THE INSTITUTE OF CONSERVATION

Morning Session:

From Boxes to Buildings: Creative Solutions for the Storage of Textiles and Dress

Afternoon Session:

General Papers

Forum of the ICON Textile Group

27th March 2017

The Assembly Rooms, Bath

Edited by Sarah Glenn ACR and Katy Smith

Contents

Posters

Foreword

'*From Boxes to Buildings: Creative Solutions for the Storage of Textiles and Dress*' was the title of a one day conference organised by the UK's Institute of Conservation Textile Group and held at The Assembly Rooms, Bath on 27th March 2017. Half of the day was devoted to the storage topic with the remaining time given to talks on a variety of subjects of general interest to the members. Speakers included conservators and curators working in private practice, museums and historic houses.

Eleven of the thirteen presentations and all eleven posters are included in these postprints.

Six presentations and three posters on storage ranged from explorations of the challenges of maintaining appropriate storage conditions for large mixed collections to approaches and methods used for specific types of textiles. The need to devise solutions that addressed issues such as enabling access, working with budget and/or space limitations, achieving energy savings and meeting tight deadlines whilst maintaining high standards was a recurring theme. The audience was also introduced to STASHc.com: an online resource for collection storage.

The other seven presentations and eight posters covered a wide variety of topics. These included project management and evaluation, innovative methods and materials for cleaning, stabilisation and mounting, and object based research. The likely dissertation topics of the final year students of the MPhil Textile Conservation, University of Glasgow were also introduced.

The Textile Group Committee would like to thank all the speakers and poster authors, the chairs (Ann French, Bevan O'Daly, Elizabeth-Anne Haldane and Alison Lister), and everyone who contributed to the organisation and running of what was a highly informative and interesting day.

Particular thanks are given to Sarah Glenn and Katy Smith for managing the production of these postprints.

Alison Lister ACR
Chair of the ICON Textile Group Committee
October 2017

Maintaining collections storage standards whilst achieving energy savings

David Singleton

Preventive Conservator, Bristol Museums, Galleries and Archives

Introduction

A lack of British Standards relating directly to museums and heritage collections has, in the past, led to heavy 'borrowing' from those relating to archives, and in particular BS5454:2000. This document called for tight relative humidity (RH) and temperature control, and in many cases led to the implementation of full air conditioning for storage areas. In 2012 the BS5454 was replaced with a new version, which turned much of the previous regulations on its head: the range of RH acceptable is greatly broadened, and the tight temperature control is dropped almost all together. The museum guidelines produced at the same time (PAS 198:2012), and those that are subsequently superseding them, have moved parallel to those of archives and many institutions have used the opportunity to lower their energy bills and carbon footprint.

This paper offers two case studies where practical implementations of the post 2012 British Standards have been put into practice.

CASE STUDY 1 – B-Bond Bristol Archives

Bristol Archives are housed in the west side of an early 20th century bonded tobacco warehouse. The ground floor provides accommodation for the search room and staff offices. The four floors directly above offer secure strong rooms for the city archives. The floors above this are used by other council departments. The east side of the building houses the 'Create Centre'. The ground floor of the Archives is heated with electric heaters. The four strong rooms were fitted with full air conditioning when the archives were moved into the building in 1992.

Following the publication of PD5454:2012 and PAS 198:2012, a meeting was held between the senior archivist (Richard Burley) and the preventative conservator (David Singleton) to look at how modifications could be made to ensure that the Bristol Record Office was following the new standards. A preliminary investigation looked at what level of experimentation could be safely undertaken in pursuing a passive approach to controlling the environment within the strong rooms. This resulted in a decision to turn off all fans, heating, cooling, humidifying and dehumidifying systems and to constantly monitor the spaces over the period of October 2012 to September 2013. Advice from the conservation scientist and consultant Tim Padfield reassured managers that our period of experimentation was no more likely to put the collections at risk, than if we continued to run the existing air conditioning system.

The standards for the archives had previously been governed by BS5454:2000. This document set temperature and RH at fixed points with little tolerance and these conditions were not achievable without elaborate air-conditioning.

The new PD5454:2012 is radically different, giving more tolerance to RH limits and considerably greater allowance for temperature variation, with a view to moderating energy usage. By taking the different groupings and combining them where possible to allow for mixed storage, one ends up with conditions for a general store with RH between 35-50% and temperature range 13-18°C and chest freezers for housing acetate film and tapes.

As well as taking constant temperature and RH readings in all four stores at central locations, spot readings were taken at the extremes of the store areas. Improving the sealing of the spaces from air ingress was undertaken and collections adjacent to walls brought further within the spaces.

Findings from the records for 2012-2013

Our target RH parameters (35-50) were met throughout the period, with the exception of nine days at 32%. The average RH for the year was 43%.

A minimum temperature of 15 °C was met throughout the period, however keeping the temperature below 18 °C proved unachievable. The maximum temperature recorded was 27 °C. The stores only managed to maintain a temperature under 18°C during the period December 2012 to April 2013. The average temperature for the year was 19°C.

Spot readings were taken at several locations at the extremes of the store areas, on all four floors, and showed that the RH never varied more than 4% and the temperature more than 1°C from the central recording locations.

Findings from subsequent records

A gradual average 2% RH increase each year has been recorded. This is now increasing summer readings to above the 50% target maximum.

The average summer temperatures within the stores are directly related to the external temperatures; the high of 27°C in 2013 has not been matched in any subsequent years.

From our initial investigation and Tim Padfield's report on the environment within the strong-rooms, the main source of heat affecting floors 1-4, for the period October to May, was identified as the ground floor. The ground floor is occupied by the search room and offices of the Archives. For as long as people are being based in this space, a heat source will remain during the October to May period and this level of heating seems sufficient to control the temperature and RH in the autumn, winter and spring. Experimentation with dehumidification is being carried out to see what equipment is required to remove the excess moisture from within the strong-rooms and keep the maximum RH at 50%. It is expected that a single refrigerant-type dehumidifier will be sufficient on each floor.

The building is constructed from reinforced concrete. The floors seem to have little insulating effect and allow the heat to readily pass up through from space to space. The external walling is of double-brick without any void or insulation and the windows are single glazed. It is proposed that a single floor be tested with 'hempcrete' (a bio-composite material of hemp hurds and lime) walls within the existing walls, to help lower summer temperatures and maintain a stable RH. A similar system has proved very successful at the Science Museum stores at Wroughton.

Any attempts to lower the summer temperature of the strong-rooms with artificial cooling have been ruled out. This might bring associated problems which could outweigh the dangers to the preservation of the archives from the higher temperatures. If the air within a strong-room was reduced in temperature, then the RH would rise. De-humidification would therefore be necessary to maintain a steady RH. A fault in the cooling and drying systems could easily lead to an RH of over 65% and this could lead to mould growth in the collections. This would almost certainly have a more detrimental effect than that caused by the elevated temperatures during the summer months. It appears that there is no scientific data to suggest that there is any step-increase in threat to

collections at any point under 30 deg. C. (PAS198:2012 Table E1, page 27 states that digital ink is stable up to 30°C, provided the RH is less than 60%).

The average annual temperature in the BRO strong-rooms was 19-20°C. If we are considering the acceleration of chemical-induced degradation of the materials within a collection, we should be looking at the average annual temperature and the rate of fluctuation (seasonal change) as our most important considerations in terms of temperature.

Summary

Since the experimental period began we have only used the waste heat from the ground floor to condition the four strong rooms above. The air conditioning has been turned off and there has been no energy bill for storing the entire archive, with no apparent detrimental effects to the collection. Calculations have suggested an annual saving of £6.5K (£1.5K on gas and £5K on electricity). The cost of maintaining plant has also been eliminated.

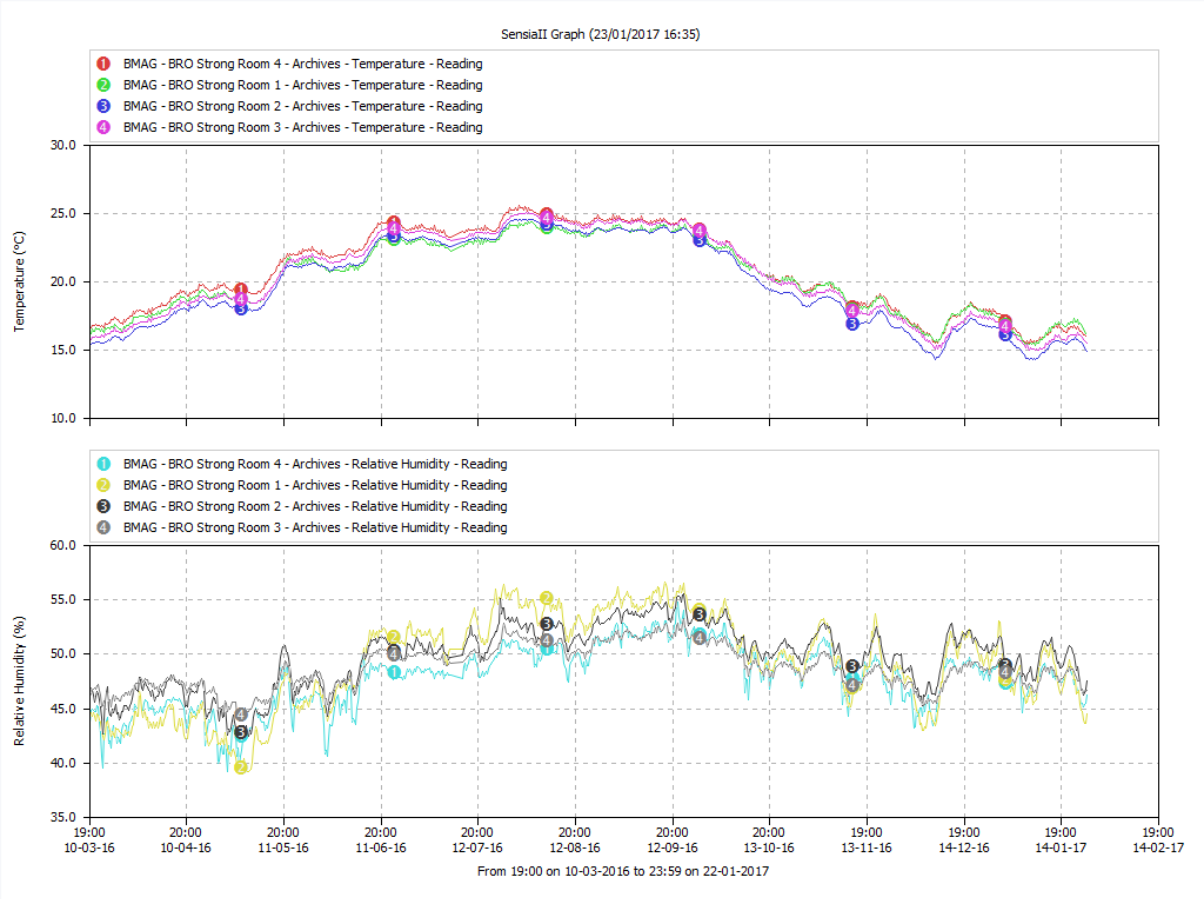

Figure 1. B-Bond – Bristol Archives. These charts show the temperature (in °C) and relative humidity (%RH) in all four strong rooms over the period March 2016 to February 2017

CASE STUDY 2 – A-Bond museum storage: improvements made to the environmental conditions for the Housing of the British Empire and Commonwealth Collections (2012/13)

At the beginning of 2012 there was an immediate need created for more storage in Bristol Museums, Galleries and Archives, by the taking over of the collections of the British Empire and Commonwealth Museum. The 7,000 objects and 77,000 archives had to be documented, packed and

transported into new stores at short notice, to enable handover of their existing accommodation for development. It was decided that A-Bond warehouse, located next to B-Bond, was the only feasible option. Floor 2A (east), which already contained some museum collections, should be fully utilised for museum storage and floor 6B (west) would be used to accommodate the associated archives.

Dimensions

A-Bond, an undeveloped bonded tobacco warehouse, next to B-Bond, had several empty floors. Like B-Bond the floors are divided across the centre of the building forming two discrete stores. Each of the half floors is roughly square with a floor area of 865 m2. The ceiling height is 2.4 m; however the usable working height for storage, due to lift size and ceiling supports, is only 2.0 m. The volume of each half floor is therefore 2076 m3 (with a storage volume of 1730 m3). The ground floor of the building is double height.

Monitoring and testing prior to suggesting modifications

Measurements for relative humidity (RH) and temperature had been recorded in the 13 month period between June 2010 and June 2011. Readings were taken on the ground and first floors with the windows closed and the second floor with some of the small windows open. All readings were from the A-side (east) stores within the warehouse (which have less solar gain).

Records for the first floor gave a minimum temp of 3°C in December and a maximum 19°C in July. The temperature changes were gradual and similar to the external average figures. The maximum range within any month was 7°C in Nov (6.5 to 13.5). The minimum range within any month was 0.2°C in July (18.9 to 19.1).

The RH records for the floor 1A gave the range 53 - 80%. The lowest average month was May with 60% and the highest average month was February with 71%. For considerable periods of time the RH was over the 60 - 65% RH danger-threshold, at which mould growth on organic materials and accelerated corrosion of some metals can occur.

The records of temperature for the floor GA (ground) show that it was generally about 0.5°C cooler than the first floor, but recorded a minimum annual temp of 5.9°C in January (3°C higher than the floors above). Each month the average RH for the ground floor was 6% higher than that on the first floor.

Floor 2A, where the windows were open, showed greater variation in temperature and was generally one degree C hotter than floor 1A. The RH readings show fast and wide variations within the range 47 - 89%. The average RH reading each month is however very close to the average readings from those on the first floor (where the windows were closed).

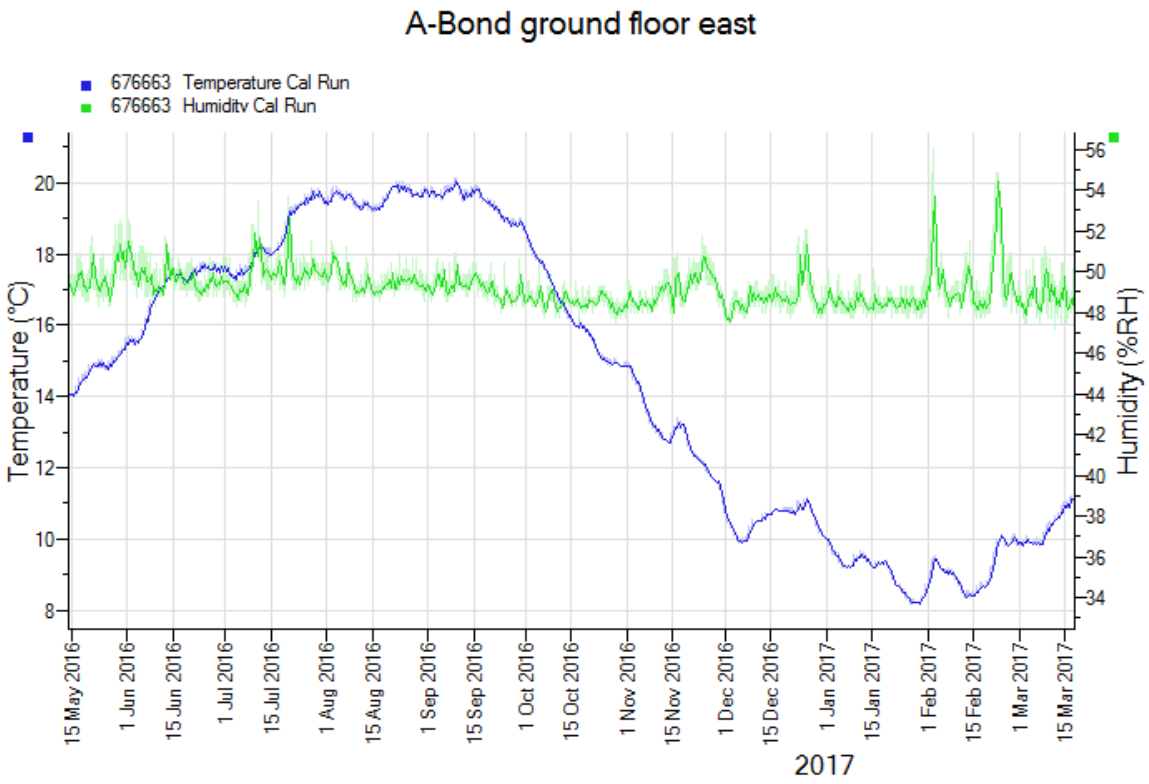

Figure 2. A-Bond – British Empire and Commonwealth Collections and Archives. This chart shows the temperature (in °C) and relative humidity (%RH) in the ground floor store over the period May 2016 to May 2017.

Implementation of environmental control measures on floors 2A and 6B

In April 2012 de-humidifiers were installed in floors 2A and 6B of A-Bond. 3 x Cotes Type CR200 dehumidifiers were fitted in each space using existing vents and grills in the exterior walls for intakes and outlets. At the same time the windows were closed and sealed with silicone and a secondary insulation was added over each window recess, in the form of a sheet of fire-retardant bubble-wrap stretched over a wooden frame, screwed to the wall and sealed around the edges with silicone.

Comparison of the modified (2A) and unmodified (1A) stores on the east side of the building

By comparing the records for floor 1A (unmodified) with 2A (modified with de-humidifiers controlled by hygrostats) for the period May 2012 to April 2013, it was seen that the temperature was on average two degrees hotter in the modified space (2A) for the first six months and after that the same as floor 1A. The RH on Floor 2A (modified) remained within the range 33-57%, whereas floor 1A (unmodified) ranged between 60-79% during the same period.

The collections arriving at floor 2A required immediate drying as they had previously been in damp conditions and control of mould was essential. A set point around 50% was used on the hygrostat switches. A rotating 'master and slave arrangement'[1] was set on the three de-humidifier controls

[1]A model of communication where one device or process has unidirectional control over one or more other devices

(with set points at 48%, 50% and 52%) to ensure that all three machines would not cut in together for a short period of time and then all turn off again. Setting the controls in this way ensured a more gradual change in RH while still retaining the full drying potential when it was required. The initial period after the 'damp' collections were introduced to the store saw two of the three de-humidifiers running almost constantly. This was almost certainly due to the drying of the collections and the fabric of the building rather than a reaction to the air-change in the space. The third de-humidifier was not necessary after the first six months.

For floor 2A (modified) the average temperature variation in any month was 3°C and was at its greatest variation in May (12-18°C) and April (6-10°C). In both months a gradual increase is shown with less than a 1°C daytime to night-time variation. The average temperature variation in any month for floor 1A (unmodified) was 2.5°C and was at its greatest variation in May (10-16°C). The maximum temperature was in August (21°C) and minimum in March (5°C).

