographs taken after a 48 hours recovery period

Figure 7: Deformation of support fabric

Figure 8: DIC "strain map". Red= higher strain (9.8% eyy), Light purple = lower strain (0.5% eyy)

Table 1: Mean and *p*-values for each data set