The average RH variation within any month for floor 2A (modified) was 13% and varied most in November (34-57%). The results showed a double peak (44-57%), over a five-day period, and is probably the result of a faulty hygrostat switch. By comparison floor 1A (unmodified) gave an average monthly variation of 14% and varied most in April (57-81%). The range in this case is of little relevance as very rarely was the RH ever within the 'safe' parameters for inhibiting mould growth (less than 60-65%).

Energy use and costs for initial year of BECM storage

The initial year involved the cost of new dehumidification equipment (£10,686.00 per floor) and new ring mains.

The three de-humidifiers on floor 2A ran for a combined period of 7358 hours. Based on an average p/kWh price of 10.09 p and assuming an average running rate of 1.7 kWh per machine, the total price for the 12-month period is £1,266.75.

The three de-humidifiers on floor 6B ran for a combined period of 8219 hours. Based on the same calculations, the total price for the 12-month period is £1,409.81.

Both of these figures include a six-month initial period of drying out of the collections and building.

Comparison of the modified 2A (east side) and modified 6B (west side) stores

Records for floor 6B (controlled) reveal the maximum temperature recorded to be 23°C (July) and the lowest 4°C (January). Over the same twelve-month period floor 6B has been 3 or 4°C hotter than 2A (controlled). This is no doubt partially due to the greater solar gain experienced on the west side of the building. Another factor that might be influencing these results is the exterior wall thickness. In A-Bond the exterior walls are partially supporting the building above. With each additional floor weight the exterior walls increase in thickness as you descent from the eighth floor down to the ground. The solid brick walling on the 2nd floor is approximately twice the thickness of the 6th floor and therefore has considerably more insulating potential. The solar gain effect is probably greater on floor 6B than in 2A due to the insulation properties of the walls.

For floor 6B (controlled) the average temperature variation in a one-month period was 5°C and was at its greatest variation in May (11-21°C). In this month a gradual increase is shown with less than a 1°C daytime to night-time variation. The RH range has been controlled within the range 35-57%. The average RH variation within any month was 11% and varied most in December (38-57%). This seems to be the result of the faulty hygrostat switch that prevented the dehumidifiers cutting in at their set

point of 50%. With the exception of two brief periods in December and January the RH remained within the parameters of 35-52%.

The target parameters for floor 6B (Archives)

The conditions for floor 6B should be attempting to comply with PD5454:2012 as these regulations are mandatory for archives. A combination of the outer limits from sections 4.2.2 (mixed archives – excluding wax seals), 4.2.3 (paper records) and 4.3.2 (photographic, audio-visual and electronic) set the combined set of parameters for temperature at 5-18 deg. C and an RH range of 35-50%. Magnetic tape is specified at RH 25% and gramophone discs 30%. Without the capability of providing an independent store for each category at this stage, it was attempted to keep the RH appropriate for the majority of the collections stored there. The maximum temperature for general archive collections storage is specified as 20°C (25°C for paper records). 22°C is set for the duration of an exhibition, with a maximum of 25°C (4.10.3). The reason for a maximum temperature is not specified and there is no suggestion that a brief period of the year could not be allowed at temperatures up to 25°C, provided this did not have a detrimental effect on RH stability.

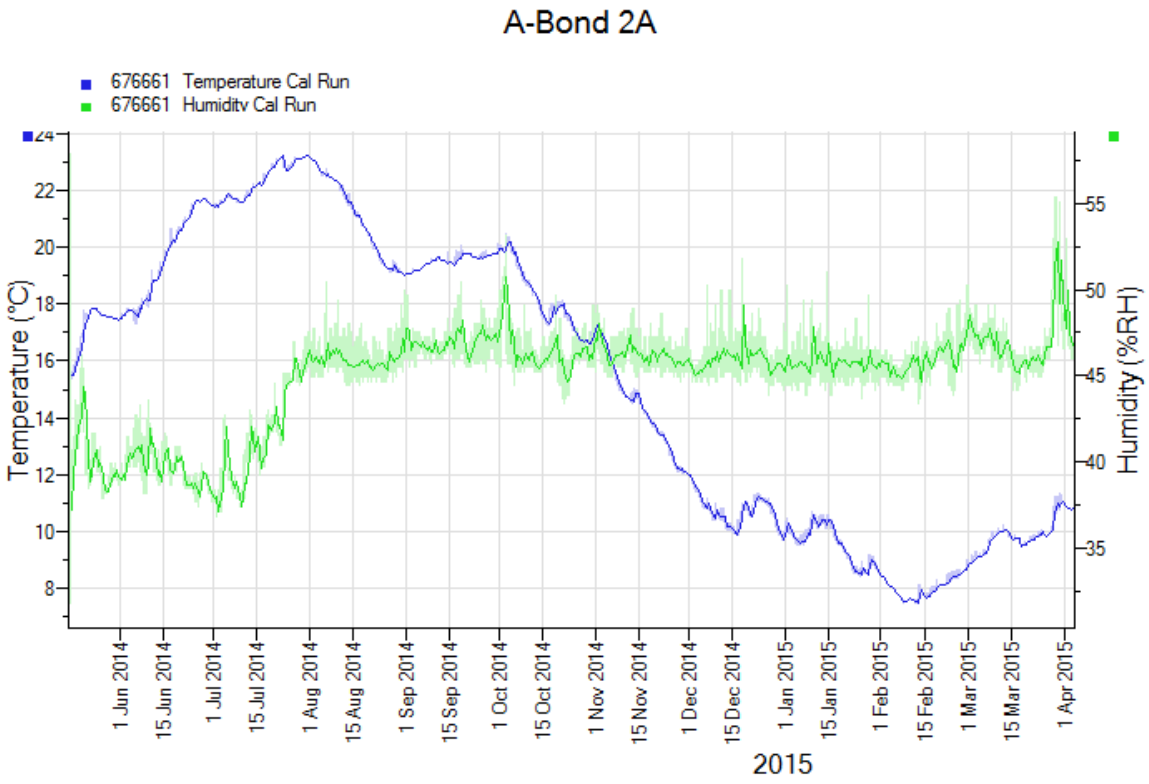

Figure 3. A-Bond – British Empire and Commonwealth Collections and Archives. This chart shows the temperature (in °C) and relative humidity (%RH) in the second floor store over the period May 2014 to April 2015. The change in RH in July 2014 is related to a better quality humidistat being fitted, which gave accurate control to the 'set point' and 'cut-in' point.

The target parameters for floor 2A (Museum storage)

The conditions for floor 2A should be attempting to comply with the Specification for managing environmental conditions for cultural collections PAS198:2012. For the materials stored in the space

a maximum temperature of 20°C is indicated (page 20). An advisory minimum 5°C is given because of 'risk of frost damage to pipes'. This is not relevant to these stores, as no mains water supply exists above the ground floor. Chemical and mechanical stability parameters for RH for organic materials are set between 30% and 65% RH. Maximum fluctuation is stated as +/- 15%. It is noted that some inorganic materials, such as metals, benefit from RH below 30%.

Summary

The modifications to the floors for basic museum and archive storage has caused no visual alteration from the exterior of the building, involved no new holes having to be made in external walls or windows and no alterations being made to original features or the structure of the building. The interior of this listed building remains visible to visitors still as a warehouse, but now with varied items stored within the spaces. The environmental conditions created in the modified areas are close to meeting those specified in BS5454:2012 for storage of archival materials.

In 2014 the hygrostat switches were replaced with more reliable models to attempt to minimise RH variation for collections in stores and minimise waste of energy (through unnecessary operation time).

Once initial drying had taken place for floors 2A and 6B, two of the CR200 dehumidifiers were re-sited in the ground floor store (GA). All three conditioned stores are now capable of maintaining a stable RH between 47-55%.

A National Trust House Manager's perspective on open stores

Eilidh Auckland

House Manager, Dyrham Park

Dyrham Park is a National Trust property located 8 miles north of Bath and has been open to the public since 1961. The property houses a mixed collection of over 8000 objects typical of a large country house. Following a major roof conservation project in 2015, the House and Collections Manager has created an open store on the second floor of the mansion. More than 250,000 visitors come to Dyrham Park each year, and it is the aim of National Trust to ensure visitors experience a visit that moves, teaches and inspires support. The stores are open daily to free, public guided tours, available to conservators and a small studio provides a bookable space for training sessions or researchers.

This paper illustrates how visitors access and experience the stores, the training of the volunteer guides, how the stores benefit the organisation in terms of getting our core message across, while providing better storage facilities and a space to work. The rationale behind the creation of the store along with the plans for the rest of the mansion and its important 17th century collection of tapestries, paintings, delftware and furniture will be explained as Dyrham plans to undergo a period of re-interpretation and conservation.

A history of the future - storing a popular culture collection at Manchester Metropolitan University Special Collections

Alison Draper

Object Conservator, Manchester Metropolitan University

Many smaller organisations do not benefit from the expertise of different in-house conservation specialisms and lone conservators frequently have to deal with a variety of collection, object and material types. This paper describes the storage decisions taken in relation to the acquisition of a new collection. The collection encompassed many different types of objects and materials dating from the 1970s to 1990s – termed here as a collection of 'Popular Culture'.

This paper will also describe how Manchester Metropolitan University (MMU) Special Collections uses the collections for object based teaching sessions and how this consideration impacts upon storage decisions.

Context - MMU Special Collections

MMU Special Collections is a University Museum primarily used to support teaching, learning and research by providing access to primary source material. It is fully accredited by Arts Council England. The collections consist of a number of discreet, named collections, most of which have their foundation in the Manchester School of Art. This originated as the Manchester School of Design in 1838, and became the Manchester School of Art in 1853.

The nucleus of the collection was acquired for the associated Arts & Crafts Museum, established 1898, and the Arts Library, established in 1845. In 2005, the collections were formally brought together under the title of 'MMU Special Collections' and housed in the University Library. In terms of public spaces, this now consists of a research and reading room, an education space and a public exhibition gallery.

The storage areas are divided into three, and reflect the broad collection areas of objects, books and paper. The object collections span the decorative arts of the nineteenth and twentieth centuries, as well as contemporary craft and design. These are stored in a small storeroom entirely fitted out with metal cupboards, long span racking and picture mesh.

The book collections are stored on open access shelving within an environmentally controlled and invigilated reading room, and include artists' books, books relating to book design and childrens' collections. Finally, the paper collections including archives, print history, works on paper, Victorian ephemera and decorated papers are stored in a room fitted with standard plan chests and shelving.

Overall, space is extremely limited, with a small exhibition space, reading room, conservation studio, office and two stores. There is no room for expansion, with stores fitted out to their maximum capacity.

Description of the Collection

The collection discussed here is known as the Malcolm Garrett Collection of Popular Culture. Malcolm Garrett is a graphic designer, the first Royal Designer for Industry, an alumnus of MMU (as Manchester Polytechnic), and known for designing many iconic record covers including those for Buzzcocks, Magazine and Simple Minds. He was involved professionally and personally in the Punk scene, and then the 'New Wave' and 'New Romantic' periods (Garrett, 2017).

This collection of popular culture reflects the period of 1970s, 1980s and 1990s and encompasses books, zines, objects and, significantly, over two hundred items of clothing and related accessories.

The decision to acquire this collection was taken at a senior University level and consideration of any storage or conservation requirements was nominal. Although MMU Special Collections was enthusiastic about acquiring this new type of collection, the practicalities of housing it and making it accessible were recognised from the start.
Costume and related accessories was a new area of collecting, having never been actively collected before, partly due to close proximity of the designated costume and textile collections of the Whitworth and Platt Hall. Significantly, these items of clothing were not collected because they were costume but because they are part of a much wider collection. It was a big change in direction and had associated implications for the service.

Costume forms a significant part of the collection, with clothing ranging from the 1970s to the 1990s, bought by Malcolm Garrett from Vivienne Westwood and Malcolm McLaren's various shops including *Seditionaries* and *BOY London* - with their relative exclusivity and high price tag. Other items were sourced from outlets in Manchester and charity shops, second hand and vintage shops, as well as specialist Westwood dealers.

The collection contains both male and female clothing; typical punk clothing such as muslin shirts, bondage suits, T-shirts, later Vivienne Westwood items from both couture and ready to wear collections, footwear and other vintage items. They span the (seemingly) roughly made frayed hems and printed slogans of the early punk clothing to the luxurious fabrics and tailoring of Westwood's Gold label. Materials include synthetic and industrial fabrics like PVC, rubber and plastic or metal clips and d-rings.

Some of the punk period clothing represented in the collection is now rare and other museums and collectors have recognised this (Kavanagh 2016). This rarity is due to a combination of factors, such as the often chaotic lifestyle of the owners, the destructive way of wearing these clothes, the punk DIY aesthetic that cannibalised clothes to make new outfits, as well as the ephemeral nature of fashion.

Storage Challenges and Compromises
The overriding problem in acquiring this collection was the lack of appropriate space to store it. The two existing stores were completely full so no physical space was available. After much deliberation, it was accepted that it was not possible to store the existing collections more efficiently to create space in this way.

The type of existing storage furniture was also problematic, the plan chests and shelved cabinets could not accommodate the very different storage requirements of costume -and so could not be adapted. With no option of acquiring more appropriate furniture and nowhere to put it, it was not possible to unpack and assess the collection initially.

However, from the very start, the level of interest from staff and students was great, with many requests to access the material, and this had been not fully anticipated. This demand could not be disregarded or deferred, as the need to demonstrate that the collections are relevant and valuable to activities of the University is ever present.

A number of compromises were made in order to improve the storage of the collection and to enable access. The first compromise was the creation of a small storage space by partitioning off an area from the limited exhibition space. This made use of a mobile walling system that was already

present. Although this new storage space was within the secure envelope of MMU Special Collections, it did not meet some basic requirements of appropriate storage. The walls are not fixed and do not reach as high as the ceiling. As a result, there is ingress of dust and (potentially) pests and no environmental control.

The second compromise was storage furniture. From a small amount of money available as end of year surplus, the only option was to purchase ready-made, inexpensive racking that was immediately available and that could be erected without technical help. The shelving chosen was galvanized steel that clicked together easily, and performed its function to a certain degree. However, it was insubstantial with an obvious short expected life span; it was difficult to clean around and had sharp edges all over. Most importantly, it was not space efficient as ready-made configurations were limited. A bespoke configuration would have precisely fitted the contents to the shelves and made use of all available space- this is crucial when space is severely limited. The available units that fitted best resulted in the store being full of racking yet still not sufficient to accommodate the needs of the collection.

The third compromise was to buy ready-made hangers, padded hanger covers and Tyvek garment covers. Time and human resources were too scarce to make these items in-house, which was the preferred option. These garment covers and hangers were a priority due to the shortcomings of the storage space and the need to make the collection available as soon as possible. If the collection was left uncovered, the combination of soiled clothing, warm conditions and easy accessibility to flying insects posed a high risk. The obvious disadvantage of buying ready-made items was that it was a much more expensive option. As these covers were not made to bespoke sizes, there was much wastage in both materials and space; billowing covers were often the only size option available. Although the costume collection is now safely stored, readily accessible and risks to it are minimized, the overall combination of inadequate racking and oversize covers give the store an unkempt appearance. This can be considered a significant failing, as conservators know that meticulously packed and stored items will encourage people to treat items with more respect. This is particularly important at MMU as non-museum professionals access the store to select items. For example, academic staff may select items for their teaching sessions from store, and with their different priorities, time-scales and awareness, they can be less concerned with conservation considerations.

T-Shirts

The collection contains over one hundred t-shirts in different sizes, styles and condition. These t-shirts are of importance both to the punk identity and for their iconic designs, and so are in great demand for study.

For reasons previously described, it was not possible to hang these items. There was neither space nor money for housing materials. It was not desirable to box the t-shirts as it was expected that people would frequently want to physically search through and select items.
Copyright restrictions and lack of IT resources prevented a digital option being pursued as a search tool. Therefore, inspiration was taken from storing vinyl LP's and a modified conservation version was used. The t-shirt was folded around acid free card, so that the design was clearly visible, and then placed in a Melinex® sleeve. This formed a rigid packet, which could then be stored vertically, in a strong and stackable acid-free polypropylene box, with lids and locking handles. Purchasing ready-made sizes kept the cost of materials down.

This method enabled people to quickly search through the t-shirts, looking at designs whilst minimising possible damage from handling. However, folding the t-shirt created relatively sharp creases. Padding the card to reduce creasing meant that only bespoke sized melinex sleeves would have been large enough; something that was not an option with this project. With this in mind, this

storage method is not considered permanent and a long-term solution sought is when more space is available.

Cleaning

During the storage process, consideration was given to cleaning certain items. Many pieces were obviously soiled and contained sweat, dirt and other stains, and this made an interesting contrast to object conservation. The decision to remove any dirt and deposits is always carefully considered and recognised for the irreversible process that it is, but with clothing further factors required consideration. Dirt on the majority of decorative art objects for example, is most often museum dirt or similar and only rarely related to function. However, with these clothes in particular, the soiling was intrinsically related to their use. This smell was from being worn to gigs and parties and being lived in, and begs the question: should such a direct and intimate connection to the object be removed? This presence of soiling seemed to have resonance when considering its context and the punk ideology of embracing chaos, shock and rejection of society's values.

Like many items of clothing stored together, they do have a particular smell more so in the warm and still environmental conditions of the store. It was found that once the items were enclosed in their Tyvek protective covers, any smell was contained. However when they are put on open display in the future, ozone cleaning for suitable items will be investigated.

Hands-on Access

MMU Special Collections' main strength is in its object- based teaching with collections and all of the storage solutions implemented above were guided by this consideration.

The museum's purpose is "to advocate, promote and facilitate hands-on access and engagement with Manchester Metropolitan University's inspiring collection of primary source material to enrich and stimulate teaching, learning and research for all audiences."

Learning with objects has recently seen a resurgence of interest. However much of the work done and carried out in museums and galleries has focussed on designated handling collections (traditionally un-accessioned collections). At MMU, the entire accessioned collection is available for hands-on access and has been promoted as such since 2002. This approach extends to members of the public as well as academic staff and students. The only limits on physical handling are when an item is deemed too fragile, however that would not preclude the user from viewing the object at close range.

People can and do handle the collections, in particular the costume element of this Popular Culture collection. The user may be an individual researcher or maker, but more commonly, the objects are used in object-based teaching sessions, of which three a day may be scheduled at peak times. One particular Westwood corset has been requested for viewing over forty times in two years. This amounts to a lot of potential handling; from initially searching through and selecting an item, retrieving it from its store location and then from its housing, using the item in a session and then returning it to storage.

Through experience, risks to collection items have been reduced to a level that is considered acceptable to MMU. This has been achieved by both subtle and less subtle methods. The most effective method to control the risk is with subtle indicators on how to treat collections.

The most appropriate way to handle collections may have been learnt by conservators but not necessarily by others who may be new to working with collections.

The most effective method for reducing risks is the creation of the right atmosphere to encourage appropriate actions. To make users feel welcome and entitled to be there, whilst instilling certain expectations of them is a balance. MMU Special Collections is housed in the University Library; visitors enter from the lift lobby, directly into the exhibition space with its very different appearance

and lighting from the rest of the library. The visitor experiences the 'museum atmosphere' which distinguishes the space from rest of the library.

Space has been sacrificed from the exhibition area to create a dedicated object study space as an alternative to using the Reading Room. This has been found to be essential to create the calm, focussed atmosphere necessary for safe handling.

A further example of this psychological preparation for good handling can be extended to the appearance of the store. Measures such as appropriate furniture, careful labelling, packing and storage attempt to create an impression that the objects are have certain historical and cultural values and need to be treated with care. This is why the compromises made in the storage of the costume have wider implications than just physical accommodation.

Even though basic and not always ideal, the storage methods chosen have met the needs of the collection and its current usage. By rapidly making items available for study, allowing the entire collection to be easily accessible and retrievable whilst reducing risk to the objects from poor handling, the storage can be said to fulfil its requirements. The next phase of work to be undertaken on this collection will be to identify and monitor the materials it contains. Many synthetic and modern materials are present such as rubber, PVC, polyurethane and may cause problems in the future.

Conclusion

Although textile conservation has been described as being a relatively young discipline, it can be defined as highly sophisticated in its approach to both its object based research, and its conservation and treatment decisions (Brooks, 2000). The excellent breadth and detail of publications from the textile conservation community has been used to inform each step of this project and has influenced thinking about wider conservation applications.

The term 'Popular Culture Collection' is used in the title of this paper and yet indicates nothing about the material within it. It can encompass many materials. Storing, using and displaying such collections falls across many of the conservation specialisms. This cross-speciality and cross-disciplinary collaboration continues to be hugely important within conservation and can only be to the benefit of collections in the future.

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The conservation and storage of a 17th century beadwork box

Hannah Sutherland

Tapestry Conservation Intern, Historic Royal Palaces

Background

This project was undertaken during the second year of the author's training at the Centre for Textile Conservation (CTC), University of Glasgow. Projects undertaken during this part of the course aim to build on individual skills taught earlier in the programme and to challenge students to deal with more complex conservation issues. Projects are 4-6 weeks in length and students can discuss progress with the owner of the object at various points.

The beadwork box (2014.49) dates from the late 17th century, and is part of the Platt Hall Collection, Manchester Art Gallery (Figure 1). The exterior of the box is decorated with glass beads in various colours, and depicts animals and plants. The beads are stitched to linen panels, which are adhered to the wooden box with animal glue. The interior of the box is lined with card, which has been padded with cotton and wool, and covered in yellow silk. Other areas have yellow silk adhered directly to the wood. When opened, the box was found to contain several detached pieces of beadwork, padded panels and yellow silk fragments. Where these parts had come from was difficult to ascertain. The interior of the box lid revealed layers of paper, cream silk, yellow silk and thick glue. A leather hinge is believed to be original, whilst a metal one is of a later date. Holes in each corner of the base are likely to have been for feet. Although there is little provenance for the box, repair or relining is likely as various qualities of silk have been used for different elements. One of the loose padded panels contained a mid-19th century business card for an upholsterer's shop in Holborn, London.

Figure 1. Beadwork box (2014.49) Manchester Art Gallery (Gallery of Costume)

The box had undergone some previous conservation and this was the final stage of the conservation treatment. Maria Kinti cleaned and stabilized the external beadwork while a student at the CTC. The corners of the box lid were stabilized with an epoxy resin, by Will Murray, at the Scottish Conservation Studio in February 2016. This stabilization allowed the lid to sit squarely on the body of the box. For the final stage of treatment the client brief contained several points for consideration:

- Interventive treatment should focus on stability rather than aesthetics.
- The storage box should include a display mount to limit handling between storage and display, should this be required in the future and allow easy access to the loose parts.
- Handling room of approximately 10-15cm was required around the display mount.
- The storage box should include instructions for handling and packing.
- The cost of materials, both for conservation treatment and for storage should be no more than £20. Common materials should be utilized to make the method repeatable for other objects within the collection.
- The storage box needed to fit inside the museum's storage trays which measured 45x75cm.

Conservation Treatment

The condition assessment concluded that the box had suffered from water damage and was generally delicate due to age and use; the hinges were worn away and the interior showed several small ink stains. The interior of the box was also dusty, and peeling areas of silk within the box lid were a cause for concern.

Tidelines on the silk in the lid, and splits in the wooden structure suggested water damage. The movement of the wood had caused layers of glue, paper and silk to split and curl. This was most obvious around the hinges. Each time the lid was removed these curling layers were liable to catch on the box lid. Reattachment of these peeling areas was suggested to limit any further damage. Wheat starch paste was tested as it has a known affinity for working with both silk and paper (Van Steene and Masschelein-Kleiner, 1980). A ratio of 4:1 deionized water to wheat starch was used. The mixture was cooked over a hot plate for 30 minutes, until a thick, smooth paste was created. This was left refrigerated overnight and worked through a sieve the following morning. Further deionized water was added after sieving to reach a creamy consistency. Adhesion tests were carried out on naturally aged silk, wooden blocks and blotting paper to establish an appropriate method of thickening, applying and fixing the adhesive. This involved brushes, cocktail sticks, tweezers and finger pressure. A process was followed whereby a small amount of the paste was brushed onto a filter paper. After a few seconds a small amount of paste was collected. A fine paint brush was used to apply the wheat starch paste onto the lid of the box; blunt tweezers were then used to lay the silk in place over the adhesive and hold in in position for a few seconds. A cocktail stick was also used to apply pressure to individual yarns where needed. Areas of linen peeling from the exterior of the lid were also adhered in this way. During testing it was found that using filter paper to remove moisture, rather than adding less water earlier in the process, produced a smoother adhesive. At point of use, the paste had the consistency of acrylic paint. Advantages of the wheat starch paste were that it dried relatively quickly and could be produced at a consistency which would not stain the silk or paper. This method was inspired by work at the Boston Museum of Fine Arts (Thompson and Kataoka, 2011), who originally conceived it to aid reattachment of linen to wooden models of Egyptian mummies. (Figures 2 and 3).

Figures 2 & 3. Detail of box lid interior before treatment.

Three loose silk fragments found inside the box were humidified (Figure 4). These appeared to have once been glued onto a surface, as there was residual adhesive present. The imprint of a weave pattern in areas of dried glue inside the box lid were compared with the weave of these fragments. They were found to match. Small yellow silk yarns were also found held in these areas of glue. Humidification allowed for easier identification of original orientation within the box lid. Only those creases which caused their “crushed” appearance were humidified. Long horizontal creases which appeared to line up with the structure of the box were left in place. Small pieces of dampened blotting paper were aligned with individual creases, to ensure humidification was carried out only where desired. Humidification produced the desired result and each piece was able to be correctly matched to its original location (Figure 5).

Figure 4. Silk fragments before treatment.

Figure 5. Silk fragments after treatment.

The next stage of the project required a storage solution that ensured the longevity of the adhesive treatment and for the humidified pieces to remain flat.

Storage Experimentation

The box, and its associated parts, bring together a picture of the box's history and usage, by showing multiple stages of interior decoration and tools left behind by a previous owner. Ensuring their survival as a group was paramount. Due to the number of parts which comprised the 'object', a key issue was potential disassociation.

The starting point for the design of the storage box was one made by Manchester Art Gallery for another 17th century box in their collection. This design allowed one side of the box to be folded down, which meant the object could then be slid out on a display mount; something desired by the museum. The decision was taken to remove the fragments from the main beadwork box for storage. This ensured that it would not need to be opened to allow access to the fragments, therefore reducing handling. A method of creating separate spaces within one storage box was required.

Several designs and prototypes were compared, which looked at various ways of holding a shelf or tray in the same space as a display mount for the beadwork box. Methods of 'floating' a tray inside the storage box were discussed with CTC staff and paper models were used to test prototypes and to aid explanation to the client of the tray system. Melinex® tracings were made of all the flat fragments to experiment with various layouts within the storage areas. These models helped identify several early issues in the box design. One issue discovered was that lowering one of the long sides to provide access, caused the two short sides to bow outwards slightly. This in turn could have caused the any shelf or tray to move. The design was altered to make the box open at the short end, giving greater stability to the whole storage box. Another issue to consider was how to support the tray holding the fragments. Blocks of Plastazote® LD45 28mm (medium density, non-absorbent polyethylene closed-cell foam) were chosen as they were lightweight, but strong, and could be adhered in place using Lascaux HV 498 (poly(butyl acrylate) / poly(methyl methacrylate) copolymer thickened with acrylic butylester). To test the tray supports a block of Plastazote® was glued to a piece of box card, left to dry and then weighted. The support remained firm and took a much greater weight than that of the tray which would be carried inside the box. Although not an ideal scenario, as it did not replicate the exact storage box structure and storage conditions, this test did enable experimentation with scoring the Plastazote® to aid adhesion and was felt to be useful at the time. To remove any future bowing issues, a fixed shelf was added into the design. (Figures 6 & 7).

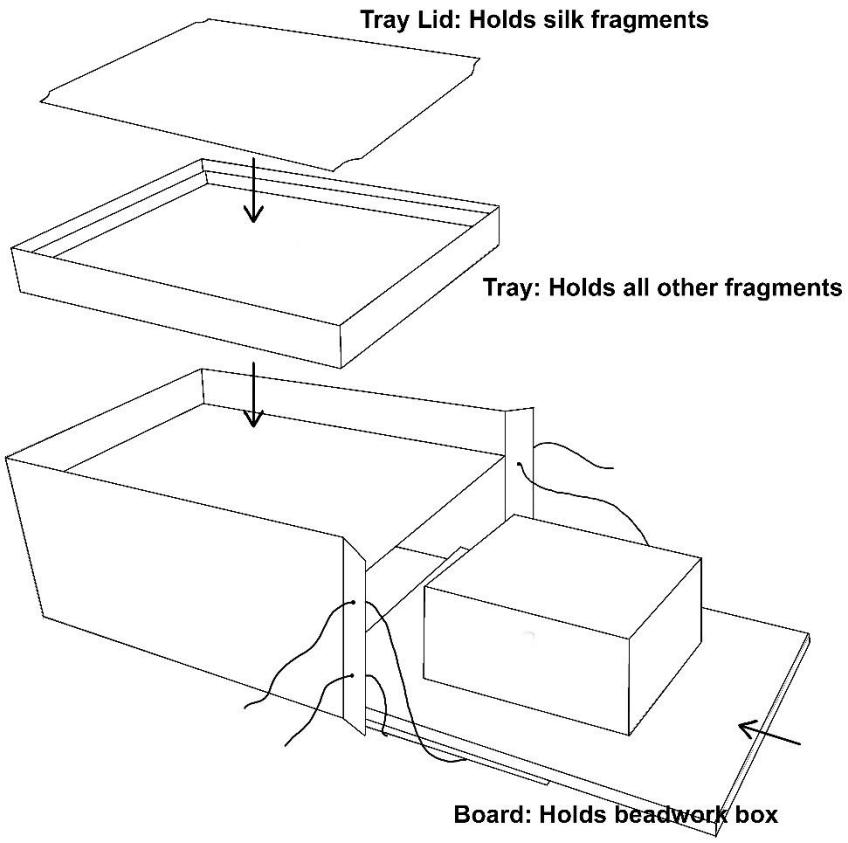

Figure 6. Final storage box design.

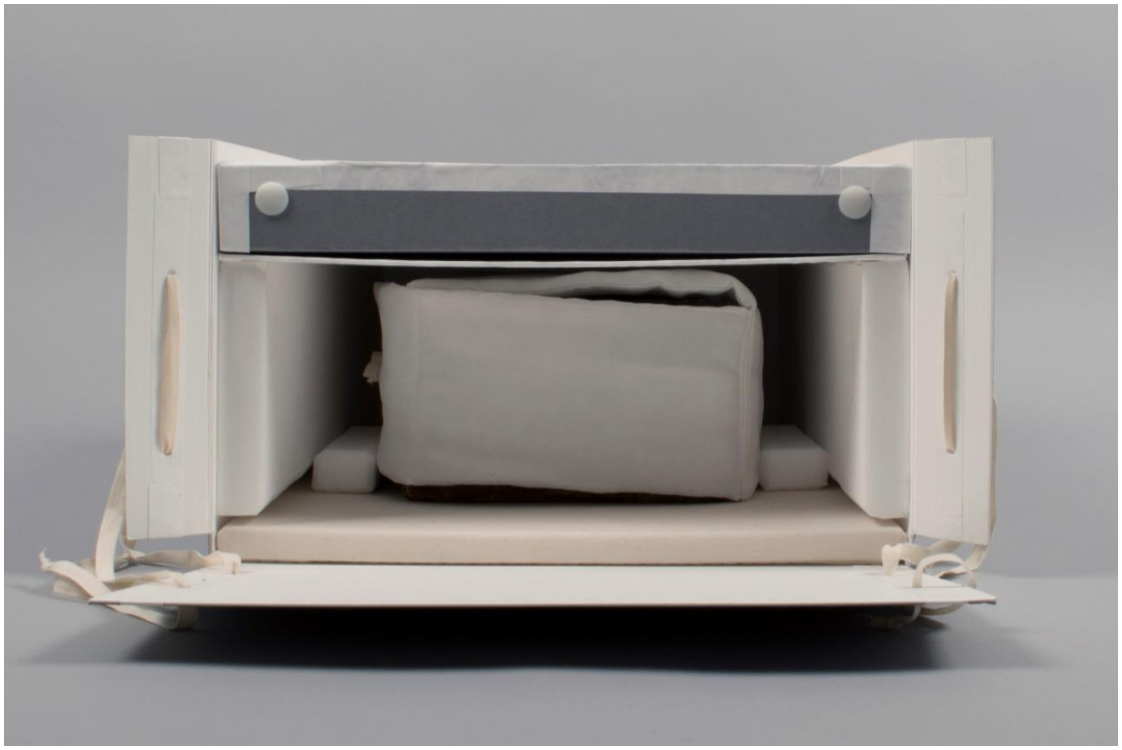

Figure 7. “Cross-section” view of storage box, showing supports and shelf.

Storage Solution

The inner lid of the storage box holds the, now flattened, detached silk panels inside a polyester pocket. This allows them to be picked up and examined from both sides. This top tray also houses an enlarged photograph of the card advert for the business in Holborn. Viewing the advert in situ requires opening a delicate padded panel. Including a detailed photograph aims to limit the number of times the panel is opened in the future. This lid sits atop a tray. The tray holds the three-dimensional fragments: the beaded panels; padded pieces of card and a pot of detached beads. Plastazote® LD45 10mm lines the bottom of the tray, with cutouts for each fragment. The tracings were used as stencils when cutting these voids. This tray sits on a fixed shelf, which is supported by Plaztazote® glued to the inside of the storage box. The whole tray can be lifted out without needing to touch or move the beadwork box, and equally the beadwork box can be removed without needing to remove the tray or lid. The beadwork box sits on a slightly padded board, covered in scoured calico. A soft wrap of silk and polyester wadding was made to surround the beadwork box to stop any abrasion of the delicate beadwork. A piece of Reemay® (acid free, random-spunbonded 100% polyester) was added between the box and box lid. This prevents abrasion of the silk on the lip of the box and of the conserved areas of silk and paper. (Figure 8)

Figure 8. Final storage box.

During the CTC's annual open day in March 2016 several visitors expressed an interest in viewing the reverse of the detached beaded panels. This construction detail cannot be seen elsewhere on the object. These panels are now stored with one face-up, and the other face-down. This was a change brought about through discussion with those who may want to access the object for research purposes. Meeting some of their needs during the storage design stage, may help reduce unnecessary handling in the future.

Conclusion

The storage box suited the needs of the object, and met the specifications of the museum's storage shelves. The removable trays allow easy access to the object, without the need for handling the object directly. This was particularly important to the client as the objects were potentially to be accessed by non-conservation staff. Instructions for handling and packing, with images, were adhered to the storage box to aid its opening and closing.

An issue that was not considered until the end of the project was transport. The beadwork box needed to be returned from Glasgow to Manchester. There was concern that tipping of the storage box in transit could cause the beadwork box to slide. A temporary solution was to add in small blocks of Ethafoam® to fill the spaces. It may have been possible to make the shelf supports wider, filling in this space, or to investigate a method of strapping the box to the display board for transit.

The materials for the conservation and storage work came in on budget and the work took 60 hours to complete. Around 23 hours was spent on the storage box. The author feels that allowing students this time to solve storage issues is good experience for dealing with more complex storage problems later in their careers. Of the remaining hours, 11 hours was spent undertaking practical experimentation and treatment, with much of the rest taken up with research, report writing and photography.

Acknowledgements

Thanks to Manchester Art Gallery and the University of Glasgow for allowing this project to be shared at the ICON Textile Group Spring Forum. Also to Ann French and Karen Thompson for their invaluable input throughout.

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Van Steene, G and L. Masschelein-Kleiner. 1980. Modified Starch for Conservation Purposes. *Studies in Conservation* 25, pp 64 -75. DOI: 10.2307/1505861.

Suppliers

Reemay®, 75 Micron 430mm x 307mm Clear Pockets, Plastazote® LD45 10mm and 28mm and Lascaux HV 498

Preservation Equipment Limited
Vinces Road
Diss
Norfolk
IP22 4HQ

How to prepare and store efficiently more than 400 printed handkerchiefs

Melina Plottu

Textile Conservator, Museum of London

Introduction

In January 2015 the Museum of London accepted more than 400 printed handkerchiefs in lieu of inheritance tax. Christopher Lennox-Boyd (1941-2012), a man of independent means who was a great connoisseur, particularly of mezzotints[1], had put together a collection covering the period from the early 18th century to the First World War. We call these textiles 'handkerchiefs', but some are as big as scarves and they range in length from around 200 to 1100 millimetres. The handkerchiefs commemorate political, military, royal and sporting events, as well as exhibitions, and maps. The museum already had a notable collection of printed handkerchiefs, and now owns more than 600.

This paper charts the different stages of bringing this acquisition into the museum and preparing it for long-term storage. It highlights the team effort required to document and treat the objects, as well as design the correct storage for this important addition to the museum's holdings.

Documentation and assessment

Preparing the different stages of the documentation was the first step. Auditing and assessing the condition of the collection was crucial to understand its content, and develop a plan for storage. Before the objects arrived at the museum, the donors had provided a list containing short descriptions and low-resolution digital photographs, and an unwieldy spreadsheet combining the two. The acquisition was processed following the usual museum procedures while preparations started for the temporary and long-term storage of this large collection. The paperwork for, and transport of the collection to the museum was organised by the registrar team after confirmation from the Arts Council England and the donors that the museum could receive it.

The handkerchiefs arrived at the museum in five large, flat cardboard boxes (figure 1). Only one day could be dedicated to the assessment of the 400 handkerchiefs before they were going to be transported to another institution with a freezer large enough to hold the boxes. This work was undertaken in a room in the museum's Clore Learning Centre, away from the rest of the collection to avoid any risk of pest infestation. Due to the large amount of objects that had to be checked, the entire conservation department and one curator were required to complete the task in time. A report template was specifically created to help record basic information for each handkerchief such as measurements, materials and any damage. Most objects are made of cotton or silk, with some wool. Depending on their knowledge of textiles, the team members recorded the fibres and condition more or less accurately. Correct measurements were necessary for preparing the permanent storage and these were captured well. The assessment was essential for the next phases of the project, to provide a better understanding of the collection and to help find the best storage solution. It was also a good example of great teamwork: everyone from the head of department to interns took part.

Once assessed, the collection was repacked and sent for freezing treatment as a precautionary measure. The museum owns two freezer units but their sizes were not sufficient to treat the entire collection. The collection was sent to the Historic Royal Palaces' walk-in freezer at Hampton Court Palace for a two-week treatment at -22 degrees centigrade.

[1] http://www.telegraph.co.uk/news/obituaries/culture-obituaries/art-obituaries/9504619/Christopher-Lennox-Boyd.html Accessed: 18 April 2017

Once back at the Museum of London, the collection was photographed by in-house photographers requiring three curators and one textile conservator to assist with handling. The handkerchiefs were photographed front and back on an angled grey, Plastazote® background (Figure 2).

Each object was given an identification number, following Museum of London's convention, and both images and object information were added to our database by our documentation officer and curators. This crucial step was going to help the team identify and locate each object during the different stages of the project. Updating the database was going to take some time, therefore the information collected during the assessment was initially put into a spreadsheet to allow investigating options for storage.

Background information about this type of object was provided by Mary Schoeser, a textile historian and Senior Research Fellow at the University of the Arts, London. Using the collection, she has written essays on five different themes; fun and games, sporting achievements, a day at the exhibition, World War 1, and the 'useful' handkerchief. These can now be used by curators and researchers and will help put the collection in context when it goes online.

Figure 1 *Handkerchiefs in their cardboard box when arrived at the museum ©Museum of London*

Figure 2 *Photography of the handkerchiefs ©Museum of London*

New storage units

Designing new storage units can be challenging. In this case the units had to hold not only the handkerchiefs, but more than 1000 other artefacts, from fans to sixteenth century headwear, which were housed where the new units were going to be installed.

Most of the handkerchiefs were suitable to be rolled on tubes. Based on the figures from the assessment, it was decided to store the handkerchiefs on cardboard tubes of four different standardised lengths: 500, 700, 900 and 1100 millimetres. The lengths and the number of tubes required in each size provided the starting point to design the new storage units.

At this stage of the project, there remained a crucial question: Where to accommodate this large collection in a store already full with over 23,000 dress and textile objects and accessories? One area on the upper level of the store was soon identified as the most suitable. There some wooden plan chests had remained after a previous store refurbishment in 2008-2009 (Figure 3). The handkerchief project provided the perfect opportunity to acquire new storage units and finally remove the old ones. The priority was to optimize the space in order to accommodate the handkerchief collection but also

to take into consideration various limitations imposed by the building such as pipes, lamps, surrounding storage units and to leave enough floor space to move safely.

Several companies specialising in museum storage were consulted to provide a plan and a quote. In the meantime, the existing wooden chests and the objects they held were moved by collection care technicians in order to make room for the new units. Space was found in the research area and the textile conservation studio, which form part of the larger dress and textile store. This meant that the collection remained in the same area, still within easy access, which proved to be extremely useful for subsequent object movements.

The company Rackline® was chosen to provide purpose-built storage for the collection. Their solution consists of eight new units with a total of 118 drawers (figure 4). Four units are dedicated to the handkerchief collection based on the four tube lengths described above, as well as the tubes' diameter. The other four units are used to store much of the already existing collection. The cabinets are made of powder-coated steel, matching the rest of the store furniture. Units dedicated to the storage of handkerchiefs have internal side supports made of the same material for receiving poles made of aluminium to reduce weight (Figure 5). Acid-free cardboard tubes with the handkerchiefs rolled onto them were hung from the poles so that the handkerchiefs are suspended and not resting on themselves. The supports are removable should drawers be used for another type of collection in the future. Drawers used for the existing collection are lined with a layer of pre-cut Plastazote®[2].

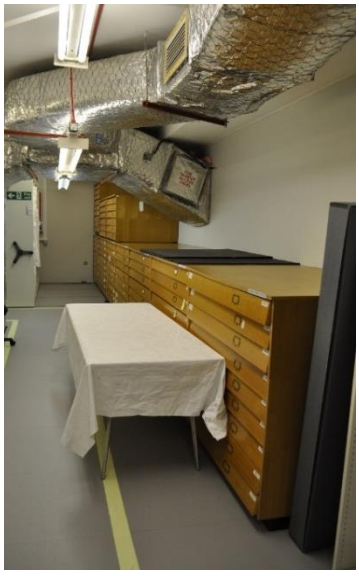

Figure 3 *Previous wooden plan chest for storage ©Museum of London*

Figure 4 *New storage units after refurbishment ©Museum of London*

Drawers can be pulled out 90 percent for optimum and safe access to the collection (Figure 6). When closed the drawers avoid any dust deposit and they are provided with a smooth runner system to minimise vibrations and object movement during opening and closing. The units were installed by Rackline® over five days.

Aluminium poles without finish turned out not to be the best choice. The poles were delivered covered with metal dust from cutting and required cleaning, an additional piece of work that had not been expected. A group of four volunteers already working in the store were a great help with cleaning all 400 poles.

[2] Ramfoam® Reference R145 LD Black, 5 mm thick

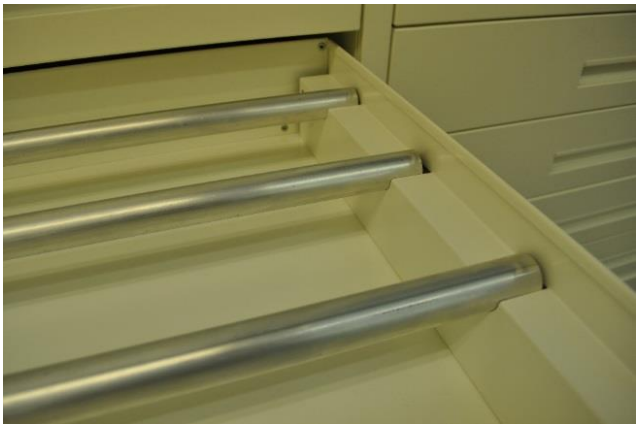

Figure 5 *Drawer fully opened with pole storage system ©Museum of London*

Figure 6 *Detail of the drawer internal support with aluminium poles ©Museum of London*

Moving, marking and rolling the collection

One curator together with conservation interns and a volunteer team undertook the huge task of auditing and moving the already existing collection into their new drawers. It was not possible to accommodate everything from the old wooden plan chests in the new units. Parts of the collection such as a large group of dolls were moved into new storage boxes, which are now kept on shelves. Once empty, the wooden plan chests were donated to regional museum with the help of our Arts Council England Collection Care development officer.

Research into various materials and storage methods was undertaken to find the quickest, safest and most effective way to rehouse the collections and to mark and roll the new handkerchiefs. Almost the entire collection was marked with a label sewn to the back of the handkerchief. The label is made of polyester tape to which a thin coat of 10% Paraloid B-72 (poly(ethyl methacrylate-*co*-methyl acrylate)) in acetone is applied before the identification number is written on top using a Pigma® archival black pen. The pre-cut, acid free cardboard tubes[3] chosen to roll the handkerchiefs were acquired from Klug®, a German-based company specialising in acid free cardboard boxes and tubes. As explained above, four different lengths of tube (500, 700, 900 and 1100 millimetres), all with a diameter of 58 millimetres, were chosen.

The handkerchiefs were rolled 'face out' with an interlayer of spider or acid free tissue. The outer layer of acid free tissue was secured with cotton tapes one of which also holds a Tyvek® label. It took the museum textile conservator and two external contractors, Gabriella Barbieri and April McNee, a total of 22 days to complete marking and rolling the collection (figure 7). Once rolled, the handkerchiefs were moved to their new location and the database updated (figure 8). The few handkerchiefs that could not be rolled for storage due to fragility, or because they were adhered to cardboard, or pinned to a frame, were stored flat in the drawers.

[3] https://www.klug-conservation.com/Tubes-made-from-conservation-board Accessed: 18 April 2017

Figure 7 *April McNee rolling an handkerchief on a cardboard tube ©Museum of London*

Figure 8 *Handkerchiefs marked and rolled on cardboard tubes in their final storage drawer ©Museum of London*

Funding and communication

Thanks to the efforts of its Development department, the museum was able to part-fund the handkerchief project. The Drapers' Charitable Fund and the Barbara Whatmore Charitable Trust generously helped the museum acquire storage material, pay for the extra help with marking and rolling the handkerchiefs, and for the contextual reports mentioned above.

There is still much to be explored about these type of objects, such as who printed them, where were they sold, how they were used. On 17 March 2017, a one-day colloquium brought together experts from several disciplines to share their knowledge. The day included a visit of the Dress and Textile Store in order to show the work accomplished by the museum team to the funders.

The project was also promoted on social media using the Twitter®[4] platform to share the progress of the work.

Conclusion

This ambitious project was undertaken while regular museum work continued. It is therefore unsurprising that it ended up taking almost two years and involving more than thirty people.

There were some unexpected setbacks, such as having to remove grease and metal filings from the aluminium poles, which could have been avoided by choosing a different material or asking the contractor to provide already cleaned poles. The marking and rolling of such a large collection of flat textiles promised to be a lengthy task, which indeed it turned out to be. However, the methodology used was very successful.

Overall the handkerchief storage project proved how much can be achieved in a short time with good preparation and teamwork.

Acknowledgments

This project was only made possible with the help of Museum of London colleagues, volunteers and contractors. With many thanks to Historic Royal Palaces for their help with the freezing treatment and

[4] https://twitter.com/melinaplottu/media Accessed: 18 April 2017

to our donors The Drapers' Charitable Fund and the Barbara Whatmore Charitable Trust for their generous contributions.

Suppliers

Storage units	Rackline Oak Tree Ln, Talke, Talke Pits, Stoke-on-Trent ST7 1RX Telephone: +44 (0)1782 777 666 http://www.rackline.com/
Acid free cardboard tube	KLUG-CONSERVATION Walter Klug GmbH & Co. KG Zollstraße 2 87509 Immenstadt i.A. GERMANY Telefon +49 (0)8323 9653 37 Telefax +49 (0)8323 9653 399 37 www.klug-conservation.de
Polyester tape	Cole fabrics Romandus House Ludlow hill road West Bridgford Notthingham NG2 6HF Telephone: +44 (0) 115 923 6000 Fax: +44 (0) 115 923 3274 www.colefabrics.com
Pre-cut Plastazote sheet	Ramfoam Ltd Birmingham Rd, Dudley West Midlands DY1 4RF Telephone: +44 (0)1384 453160 http://www.ramfoam.com

Storage techniques for Art, Science and History collections (STASHc.com): an online resource for collection storage

Lisa Goldberg
STASHc Editorial Committee Chair

Rachael Perkins Arenstein
American Institute for Conservation e-Editor

The need for wide access to information on storage solutions was documented in the US by the Heritage Health Index survey, conducted in 2004 (Heritage Preservation 2005). This comprehensive survey assessed the condition of U.S. collections held in archives, historical societies, libraries, museums, and scientific research organizations, large and small, from internationally renowned art museums and research libraries, to local historical societies and specialized archives. Published in a report called *A Public Trust at Risk: The Heritage Health Index Report on the State of America's Collections*, the study documented the conditions of approximately 4.8 billion artifacts held in U.S. public trust Heritage Preservation, 2005). The report concluded that priority needs included staff training and storage solutions (Figures 1 & 2). This survey was followed by a second survey in 2014, with informally reported results indicating that the highest need for collection care was inventory and registration control. The ability to perform these functions is driven by adequate storage space and storage housing, indicating that the need to disseminate good information on storage resources is still a high priority in the U.S (Langa 2015).

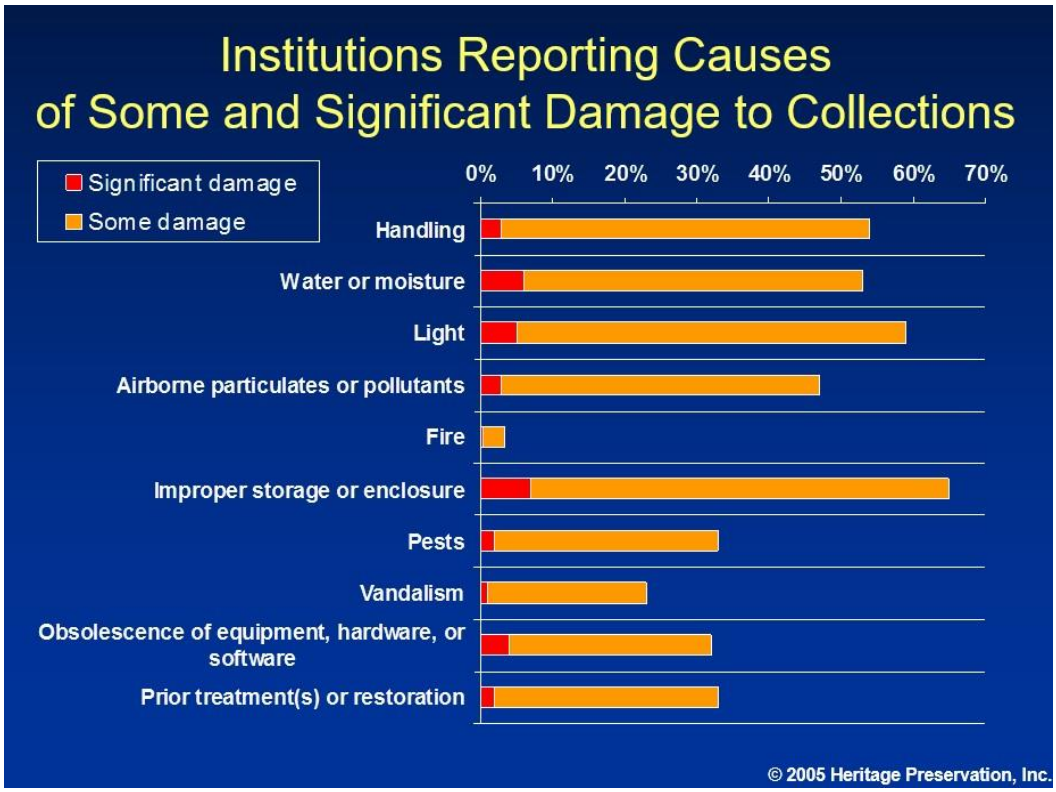

Figure 1: The 2005 Heritage Health Index reported that approximately 65% of institutions suffered some sort of damage to collections due to improper storage containers or methods

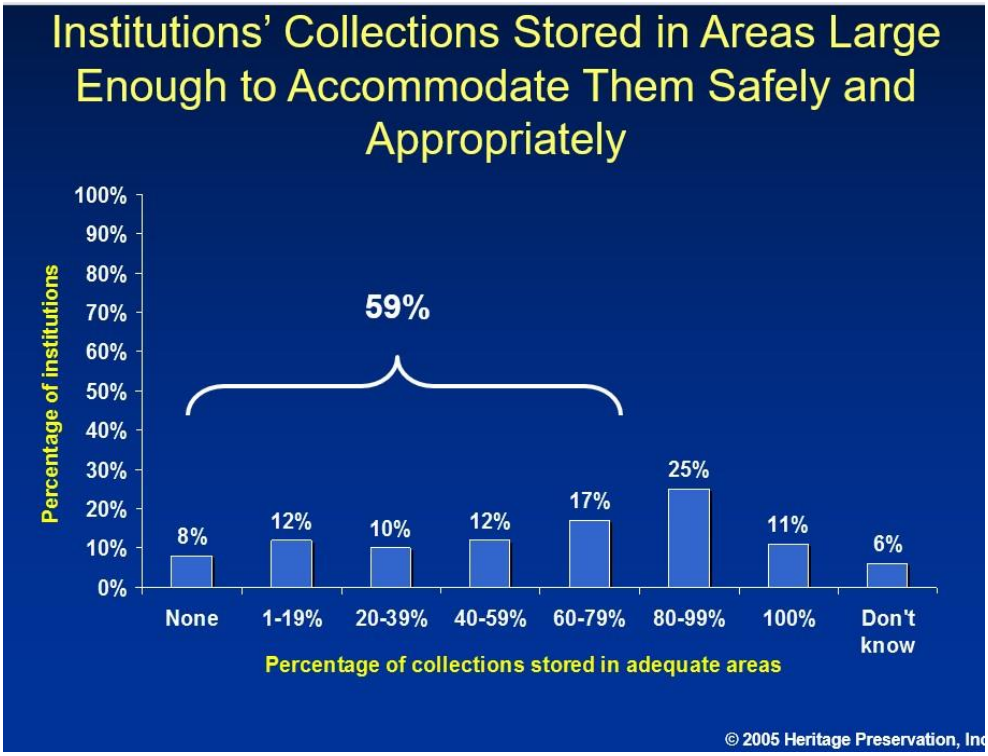

Figure 2: Almost 60% of institutions reported that their storage facilities were not adequately sized to safely store the majority of their collections. (Heritage Preservation, 2005)

Other similar surveys including the Canadian collections survey conducted in 2008/2009 by the Canadian Art Museum Directors' Conference (CAMDO); the Wales Spotlight on museums survey (conducted in 2007 and 2015); the U.K. 2008 Collections for people: and the stored collections of UK museums report indicated that collecting institutions lack adequate storage facilities (RE-ORG 2017). These wide-range, large scale surveys all point to the need for accessible resources to help institutions address their storage needs.

The recent development of free online resources for the cultural heritage community has given museum professionals access to an array of tools that provide easy access to collections care reference information, facilitate online conversation among disparate colleagues and offer examples of active engagement in collections care activities. Online communities of collections care professionals have created multi-faceted tools like MuseumPests.net to provide information on targeted subjects like pest identification, control and eradication. Professional organizations like the American Institute for the Conservation of Historic and Artistic Works (AIC) have designed knowledge building collaborative platforms like the AIC Wiki and are shepherding online community resources like Connecting to Collections Care.

Online self-assessment tools are now available to help institutional staff examine their facilities and collections condition, to provide insight on collection storage. For example, the Preservation Self-Assessment Program (PSAP) developed by the University of Illinois Libraries, is a free online tool that allows users to evaluate the condition of their collections and make improvements through a "guided evaluation of materials, storage/exhibit environments and institutional policies" (University of Illinois, PSAP)). The site includes a very useful "Collection ID Guide" that helps users identify the composition and history of their collection item materials, and provides direct guidance for storage environment, enclosures, storage orientation and collection handling.

More global in scale, the RE-ORG site[1] sponsored by ICCROM, provides methodologies that allow institutions to re-organize their storage space in a methodical manner. This tool takes the user through four phases of storage assessment and re-organization, including an institutional self-evaluation, a storage condition report, planning for storage re-organization, and implementation of storage re-organization as a single project. The goals and outcomes for this project are:

- Improvements in collection storage housings
- Full collections accessibility
- The creation of systems to maintain and develop even better solutions for storage areas.

In 2014 the Foundation for the American Institute for Conservation (FAIC) and the Society for the Preservation of Natural History Collections (SPNHC) launched Storage Techniques for Art, Science, and History collections (STASHc) (Figure 3). This website is designed to gather, organize, and solicit information about collections storage exemplars. The site expands upon the 1992 SPNHC volume *Storage of Natural History Collections: Ideas and Practical Solutions*, edited by Carolyn L. Rose and Amparo De Torres, one of the few published books on storage support designs.

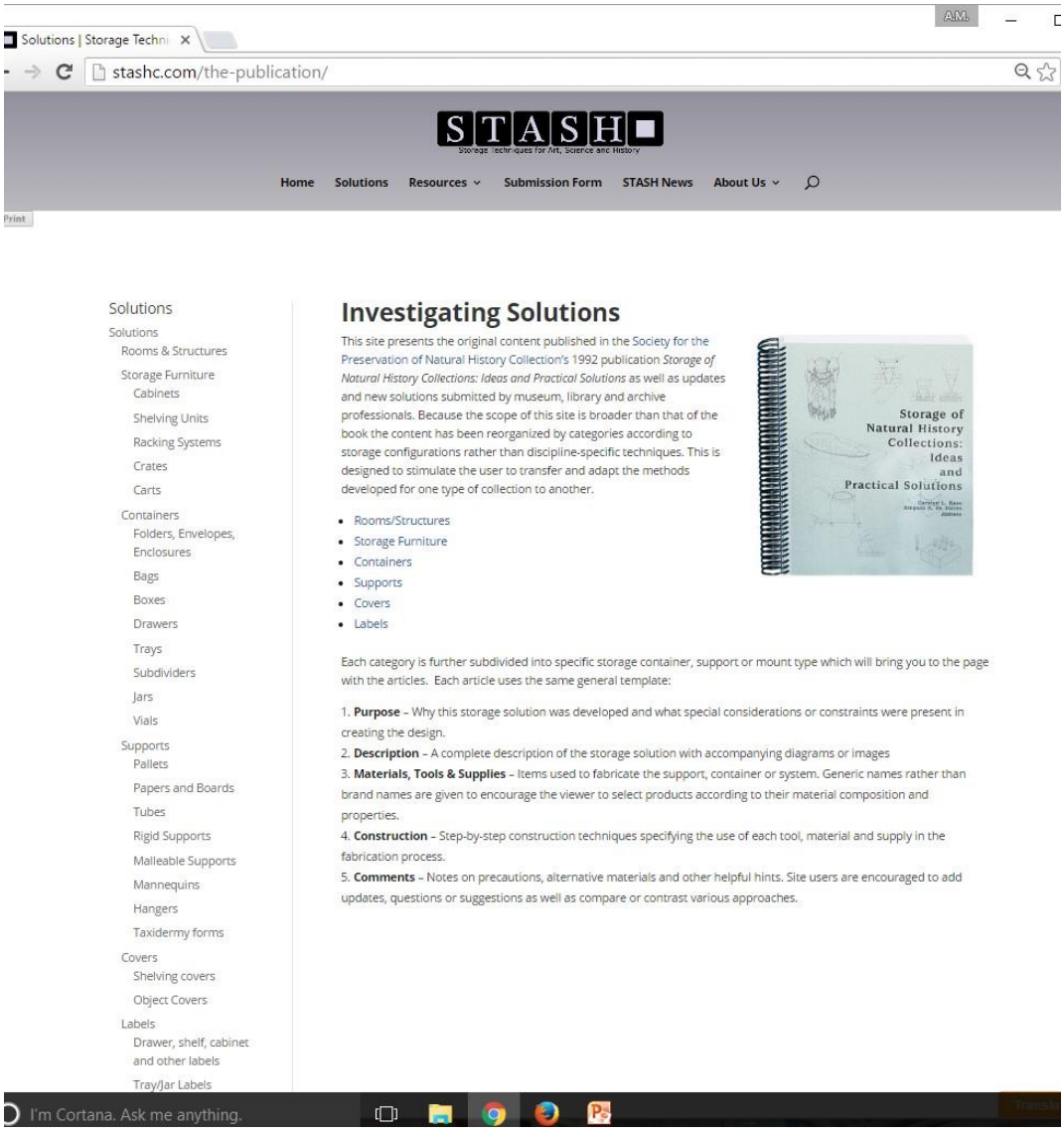

Figure 3: Screen shot of the www.STASHc.com website

The STASHc website catalogues storage support solutions for cultural property, creating an online resource that gives museum professionals from institutions of all types and sizes access to a bank of ideas designed to provide better collections care. The site can be used to find solutions to recurrent storage problems, prompt the development of new ideas, or browse entries to view what others have done to resolve their own storage conundrums. A digital platform was chosen to allow for new contributions, conversations about rehousing solutions, and the materials and tools used to create them. The site encourages multiple solutions for similar collection types, recognizing that a successful mount design will depend on a variety of factors including time, space, material availability and staff skills. The website catalogues storage support solutions for all kinds of cultural property, thus creating an online resource that gives museum professionals from institutions of all types and sizes access to a bank of ideas designed to provide better collections care.
The organizational scheme for storage configuration relates directly to the nested storage model that many museum professionals use when considering levels of protective care (Figure 4). By considering this tiered model, STASHc can be used synchronously with the RE-ORG website. Museum professionals can utilize RE-ORG to help evaluate current storage space configurations in relation to individual item storage, and then determine which collection components will be allotted time and resources for planned improvements.

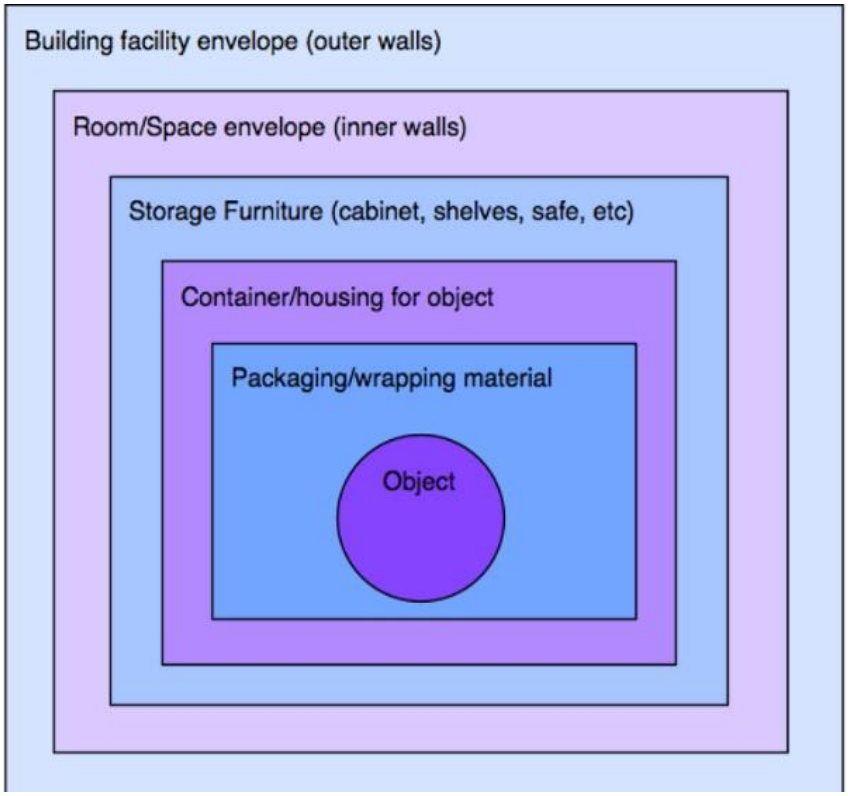

Figure 4: Decisions made on packaging and containers in storage will depend, in part, on how much protection the item is receiving from the storage furniture, room and building.

STASHc is organized by storage configuration, rather than discipline-specific techniques or object name, to encourage thinking first about the type of spaces available for storage, followed by exploration of various options for housings. While this may seem counterintuitive when searching for design ideas for a particular type of object, the site includes a robust search function that allows users to query broadly. Based upon the tiered or nested model for storage, this organizational

scheme allows users to consider their proposed solution within the framework of extant storage options for their particular institution.

The *Solutions* section of the site where the articles are presented is organized using the following site structure:

- Rooms & Structures
- Storage Furniture
    - Cabinets
    - Shelving Units
    - Racking Systems
    - Crates
    - Carts
- Containers
    - Folders, Envelopes, Enclosures
    - Bags
    - Boxes
    - Drawers
    - Trays
    - Subdividers
    - Jars
    - Vials
- Supports
    - Pallets
    - Papers and Boards
    - Tubes
    - Rigid Supports
    - Malleable Supports
    - Mannequins
    - Hangers
    - Taxidermy forms
- Covers
    - Shelving covers
    - Object Covers
- Labels
    - Drawer, shelf, cabinet and other labels
    - Tray/Jar Labels
    - Object Labels
- Environment

Each category includes introductory material to help define the type of storage containment or support offered by each configuration. To use the site, first identify the configuration that best suits specific collection needs and then browse for ideas among the list of titled entries. The nested structure of the site encourages individuals to think more broadly about the type of support or mount serving the storage function that fits within the designated space. For example, 'bags', 'boxes', 'drawers' and 'trays' are all found by targeting 'containers', while internal supports, such as

‘rolls’, ‘mannequins’, ‘malleable (soft) supports’ and ‘hangers’ are all found under ‘supports’. For textiles, rolled storage systems are found nested under ‘Storage furniture’ as ‘Racking Systems’, and includes articles that describe support structures for long narrow objects, but can be expanded to include support systems for other types of objects such as vertically mounted masks, paintings racks and storage systems for crates requiring power-driven equipment like fork-lifts. The advantage to grouping storage systems together is that practical solutions for seemingly dissimilar structures can sometimes spark new innovations in how we construct solutions.

Each article is presented as a downloadable PDF, and each article uses the same general template:

- Purpose – Why this storage solution was developed and what special considerations or constraints were present in creating the design.
- Description – A complete description of the storage solution with accompanying diagrams or images
- Materials, Tools & Supplies – Items used to fabricate the support, container or system. Generic names rather than brand names are given to encourage the viewer to select products according to their material composition and properties.
- Construction – Step-by-step construction techniques specifying the use of each tool, material and supply in the fabrication process.
- Comments – Notes on precautions, alternative materials and other helpful hints. Site users are encouraged to add updates, questions or suggestions as well as compare or contrast various approaches.

The site also includes:

- A Glossary to assist in understanding technical terminology.
- A Materials, Supplies and Tools chart that identifies various products by material component, brand name, manufacturer and supplier.
- A Conversion tool to easily convert measurement units
- Integration with Google Translate, allowing users to translate text into a variety of languages.

The site encourages online communication about storage solutions through:

- A blog with posts that addresses broader storage themes and issues. The blog provides a page for topics that affect storage choices. Examples include posts covering labeling and visible storage.
- An online comments feature to allow for interactive discussions, reviews or modifications of entries. This feature was designed to encourage user comments about variations such as design elements or materials choices.
- An ‘Adapted from’ section within each article to direct site users to other, similar case studies that may provide additional ideas for storage design modifications. This section in each article allows authors to reference the sources used in designing their solution.

New content can be submitted to the site several ways:

- Through an online submission form that provides pre-set blocks for entering information within the pre-determined template. Filling out this submission form will alert the editors automatically that you have sent in something new.
- By emailing a copy of your submission to authors Rachael Arenstein or Lisa Goldberg as a MS Word document
- By participating in a STASH Flash session of lightening round contributions at the Annual Meeting for the AIC or at other allied professional meetings.

The site is supported by allied professionals representing a wide range of professional associations with the goal of encouraging discussion about storage solutions among all sectors in the cultural heritage field, such as curators, conservators, collections managers, registrars, museum preparators, and volunteers. Each of the editors working on the STASHc site helps upload articles, and engages their professional community to encourage submissions and site use. As the site grows, some of these individuals are exploring options for meeting sessions within their organizations that will encourage more submissions. The editorial team is appreciated and applauded for their work in making STASHc a resource that can be used by cultural heritage professionals in a wide variety of institutions.

Unlike some other aspects of preventive care, there are few right or wrong answers in creating storage supports, and a successful solution is the result of numerous choices regarding materials, techniques, time and skill. STASHc crowd-sources community driven solutions and creates a platform for connections and commentary between collecting institutions, individuals involved in collections care, and preservation vendors, thus creating a community for individuals directly involved in collections care activities (see Poster).

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The powers of microfibre cloth

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Introduction

The Victoria and Albert Museum and National Trust both have textiles that have become soiled from open display, this is a common predicament for Collections across the world. For the V&A, amongst the most problematic are a group of carpets that hung on semi-open display for over 50 years. In the case of the National Trust, for whom open display is the norm, the example discussed in this paper is a suite of upholstered furniture at Knole House, which has been on open display for 150 years.

The other common factor between the two groups is both are piled textiles; the V&A carpets are hand knotted and the Knole seat covers are wool velvet. The soiling had not responded sufficiently to various methods of dry removal, including thorough vacuum cleaning and smoke or cosmetic sponges. Whilst it was anticipated water would be required for removal, full immersion washing was not desirable in the case of the carpets, and not possible for the in-situ upholstery covers.

Microfibre Cloth

Microfibre cloth has been used for some years in Europe but the treatments brought to the attention of the authors were all dry usage. Also the products in use were not readily available in the UK. A sample microfibre make-up pad available from German retailer Jemako was obtained from the Abegg Stiftung.[1] Further information from conservators at the Rijksmuseum showed they were using them very successfully to surface clean fragile silk curtains.[2] It had been made clear that the quality of microfibre was significant, both the length and type of pile: cut or looped, the weight of the cloth and most importantly the fibre composition or polyester/polyamide ratio. Research began on what was available in the UK.

Microfibre describes long synthetic fibres that measure only a few micrometres in diameter, significantly smaller than cellulose fibres. This size difference means the larger solid cotton fibres are limited in the amount of soiling they are able hold, and inevitably some is left behind. Another limitation of cotton is that it is hydrophilic (it binds with water) and does not bond with hydrophobic molecules making detergent necessary to clean greasy soiling. Polyester, the main component of microfibre, lifts grease without the need for a surfactant. Also, the structure of microfibre means that these fibres are able to pick up and retain more dirt particles than cotton.

Microfibre cloths can be 100% polyester, the higher quality are made from a mixture of polyester and polyamide. These conjugated fibres are produced together in a specific form with a star-shaped polyamide core and wedge-shaped polyester sections fitted around the outside. Percentage combinations of microfiber cloth range from 95% polyester/5% polyamide up to 70%polyester/30%polyamide.

[1] Sample kindly given by Anja Bayer, Textile Conservator, Abegg Stiftung, Riggisberg, Switzerland
[2] Our thanks to Carola Holz, Textile Conservator, Rijksmuseum, Amsterdam, Netherlands, for sharing results of her work

The quality and cleaning effectiveness of the cloth depends on the blend of fibres, equally important is the level of split. The star and wedge-shaped fibres are split apart by a specific combination of chemicals, heat and agitation into 16 ultra-fine filaments. Cloths that are highly split cling to human skin giving them a 'sticky' feel, whereas cloths that are not split just feel soft.[3]

Good cleaning properties come from two factors: static for dry cleaning and absorption for wet cleaning. Static is produced by the millions of split filaments rubbing together. Used dry, this static charge holds the dirt particles inside the fibres until the cloth is washed when the charge is released and the dirt falls away. Polyamides can bind with water, however when used damp most water absorption is a result of capillary action pulling the water deep into the cloth via the large surface area of the different shaped fibres. Water is stored between the fibres but is not chemically attached to them, as it is with natural fibres. Microfibre cloths can absorb 8-25 times their own weight in water.

Initial tests

Initial tests were carried out at the Knole Conservation Studio on sample textiles removed from 19th century chairs.[4] They were:

a) red wool velvet

b) blue cotton velvet

Both had quite heavy surface soiling in the pile, representative of that found on both object types (velvet upholstery and pile carpets). Prior to the test both samples were vacuumed and smoke sponged.

Dry tests - The covers were divided into individual test strips of approximately 3.5 x 9.0 cm. Each of the cloths listed below was first tried dry, wiping over the pile: side-to-side and in a circular motion for 5 mins. Though only a small amount of soiling was removed in all cases, it was clear there was a difference in performance of the cloths:

Results

1) 100% cotton – little soiling removed
2) 100% polyester - slightly better
3) 80% polyester/20% polyamide – good

Wet tests - The cloths were then dampened in de-ionised water and again wiped over the pile: side-to-side and in a circular motion for 5 mins. The damp application was immediately followed by wiping over with a dry cloth, until the relevant strip was dry to the touch.

Initial results - Again cloth 3) performed noticeably better than the other cloths, removing considerable amounts of soiling with both the damp and dry applications.

Detergent test - Using cloth 3) (80/20 microfibre), it was dampened in wash solution (0.5g Dehypon LS54 in 500ml de-ionised water) and wiped over a strip as above, the strip was 'rinsed' using a clean cloth dampened in water only, total time 5 mins. This was followed by a dry cloth.

[3] 100% polyester microfibers and unsplit conjugated fibres are used for clothing and baby wash cloths etc.
[4] Inside back chair covers retained by Heather Porter while working in the upholstery trade.

Commercial dry cleaning powder test - A strip was cleaned using 'HOST SJ', a powder made from tiny cellulose sponges containing water, an anionic detergent and 'safe-to-use solvent'.[5] It is stored in an airtight container and is damp to the touch. For use, a teaspoon of HOST SJ was wrapped in muslin and wiped over a test strip on each seat cover as described above.

Results - All the cleaned strips were evaluated by the authors and colleagues present in the Studio. All participants picked the same two strips as being the cleanest, they were:

- 80/20 microfibre cloth dampened in deionised water only
- 80/20 microfibre cloth dampened in wash solution

There was little visual difference between these two strips, and to avoid issues arising from detergent residue, it was decided to use water only in the next stage of testing.

The commercial dry cleaning powder had not performed well and it was noticed that it had left the cotton pile with a clumped appearance.

Upholstery Test

The first suite of furniture at Knole requiring cleaning is covered in an 18th century wool velvet fabric.[6] The same fabric has been used to make window curtains, a table cover and line the walls of two rooms. The seat furniture alone consists of six sofas and nine chairs. A seat cushion from one of the most soiled sofas was chosen for this test. The cushion had been thoroughly vacuumed, smoke sponged and vacuumed again. Though much soiling had been removed, the cushion remained stubbornly dark in appearance.

Methodology – To monitor what was happening on the reverse of the velvet, the four cotton tapes used to close the cushion along the back were untied and Tyvek inserted between the velvet and the cotton ticking cushion cover to monitor any dampness on the cushion below. Using 80/20 microfibre cloth, the cloth was sprayed with deionised water until uniformly damp, and wrapped around a piece of damp Ramer sponge.[7] Using the cloth in combination with the sponge had two advantages: the level of damp was easier to control and maintain, and the resulting package gave a soft but substantial pad with which to work.

Working in sections of approximately 20cm x 15cm, the pad was wiped over the pile, side-to-side and in a circular motion to encourage the soiling off the pile and onto the cloth. The area was then wiped over with a dry cloth wrapped around a piece of smoke sponge, again to make a soft but substantial pad (Figure 1). The processes were repeated until the area was judged clean, ensuring the last pass of the dry cloth was always in the pile direction.

Results - Vast amounts of soiling were released onto both the damp and dry cloths and the pink colour of the velvet reappeared. It was an enormously satisfying treatment (Figure 2).

[5] HOST SJ is used commercially by sprinkling a small amount of powder onto the carpet, and using a specially designed machine with rotary brushes to move the powder around the pile. The dirty powder is then vacuumed away. However tests by other conservators found the fine powder was almost impossible to remove. Sample obtained from another conservator.

[6] Set of chairs, inventory number 129499.1-9. Set of sofas 129498.1-6

[7] Ramer sponges are made from PVA foam and are extremely absorbent.

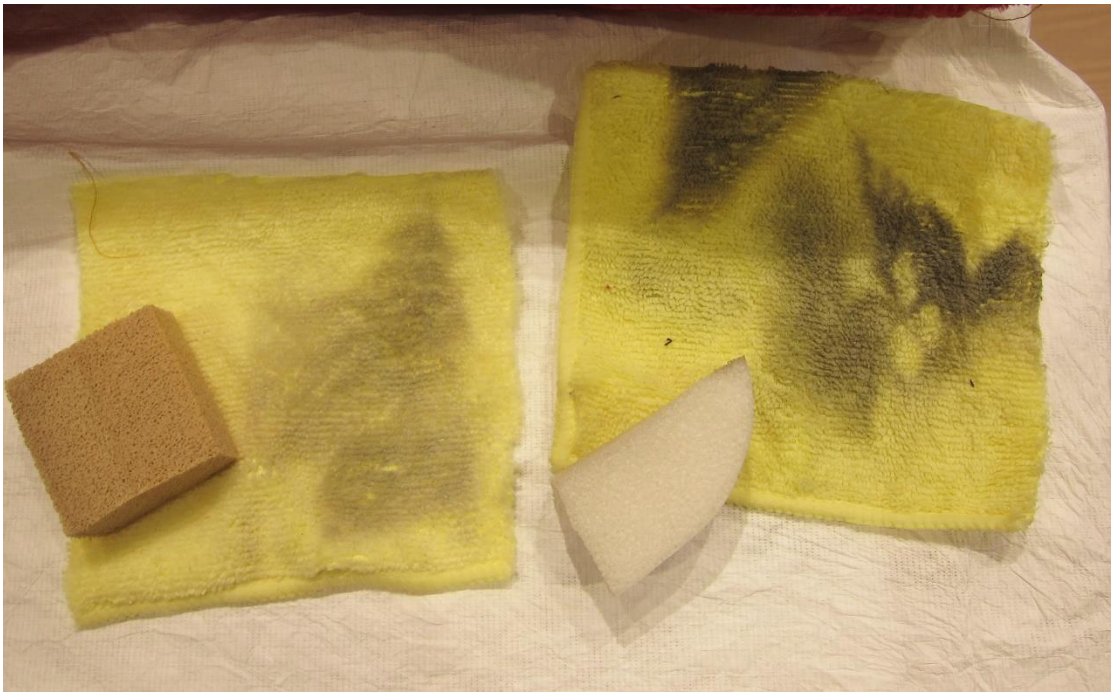

Figure 1. Initial tests with Microfibre cloth. Damp cloth on the right wraps around a damp Ramer sponge, dry cloth on the left used with a smoke sponge. Both removed significant soiling.

Figure 2. Wool velvet showing the complete colour change before and after cleaning.

Shortly after the first test day two further cloths were sourced and used damp and dry on the cushion to check their performance against the 80/20 microfibre, one performed well:

1) 70% polyester/30% polyamide 300gm – best cleaning result
2) 70% polyester/30% polyamide 500gsms – pile too long, difficult to use.

Unlike other cloth the 300gm 70/30 microfibre was available to purchase by the meter.[8] It felt the most gentle against the velvet pile and was used as the main cloth for the duration of treatment.

Treatment - Fortunately the chair and sofa covers are removable and where possible Tyvek was positioned under the velvet covers for cleaning.[9] For the first chair, a new 80/20 microfibre cloth was also placed under the cover. After cleaning, some of the velvet's pattern of flowers and leaves was found to have transferred to the cloth, as dirty water had been drawn down through the velvet's structure. This indicated the level of wetting was too high. For the other chairs the dampness of the cloth was kept to a minimum but the precautionary Tyvek was used below all covers to prevent accidentally soiling the stuffing cover below. Results were very good but cleaning by hand was quite slow, especially on the most soiled horizontal surfaces where it was necessary to repeat the damp/dry cloths applications multiple times.

Industrial cleaning machine – a second test day was arranged to test the use of an industrial carpet cleaning spotting machine made by Alltec, in combination with a specialist hand tool.[10] The aim was to find a system to achieve the same controlled cleaning results, but quicker. Wet-vac machines work by delivering clean water from a tank via a small tube operated by a trigger, and removing the dirty water by vacuum suction along a wider hose into a separate tank. Heads vary and the Sapphire Hand Tool is one of the most advanced for industrial use (Figure 3). It has two vacuum slots either side of a row of tiny holes that deliver the water. A dial connected to the tube adjusts the amount of water delivered. Used on its own, the Sapphire Hand Tool saturated a piece of test terry towelling. To reduce water delivery, the head was wrapped in a piece of damp 70/30 microfibre cloth and immediately the water delivery was reduced.

Methodology - The Alltec spotting machine was used as described above, to clean half of one sofa cushion. Working in strips at right angles to the pile, the head was 'wet' passed once over the area and then dry passed with vacuum suction only, moving side-to-side over the same area. This short action dampened the velvet and agitated the fibres, which began to release soiling. The damp area was wiped gently with white terry towelling that came away black, followed by side-to-side wiping with dry 70/30 microfibre cloth, again coming away very soiled. The visual improvement was immediate. Using the machine was about four times faster than using the cloth only but required two to three people to operate the machine, gently tensioning the fabric to prevent wrinkling, and speed drying the area.

[8] Paragon Microfibre. Premium General Purpose Microfibre 0.13 denier. Also sold as square cloths in various colours.

[9] Tyvek used under horizontal surface - sofa arms, chair seats and sofa cushions.
[10] Alltec Spotting Machine and Sapphire Hand Tool

Figure 3. Sapphire Hand tool with very controlled water delivery through small holes and vacuum slots either side.

In further tests tepid water was used, which speeded soil release and reduced the amount of wiping required. The spotting machine does not heat the water but warmed deionized water can be added to the tank. If working by hand, water can be heated in, and sprayed directly from, a baby bottle warmer onto the cloth.

Results – Levels of cleaning achieved were good using all methods. The choice of cold/warm water and hand/machine application depended on the level of soiling, the condition of the velvet (weak and light damaged areas of short pile need special care), quantity of area to be cleaned and number of conservators available, but all ultimately delivered the same good results.

Carpet Tests

A 1950's Scandinavian carpet in the V&A collection (T.611-1974) that had been washed in the 1990's was under consideration for display in an exhibition. When it was unrolled, it was found to be covered in a layer of display soiling which had blackened the crowns of the pile, giving it an overall grubby appearance. The cotton/linen structure and base of the knots had remained clean. Tests were carried out in a discreet area to see if the damp/dry microfibre cloth method described above would remove this soiling. It did very successfully, but sadly the carpet was dropped from the exhibition and the cleaning had to be abandoned.

Further tests using the Alltec Spotting Machine were carried out on a rug donated for the purpose. Though the rug was not representative of 'display' soiling, having spent its life in a busy domestic household, it was very heavily soiled making cleaning it a generally a tougher proposition.

Using the machine and the Sapphire Hand Tool wrapped with 70/30 microfibre cloth, the methodology used on the upholstery was adopted to clean half the rug, using water alone. The first

half was then masked off with polythene and the second half of the rug was sprayed with detergent solution (0.5g Dehypon LS54 in 500ml water) and left for 2 minutes. Using a microfibre cloth dampened in warm water the area was wiped over, followed by a dry cloth. The machine was then introduced following the protocol above.

Results – The carpet, which had a cotton warp and very worn wool pile, became damper than desired. However, the appearance was greatly improved and much soiling was removed. The two halves looked comparable, though the first half cleaned with water alone had taken 1hr 15 mins and required more wiping, the second half took only 45mins and required less wiping.

Conclusion

It was known that microfibre cloth used dry, was a valuable tool for surface cleaning textiles where sponges were considered too damaging. Now microfibre cloth used damp, has proved very effective at the removal of surface soiling on objects where full immersion wet cleaning is either not desirable or not possible. Tests have shown that the inclusion of detergent can be optional. They also showed that increased dampness, increases the amount of soiling removed but this can be a danger and is an area that has to be carefully judged and controlled by the conservator.

Microfiber cloth is low tech, readily available, inexpensive and does not require specialist machines, though the use of the Alltec Spotting Machine with the Sapphire Hand Tool did speed up both treatments. The authors will carry on testing different techniques using microfibre cloth and hope that others will follow suit.

Acknowledgements

Our thanks to Anja Bayer for her assistance with samples and contacts. To Carola Holz for generously sharing results of her microfibre cloth treatments. To Ksynia Marko, Textile Advisor, National Trust for suggesting warming the water and to Glyn Charnock, Chameleon Cleaning for coming to Knole for testing and giving advice about machines and process. Thanks go also to Sandra Smith, Head of Conservation (V&A) for permission to publish.

Materials & Suppliers

Alltec Network (Spotting Machine and Sapphire Hand Tool)
Butts Business Centre
Fowlmere, Nr Royston
Herts SG8 7SL, UK
www.alltec.co.uk

Boots Chemist (Ramer Sponge)
High Street

Paragon Microfibre Ltd (70% polyester / 30% polyamide microfibre cloth 300gms)
Cousley Wood Garage
Wadhurst
East Sussex TN5 6EP, UK
wwwparagonmicrofibre.com

Preservation Equipment (Smoke Sponge)
Vinces Rd
Diss
Norfolk, IP22 4HQ, UK
www.preservationequipment.com

SYR (Heavyweight Microfibre Cloth 80% polyester / 20% polyamide 320gsm)
Lye By Pass
Lye, Stourbridge
West Midlands, DY9 8HG, UK
www.syrclean.com

The Fosshape™ Revolution

Rachael Lee

Textile Conservation Display Specialist, Victoria and Albert Museum

Introduction

Fosshape™, a low melt polyester fabric, has been gaining momentum as an alternative mounting staple for the display of fashion and dress within museums. In recent years this versatile material, which can quickly transform from a soft felt to a hardened three-dimensional form, has facilitated many new costume mounting methods at the Victoria and Albert Museum (V&A). This paper will begin with an introduction into some of the innovative and economical uses of Fosshape™ by mount-makers working in the United States. How their approach has inspired the V&A's own development will then be examined through case studies from two V&A exhibitions, *You Say You Want a Revolution? Records and Rebels 1966-1970* and *Undressed: A Brief History of Underwear.* Different methods, including how to create dynamic full figure mannequins and how to simulate the appearance of fibreglass, will provide mounting techniques and practical solutions for the use of Fosshape™.

Costume Mounting at the V&A

As the popularity of fashion and textile exhibitions has increased over the past decade, costume mounting has advanced rapidly as a specialism within the V&A's conservation department. An annual exhibition in the V&A's fashion gallery will typically house around 100 ensembles that require varying forms of mounting, for example *Balenciaga: Shaping Fashion*[1]*.* Alongside this there are also large shows in the Museum's main exhibition space, which are often fashion or textile focused in themselves[2], or in other cases contain a number of costumes that require mounting.

The growth and success of the Museum's public program has in turn amplified the expectations of curators, designers and visitors on how dress is displayed and presented within a museum setting. *Hollywood Costume*, *David Bowie Is* and *Alexander McQueen: Savage Beauty* are notable examples of how the V&A's technical expertise has developed in order to create dramatic and highly animated displays. Fosshape™, an unassuming polyester fabric, has started to play an important role in furthering the development of costume mounting for exhibitions such as these.

What is Fosshape™?

Fosshape™ is a non-woven, low melt polyester fabric[3] that shrinks and hardens when heat activated. It comes in two different weights, a lightweight 300grms 4mm in thickness and a denser 600grms 6.5mm in thickness. In its un-activated state it can be pre-shaped to fit around a solid mould. The application of pressure and heat, over 90°C or 200°F, will shrink the fibers by up to 30%[4] and can be activated using a commercial steamer and industrial or domestic iron[5]. Once Fosshape™ has set it can still be cut and sewn, making it easy to adapt into three-dimensional forms. The fact that it has a quick dry time, less than 10 minutes to the touch, makes Fosshape™ considerably quicker to use than traditional mount-making materials such as buckram, a cotton or linen fabric impregnated with wheat starch paste (Flecker 2007). Due to its inert properties and lightweight

[1] Presented in the V&A's fashion gallery May 2017 – Feb 2018

[2] Presented in the V&A's main exhibition space *The Glamour of Italian Fashion 1954-2014,* April – July 2014

[3] Fosshape™ is formed of polyethylene terephthalate (PET) (Gamper et al.2016)

[4] http://www.wonderflexworld.com/Fosshape™ -frequently-asked-questions/

[5] A muslin cloth should be used as a barrier layer between the Fosshape™ and steamer/iron

structure (Gamper et al. 2016), it is of no surprise that Fosshape™ has become popular as a conservation grade mounting material.

The Use of Fosshape™ by Mount-makers

The *International Mount-makers Forum* (IMF) is a biennial conference that brings together mount-makers, conservators, and preparators to exchange knowledge and ideas on the mounting of artefacts, art, and fragile materials. In 2016 innovative approaches to costume mounting were presented at the 5th IMF[6] by Shelly Uhlir, an Exhibitions Specialist Mount-maker at the National Museum of American Indian[7] (NMAI) and Jim Williams, Preparator and Exhibition Designer at the Kent State University Museum[8] (KSUM).

At the NMAI, Uhlir is responsible for mounting a broad range of indigenous and ethnographic costume for which it is not always possible to use commercially available mannequins. Display figures are therefore often made from scratch using a range of materials, including Fosshape™. In 2012 a new exhibition, *The Circle of Dance*[9], used the medium of music and dance to highlight the enduring spiritual culture of native peoples throughout the Americas. The representation of the costumed body in movement was integral to this narrative and alongside video footage, of ten social and ceremonial dances, ten individual costumes were displayed. Uhlir had the challenge of creating articulated mannequins in distinctive poses, from native dances such as the *Hopi Butterfly* dance and the *Lakota* men's traditional dance. The mannequins not only needed to safely support the costumes over a long display period, but embody a culturally accurate expression of these long standing styles of dance.

Uhlir's process was to start by carving an Ethafoam torso and hips which she then padded with polyester wadding and covered with stockinette. This created the main body that was secured vertically with bespoke metal fixings. The arms and legs were also carved from Ethafoam, however the visible parts of the body needed to be made from a practical material that would be more defined, Fosshape™ was therefore used to make the hands and heads of the figures.

The Method: Hands

1. Alginate moulds were taken of human hands in the required poses, some of which were expressive and others that needed to hold objects. A mixture of duoMatrix® NEO[10] was poured into the moulds, once set the alginate could be removed and the cast hands left to fully dry.
2. Fosshape™ 300 was neatly wrapped around the cast hands and seams were marked in the most discreet position.
3. Excess material was trimmed away and seams were pinned or stitched together.
4. The Fosshape™ was then activated using a commercial steamer and once cool and dry, cut along the original seams and carefully removed. The seams were then stitched back together to complete the Fosshape™ hands.

Where the mannequins were required to hold objects Uhlir first made armature mounts which would support and bear weight. The Fosshape™ then acted more like a skin that covered the armature to appear as if it was holding the object, when in fact it was not in direct contact (figure 1).

[6] The 5th IMF hosted by Cleveland Museum of Art, Cleveland OH 4th – 5th May 2016
[7] http://nmai.si.edu/ Part of the Smithsonian Institution, Washington D.C
[8] https://www.kent.edu/museum
[9] *The Circle of Dance* displayed at NMAI-NY New York, 6th Oct 2012 – 8th Oct 2017
[10] duoMatrix® NEO is a gypsum based polymer https://www.smooth-on.com/products/duomatrix-neo/

The Method: Heads
To create the heads Uhlir started with existing Dorfman Ethafoam head mounts[11], however there needed to be more distinction between the male and female dancers. Uhlir applied a cellulose based modeling product called Sculptamould®[12] directly onto the existing heads to create more definition in the faces. Once fully dry the heads were used as moulds and the Fosshape™ was then applied following the same method as the hands.

Finishing:
To complete the mannequins, all of the visible Fosshape™ parts were painted with a dark grey low-VOC[13] matte-latex paint that unified all of the figures and avoided the issue of replicating skin colours. Over brushing Fosshape™ can make it too 'hairy' and abrasive, so paint was therefore dabbed into the surface as this retained a subtle texture. For the *Hopi Butterfly* dancer, the realism of the figure was taken one step further by applying bright acrylic paints to illustrate the distinctive body-art that is an important feature of the *Hopi Butterfly* costume (Figure 1).

Uhlir's combination of materials and techniques enabled her to make functional full figure mannequins. Yet her overall approach towards mount-making is one of creative confidence as she pushed Fosshape™'s properties, resulting in vibrant display figures that embodied the character and dynamism of ten native dances.

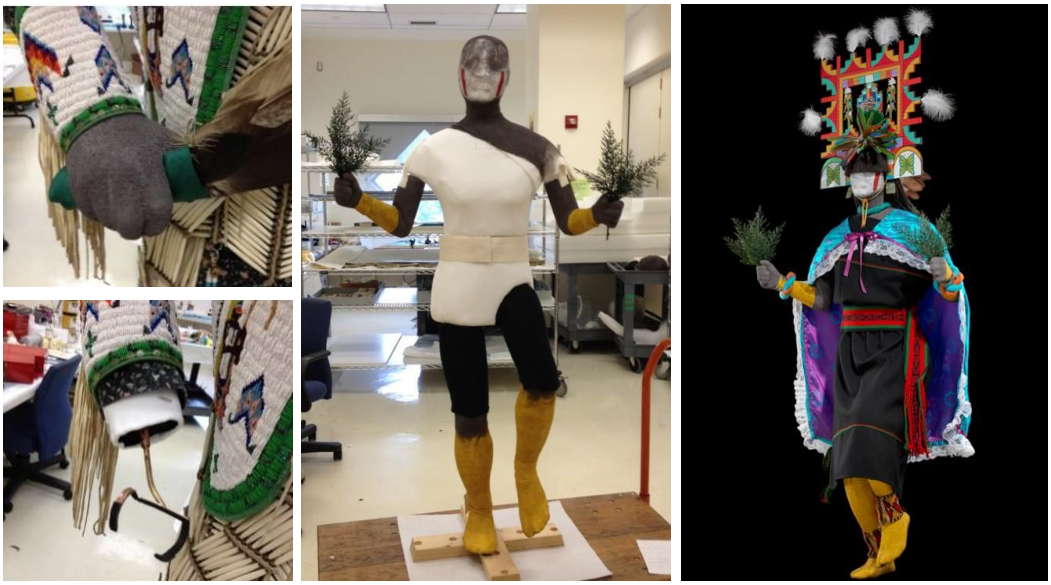

Figure 1 *Metal armature mount and Fosshape™ skin 'holds' objects in place. The Hopi Butterfly Dancer, finished mount before and after dressing**.** Photographs courtesy of Shelly Uhlir ©NMAI*

In contrast to the NMAI's colourful and characterful mannequins, Preparator Jim Williams from KSUM has been utilizing Fosshape™ as a practical problem solving material. For the KSUM's 2015 exhibition *Flapper Style: 1920s Fashion*[14]*,* there was a need for a slim boyish figure that would be

[11] http://www.museumfigures.com/
[12] A dry, white, non-toxic modeling material http://www.amaco.com/
[13] *Volatile Organic Compound*
[14] *Flapper Style: Fashions of the 1920s* displayed at KSUM 25th Sep 2015 – 4th Sep 2016

robust but with a soft finish to support heavy and fragile 1920s dresses. With only modest resources available Williams needed to devise a quick mounting solution in order to mass produce a petite female figure.

Figure 2 *The 4-part torso. Photographs courtesy of Jim Williams ©KSUM*

The Method:

- Starting with an off-the-shelf polystyrene torso, Williams carved down the figure into a more tubular, flat-chested shape.
- The torso was then cleverly cut into 4 pieces that fit together like a jigsaw puzzle (Figure 2).
- Calico was draped and pinned around the torso to work out a flat pattern.
- Using pattern cutting and sewing techniques Williams constructed the shell of the torso from Fosshape™ 600D (Figure 3).
- Fosshape™ was turned the right way through, with seams on the inside, and fitted over the 4-part torso.
- The Fosshape™ was then heat-activated using a commercial steamer.

Williams followed standard Fosshape™ techniques, however it was his 4-part torso invention that enabled a more streamlined method. Once the Fosshape™ had sufficiently hardened, Williams could remove the 4-part torso, one piece at a time. This meant that there was no need to cut the Fosshape™ off and re-stitch it back together, which not only saved time but gave the mount an overall smoother and stronger finish. The strength of the torso was also, in part, due to Williams' use of Fosshape™ 600D. The 'D' stands for 'density' as the fibres have a greater degree of mechanical entanglement compared to the regular 600grms. When heat activated the fibres form a stronger bond, thus making the finished article much sturdier. Williams' impressive 4-part torso and subsequent use of Fosshape™, provided a simple and effective method for quickly and safety mounting objects.

Figure 3 *Fosshape™ pinned and machine-sewn before fitting on to the 4-part torso and the finished Fosshape™ mount. Photographs courtesy of Jim Williams ©KSUM*

Faking Fibreglass

In 2016 the V&A's fashion gallery exhibition *Undressed: A Brief History of Underwear* presented some very unusual mounting problems. The exhibition included a contemporary piece of shape wear made of Lycra[15], which was designed to 'uplift' the buttocks (Figure 4). However when dressed onto a hard fibreglass mannequin there was no sense of the enhancing effect this garment would have on the body and the unsightly joins in the mannequin were also visible. With a limited budget to purchase new figures an existing mannequin needed to be significantly adapted, by increasing the size and profile of the buttock, in order to aid the interpretation of this contemporary undergarment.

Fosshape™ seemed like the obvious material to use, as it could easily be formed into a rounded three-dimensional shape. Yet Fosshape™'s 'furry' texture did not match the smooth surface of fibreglass and painting alone would not achieve a convincing imitation. It was clear that another surface enhancing material was needed. Foamcoat™, a water-based plaster-like coating that can be applied to a variety of materials, most commonly foam, offered a promising solution. Another mounting project carried out at the NMAI[16] proved that Foamcoat™ could easily be applied to calico and had passed Oddy testing on all levels[17]. After trialing Foamcoat™ in combination with Fosshape™ a method was established for faking the sleek appearance of fibreglass.

Figure 4 *Stages of mounting T.20-2016 ©Victoria and Albert Museum, London*

The Method:

- A larger mannequin with a rounded '*derrière*' was selected as the mould for the new buttocks.
- To pre-shape the Fosshape™ 600, darts were pinned and machine sewn to follow the curve of the mannequin.
- The Fosshape™ was then set with hot steam and pressure using an industrial iron.
- Once removed, the Fosshape™ was cut into individual buttocks that could be easily inserted between the garment and display mannequin.
- The next step was the application of Foamcoat™, the first layer was applied smoothly and evenly over the Fosshape™ using a sculptor's palette knife. Foamcoat™ needs to be worked quickly as it starts to cure after approximately 10 minutes.

[15] The Butt-lifter Premadonna T.20-2016 by 'Ann Chery', polyamide, cotton and spandex (LYCRA) 2015 worn with the waist training corset T.10-2016, 'The Works', by 'Ann Chery' for Waist Gang Society, 2015

[16] Coating a fabric covered dog to match a fibreglass horse, displayed in *A Song for the Horse Nation*, NMAI 2009-2013

[17] Oddy testing carried out by The Metropolitan Museum Department of Scientific Research, New York

- Once dry, the Foamcoat™ was sanded to a smooth finish to match the fibreglass surface. The best results were achieved with slightly dampened sandpaper.
- Two to three more coats of Foamcoat™ were applied following the same method, however subsequent layers were thinned with a drop of water before application.
- The final step was to paint the new body parts to match the real fibreglass. An air-spray paint gun provided even coverage that blended subtly with the rest of the mannequin.

The edges of the buttock inserts were rounded off and bound with a soft cotton tape that could be positioned just under the edge of the garment and held in place, without the need for additional fixings. However for a second fibreglass mannequin the technique was developed into a non-removable addition, to create a completely seamless join between Fosshape™ and fibreglass. A 1970's bra of beaten brass, made by jewellery designer Helen Newman[18], fits close to the body as a wearable piece of sculpture. A petite bust was needed to mount the bra correctly whilst providing support for the object. Fosshape™ and Foamcoat™ were used again but this time to create a new bespoke bust shape (Figure 5).

The Method:

- A flat-chested figure was selected as the starting point.
- A new bust shape was carved in plastazote and temporarily positioned onto the chest.
- Fosshape™ was then moulded over the plastazote and pinned into position.
- Hot steam and moderate pressure were applied to take a cast of the underlying bust.
- Once removed and trimmed to size, the very edges of the Fosshape™ were carefully pressed with the tip of an iron to flatten the Fosshape™ as much as possible, this helped to reduce any step between the Fosshape™ and fibreglass.
- With the plastazote mould removed, the Fosshape™ bust was permanently fixed to the chest of the existing mannequin using a hot melt glue gun.
- Foamcoat™ was then applied using the same technique of layering, sanding and then painting, hiding the join between the new bust and mannequin.

Fosshape™ was the foundation for solving these tricky mounting dilemmas but in combination with Foamcoat™ it could be pushed one step further and developed into a cost effective method for faking fibreglass, making it possible to customise and reuse expensive fiberglass mannequins.

Figure 5 *Stages of mounting M.8:1-2006 ©Victoria and Albert Museum, London*

[18]M.8:1-2006 Beaten brass bra, suede lined, made by Helen Newman, 1970.

You Say You Want a Fosshape™ Revolution?

The V&A's 2016 temporary exhibition *You Say You Want a Revolution? Records and Rebels 1966–1970*, focused on the significance and impact of the late 1960s through music, fashion, art and political activism. The V&A were tasked with the job of making mounts that reflected the fun, free-spirited essence of over 50 stage outfits and fashion ensembles, from flamboyant menswear worn by Mick Jagger to the youthful street style of British designers such as Mary Quant.

The exhibition's designers, Nissen Richards[19], were keen to experiment with mannequins and develop something new that would animate the garments and capture the character of the era. Nissen Richards' design vision was to create a disorientating collage effect for all visible parts of the mannequin such as feet, hands and heads. These were not intended to look realistic but instead have a flat printed treatment that would complement the 'psychedelic' aesthetic of the exhibition. The design proposal was not straightforward and presented the challenge of developing a system for combining two-dimensional limbs with three-dimensional museum objects.

Figure 6 *The prototype mannequin with posed Fosshape™ arms and 2D limbs ©Victoria and Albert Museum, London*

The first step was to make a prototype to determine whether the approach was feasible. The curators, designers and museum technician all gathered to assess the prototype (Figure 6). This provided an opportunity to discuss techniques and iron out any problems. It was decided that with some fine-tuning the mounting approach could work and the process was then broken down into stages.

Firstly the designers conducted a photoshoot, using live models, to capture a suitable stance for each outfit and generate the two-dimensional limbs that would be visible below the hems and cuffs of each garment (Figure 7). Each pose was determined in close consultation with conservation, taking into account each object's limitations and condition.

[19] Nissen Richards Studios http://www.nissenrichardsstudio.com/

Figure 7 *Live model and printed 2D limbs ©Nissen Richards Studio*

Once all of the limbs were photographed and roughly scaled to size the next step was for the graphic design team to begin testing different black and white printing techniques onto Forex™, a rigid foam sheeting commonly used as a printing substrate. In the meantime the costume mounting team worked on producing the mannequins.

The Method:

- A suitably sized dress-stand was selected for each outfit and customized with polyester wadding.
- Fosshape™ arms (300) and legs (600) were then made by taking moulds from existing fiberglass mannequins, following standard Fosshape™ techniques.
- Once removed, the limbs were then cut, adapted and re-stitched into different positions to mimic the poses from the photoshoot. Polyester wadding was added to the limbs where needed and finished with a stretch jersey covering.
- With the limbs made, the next step was to position and align them correctly onto the dress-stand to create a realistic pose.
- The final stage was fixing everything together. V&A technicians fixed the arms to the dress-stand using a bolt on system, so that they could easily be removed for dressing.
- The wrists were capped off with a plug of 18mm thick Palight®[20] and the two-dimensional hands were attached with a screw on fixing[21].

The decision to customise commercial dress-stands in combination with Fosshape™, successfully brought a sense of animation, personality and fun to each outfit. However the final effect in some ways did not realise Nissen Richards' concept of creating a quirky collage mannequin, as the photographed limbs looked more realistic than first anticipated. The design brief had many challenges; the combination of two-dimensional limbs with three-dimensional objects could not have been successfully realised without the introduction of Fosshape™, which has allowed for a more experimental approach towards the mounting and display of dress (Figure 8).

[20] PVC foam sheeting

[21] It was essential that the two-dimensional limbs could easily be removed for packing and transport for the exhibition tour.

Figure 8 *Finished full figure mannequins ©Victoria and Albert Museum, London*

Future Use of Fosshape™

The upsurge of full scale fashion exhibitions at the V&A has led to the continued pursuit of innovative and dynamic display methods. By working with designers, such as Nissen Richards, who are willing to embrace the often tricky dilemma of mannequin design, existing techniques can be advanced and new methods pioneered. Fosshape™ can be used creatively for fulfilling aesthetic requirements, for example creating the illusion of a shoe on a bare foot mannequin, to practical problem solving such as changing the size of dress-stands to mount distinctly shaped corsetry (Figure 9). As a go to material for cost-effective mount-making, Fosshape™ has revolutionised costume mounting at the V&A.

Figure 9 *Example of Fosshape™ shoe illusion and a dress-stand dramatically adapted using Fosshape™. ©Victoria and Albert Museum, London*

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Prier-Tisdall L. 2017. Corset mounting for Undressed: the bones of the matter. V&A Conservation Journal 64. http://www.vam.ac.uk/blog/conservation-journal/corset-mounting-for-undressed-the-bones-of-the-matter

Suppliers

Fosshape™ is currently available in the UK in two different weights, 300grms and 600grms from:

- Flints Theatrical Chandlers http://www.flints.co.uk/content/
- Preservation Equipment https://www.preservationequipment.com/

Fosshape™ 600D is available from Wondeflex World https://www.wonderflexworld.com/

Foamcoat™

- Rosco https://www.rosco.com/scenic/Foamcoat.cfm

The principles of creating a magnetic mounting system: the physics every conservator needs to know

Gwen Spicer
Spicer Art Conservation, LLC

ABSTRACT

How to fasten or secure an artefact to a mount has long been a focus in museums. We have stitched, glued and adhered items for decades, always attempting to keep the mounting as reversible as possible.

Magnets have gained great popularity recently since they offer a way to make an ideally reversible fastener. They have great potential as a new tool. Are magnets the truly reversible tool unlikely to damage an artefact?

New neodymium magnets can be part of our future, but we need a fuller understanding of how they work. Using magnets is not 'magic'. Conservators can benefit greatly by understanding some of the science behind how a *magnetic system* functions. Three key factors working in concert must be considered: the strength of the magnet itself; the receiving ferromagnetic material; and the displacement over which the magnetic field acts, 'the gap'. In this presentation, each of these components is explained in detail, to set the stage for improved mount designs. In addition, an overview of relevant physical phenomena of materials is introduced.

1. INTRODUCTION

Art conservators have been using magnets for many years, but it has been done in a very limited way (Dignard 1992; Spicer 2010). Perhaps the delay in using magnets occurred because systems had not been adequately described in the literature or because physics is not a required field of study for conservators in many countries. Perhaps it is a practice is still considered too novel to be widely embraced. Conservators need to understand how a *magnetic system* functions. Each part of the magnet system works in tandem to achieve the best combination for the artefact.

2. PERMANENT MAGNETS

Table 1: Types of permanent magnets

3. CREATING A MAGNETIC SYSTEM

When using and selecting magnets of any type, three key components are in play.

1. The strength of the magnet itself. Magnetic strength is measured and described in units of *gauss*.

2. The receiving component. This is the material that is magnetized in this system.

3. The magnetic field distance. This space between the magnet and the receiving ferromagnetic material is known as 'the gap'.

Each component is important in determining how the magnet behaves and is able to perform the task (Feynman 1964; Livingston 1996; The Magnet Story 1998). Balancing these three parts correctly determines a successful system. No one method can be generally prescribed. Instead, each component is adjusted for any particular situation, further complicated by the wide variety of needs and requirements of each artefact.

The developed system must be sufficiently strong to support the artefact, but not so strong that damage results. Each variable can be slightly altered to reach the desired outcome. Each component is described below and is compared with known alternatives (Spicer 2013a, 2013c, 2016).

3.1 STRENGTH OF THE MAGNET

Magnets are purchased with a set polar direction. The most common magnet has north and south faces located on the largest surfaces of the magnet. These magnets are axially oriented, so the flat surfaces of these magnets have the strongest pull force present. This is because all of the magnetic fields are coming or going from this centre spot. The polar direction can also be oriented side-to-side, making diaxially-oriented magnets (Figures 1a-c).

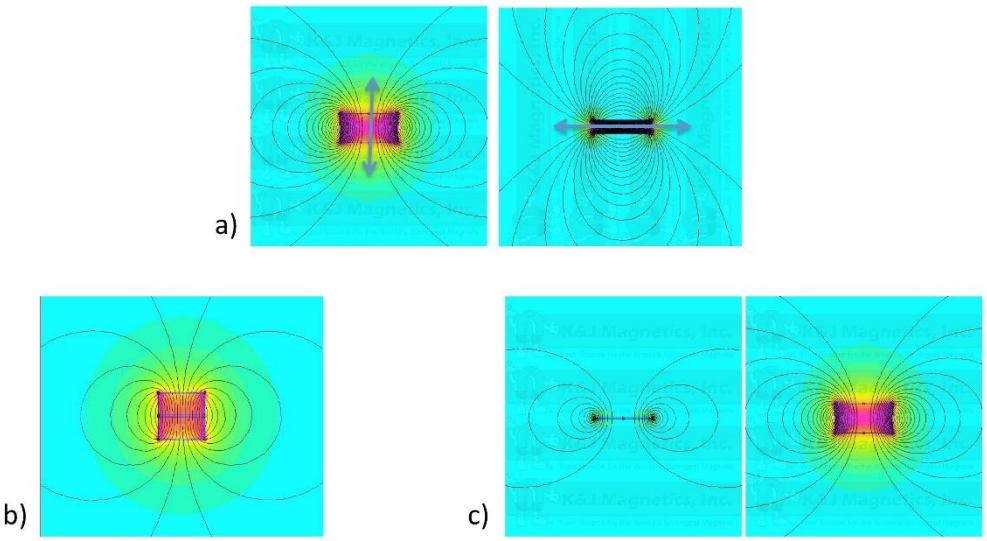


Fig. 1. a) The diagram of axially and diaxially oriented magnet. b) Two similar sized disc, axially oriented magnets creating a polar radiation loop. c) Two disc magnets of different thickness but of the same diameter. The magnetic field of the thinner magnet is much more compact at the outer edges when compared to the thicker magnets (K&J Magnets).

The pull force of a magnet, the amount of force necessary to pull the magnet straight from the surface of a steel plate, is measured in *gauss* both from its centre and from its outer surface.

The grade of a Neodymium magnet greatly alters its properties, such as strength, brittleness, and its Curie temperature (the temperature when all magnetism is lost). The grade of a Neodymium magnet can be thought of as the properties of the magnetic material itself and how the behaviour is affected. Neodymium rare earth magnet grades are represented with both letters and numbers. Grades commonly used by conservators are grades N35, N42 or N52. Note that a few suppliers use alternative naming conventions. The number represents the strength of a magnet, and generally

speaking, the higher the number, the stronger the magnet. An example is N52, which compared to a N42 of the same size is about 20% stronger, and has a higher pull force of its surface field. The higher the number, the more brittle the magnet becomes. Breakage potential increases as the magnet becomes thinner. For example, a very thin N52 magnet will easily break and should be supported if frequently handled. The numbers used by most suppliers correspond to the Maximum Energy Product (MGOe) designation. Therefore, the N42 is 40-42MGOe and the N52 is 49.5-52MGOe.

The letter represents both their manufacturing method, as well as their formulations. Sintered magnets are represented as N, M, H grades and bonded magnets as BDM grade. Bonded magnets should be considered if the potential of high humidity conditions exist. Additional alloys in mixture with Neodymium, like Terbium and Dysprosium, are added to maintain a magnet's magnetic properties at higher temperatures (Brown 2004; Jones 2011); other letters represents these.

3.2 RECEIVING COMPONENT (THE MAGNETIZED MATERIAL)

Metals are divided into groups; *ferromagnetic* ones are very attractive, *paramagnetic* are weakly attractive, and *diamagnetic* ones oppose magnetic fields. The system will not function fully if the receiving component is not properly considered, as the full strength of a magnet is achieved only with sufficient ferromagnetic material.

Ferromagnetic metals that are most attractive to magnets include nickel, cobalt, and iron. Within the structure of these materials are small regions or domains that are aligned by permanent magnets, as shown in this illustration (Figure 2). The amount of alignment within the domains or saturation enables the strength of the magnet to be optimized. This is how the receiving substrate becomes a temporary or "soft" magnet. For a given sized magnet, there is a corresponding thickness at which the steel is saturated. If one uses a thicker steel plate, there is no real increase in the pull force (Figure 3). However, attaching a magnet to thinner steel sheets results in diminished pull strength, and the magnet will behave as if it were a lower strength magnet. This occurs because the ferromagnetic material will not become magnetically saturated. This means that the receiving material cannot hold all the magnet's flux (the amount of magnetic field passing through a given surface) and fails to utilize 100% of the magnets pull force that would occur with a thicker plate. In such cases, some of the magnetic field extends behind the steel. If another ferromagnetic material is placed behind it, this too is attracted and becomes a soft magnet. In this way, the force field travels through several neighbouring layers of ferromagnetic materials, increasing the magnetic force as needed. However, if the ferromagnetic material is thicker than the magnetic field's strength supports, then the reverse side of the metal shows no attraction.

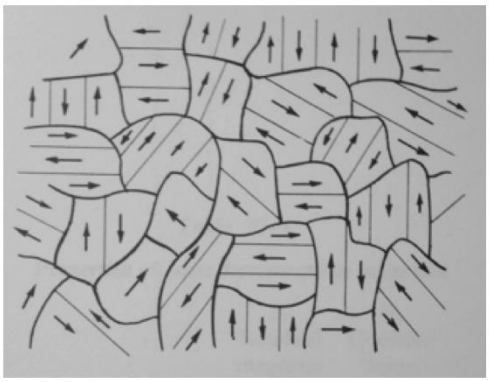


Fig. 2. Domain regions within a ferromagnetic material (Feynman *et al.* 1964).

When using rare earth magnets, the lowest and most minimum thickness of steel plate to use is 24-gauge in the US or 0.61 mm (Figure 3). A 22-gauge (or 0.76 mm) or thicker would be more optimal. (Note: in the US, the lower the gauge number, the thicker the steel). The ferromagnetic metal is an important, but often overlooked component of a magnetic system (Halbow and Taira 2011; Hovey 2012). It is only through control of all the variables: the magnet, the ferromagnetic material, and the layers between, that a system can be reproduced and adapted to any situation.

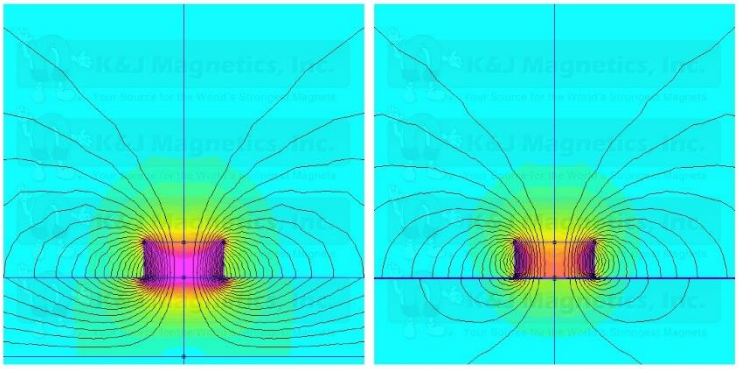


Fig. 3. The same size disc magnet on two different thickness of steel plate. The thicker steel, the magnetic field remains within the plate making it a strong "soft" magnet, where as the much thinner steel, the magnetic field extends beyond the plate, making it a weak "soft" magnet (K&J Magnets).

3.3 THE MAGNETIC FIELD DISTANCE OR THE GAP

The magnetic field strength diminishes with distance to an extent depending on the magnet strength. The *gap* is the sum of the artefact and all the layers used as padding and/or magnet barriers (such as Mylar or Melinex). The amount of usable gap distance is determined by the strength, size, and shape of the magnet used in the system. As the grade increases, the usable gap distance increases; conversely, as the space between the magnet and the receiving metal increases,

the magnetic to ferromagnetic metal attraction becomes less powerful (Feynman *et al*. 1964; Livingston 1996; Spicer 2010, 2015) (Figure 4).

Magnetic pull force calculations are based on the distance between the parallel surfaces of the magnet and the ferromagnetic material. An effective gap or field distance is directly related to the grade, shape and size of the selected magnet. Figure 4 shows three variations in optimum conditions of field distance using popular sizes and grades. The variations illustrated show a commonly used magnet, compared to a comparable lower grade magnet, and with a magnet of the same grade and shape but half the thickness. The change in thickness has a greater effect on the field distance than does the grade. Each situation shows a decrease in pull force.

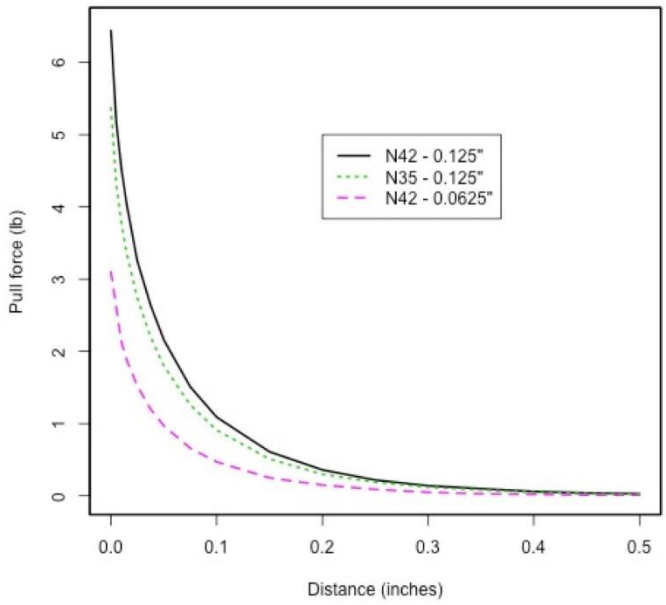


Fig. 4. The pounds of force vs. distance in inches of three different disc-shaped Neodymium magnets. (J&K Magnetics). The added layers provided added gap distance to that of the upper magnets used. 1. N42, ½ dia. 1/8 thick, (6.44 lbs of force or 2,952 gauss when in direct contact)-A commonly used size and grade; 2. N35 , ½ dia. 1/8 thick, (5.37 lbs of force or 2,706 gauss when in direct contact)-Lower grade value; 3. N42, ½ dia. 1/16, (3.1 lbs of force or 1,601 gauss when in direct contact)-Half the thickness.

The metal and magnet must be as close to parallel as possible for the system to be the most effective. When mounting artefacts, once gap materials are added, it is not only the gap distance at play, but also the types and characteristics of gap materials. Changing gap materials effects important differences in pull force performance.

3.4 The difference between pull and shear forces

To begin the discussion of the expanded meaning of *gauss*, we must distinguish pull and shear force. The difference between pull and shear forces with magnetic behaviour is very different and important to understand.

Most listings for *gauss* on websites or in the literature describing a specific magnet are based on pull force, the amount of force required to remove a magnet from a sheet of steel positioned horizontally. The magnet can either be pulled up from the sheet or down from the sheet. Each has

equal pull force. This type of force can even be calculated given field distance alone or with 'gap' materials.

When a magnet is attached to a steel sheet forming a vertical surface, gravity enters the situation, and the friction coefficient is important. This depends on the surface of the two materials, i.e. smooth, rough, dirty or greased. Each of these surface characteristics has a very different effect on the amount of pull force there is between the magnet and the steel. Unfortunately for mounting artefacts onto walls, we cannot avoid this issue. This becomes critical when selecting materials for mount coverings, and gap layers. It is good to keep in mind that it is possible that a given magnet selected may only provide 10 – 25% of any listed pull force when held in the shear direction.

4. Types of Magnetic Systems

4.1 Point Fastener

In conservation, the majority of magnet solutions involve individually placed magnets as point fasteners, the simplest method for using magnets (Spicer 2016a, b). A magnet used as a point fastener is selected for its pull force and its interaction with the surrounding ferromagnetic material. The conservator can select a size and grade of magnet for ease of handling; adjust the gap between, and design the magnet to blend with the artefact. Magnets can then be added or subtracted based on what is deemed necessary for support. Typically, the artefact is large enough that there is no connection with surrounding magnets, and the polar direction of individual magnets is not of concern. When point fasteners are employed, many magnets are used, each magnet working independently of other magnets surrounding.

4.2 LARGE AREA PRESSURE

Continuous large area support consists of using several magnets in conjunction with each other to provide overall pressure or support. Necessary pressure can be achieved by several means including: adjusting the polar orientation of the magnets; using magnets with ancillary materials; magnets embedded within stiff materials; an attached webbing sleeve; as well as combinations of these. These methods require another level of design consideration when compared to point fasteners. Large area pressure methods also have the benefit of protecting the magnet because the layering material surrounding each magnet reduces possible coercivity from shock due to striking together suddenly (see appendix).

4.3 Two-part and Three-part Magnetic Systems

Three combinations of magnet and ferromagnetic material are possible and each has different results (Figure 5) (Spicer 2016b).

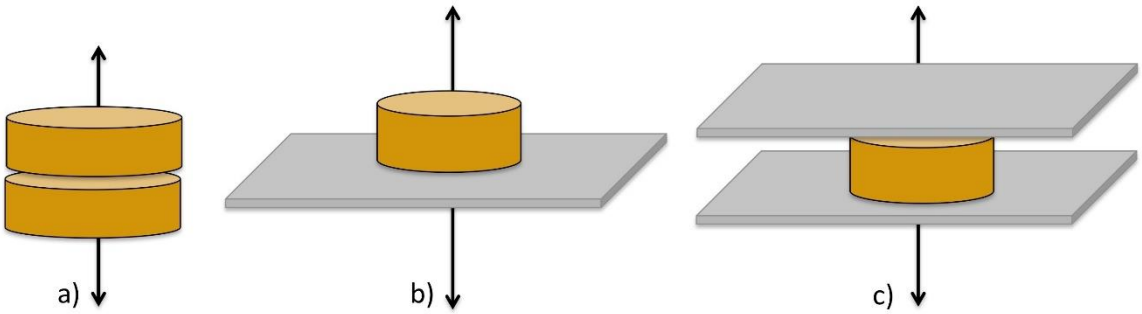


Fig. 5. Three combinations of using magnets and ferromagnetic materials; a) magnet-to-magnet; b) magnet-to-ferromagnetic material; c) ferromagnetic material-to-magnet-to-ferromagnetic materials, a three-part system.

4.3.1. Magnet-to-Magnet

Positioning an axially oriented disc magnet on a second similar magnet greatly increases the pull force of the system. When the magnets are positioned N-S to N-S, the two link together to create a polar radiation loop, preventing the two magnets from slipping from one another (Figure 1b). They are ideally suited as a point fastener. Use of steel is not necessary; Plexiglas or mat board can also be used (Ritschel and Douglas 2011).

4.3.2. Magnet-to-Ferromagnetic Material

The more commonly used magnetic system uses a magnet with a ferromagnetic material (fig. 5b). Steel can take many forms, many which are readily and economically available. This is critical for the optimal performance of the magnet. A full steel sheet gives the most flexibility of magnet placement, as it is a large board on which one can easily increase the necessary number of magnets needed for the best support. When a magnet is used with any type of ferromagnetic material, there is no radiation loop that is created. Therefore, the strength of the system is related to the alignment of domains within the steel and amount of saturation.

Both the magnet-to-magnet and the magnet-to-ferromagnetic types of systems create the same pull force when in direct contact. However, as gap layers are introduced between the two types, the magnet-to-magnet provides slightly more pull force at the same field distance.

4.3.3. Ferromagnetic Material-to-Magnet-to-Ferromagnetic Material

With the use of a third component, the pull force can be increased when another ferromagnetic material or magnet is added, thereby creating a three-part point fastener system (Figure 5c). As when a group of magnets are stacked together, their strength increases, this same effect can be used in creating a magnetic system. The pull force of any magnet can be increased 10 to 15% with the addition of another magnet or ferromagnetic material, creating a system of three elements that create both hard and soft magnets[1]. Here both ferromagnetic materials layers become “soft”

[1] Paul, M. 2014. Magnetic behavior [email] (Personal Communication, 3 January 2014). K&J Magnetics.

magnets (i.e. they are temporarily magnetized by the magnet). There is a jump in the calculated pull force when a magnet is placed between two steel plates.

5. The materials within the magnetic system

As more layers are placed between elements, and the thickness of material increased, the pull force decreases. Besides the distance affecting the force field, surface quality and area of the materials are also at play. The physical properties (topography of the materials, friction, static electricity and cohesion) all contribute to a small degree (Table 2).

It is possible that the various phenomenon that occur when materials are in contact actually assists, and are an additional force that aids the magnetic system.

5.1 Electron Exchange

Static charge has long been an issue in conservation, especially for fragile and friable materials (Margariti and Loukopoulou 2016). This concern has been part of the protocol for framed pastels, charcoals and friable silks. However, there has been little detailed research into its full role in the conservation field (Commoner 1998).

All bodies are composed of both positive and negative charges equally (Sello and Stevens 1984). The basis of electrostatic charging is a surface phenomenon where the disruption of the condition of equilibrium is seen in the neutral atom (Commoner 1998). Electrons have a negative charge. When energy is applied to a material system, such as by friction or pressure, a small number of electrons can jump from one material to the other. The material whose atoms gain electrons will become negatively charged with static electricity, while the material that loses electrons will become positively charged. When two materials are in contact, a flow of electrons moves from one to the other; whether it is the same material or between two different types (Figure 6).

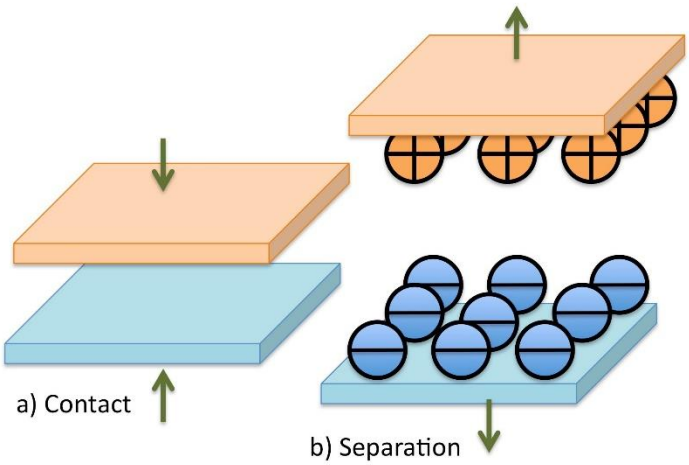


Figure 6: Schematic of electron exchange when two different materials are in contact and are then separated. The extent of this exchange is based on the materials placement on the Tribo-electric series (Table 3).

Static charge occurs when materials are in contact even without apparent rubbing, though more static is created with rubbing or other friction types. These electrical charges occur when bonds

between electrons are broken (Carlton 1962). This electrical sharing greatly increases as contact increases.

5.2 Triboelectric Series

Materials that can gain or lose electrons are called triboelectric materials. The order of propensity to gain or lose electrons is called the triboelectric series (Sello and Stevens 1984). The series is based on the conductivity of the individual material. The level of charge is linked to a material's placement in this series. (See Table 3) It is the distance of the two materials from one another in the series that increases the charge effect rather than its specific location. Therefore, if two materials in contact are neighbours on the scale, like cotton and steel, there is less exchange. However, if they are far apart, no matter where on the scale, exchange occurs. Table 3, compiled from many sources, shows the ranking of commonly used materials for mounting artefacts.

As stated above, cotton and polyester materials are the two types of materials that are frequently used for mounting. Cotton is neutral and positioned close to steel, limiting the impact of the triboelectric phenomena. Materials made of polyester and steel are widely separated in the series, explaining why polyester Ultra-suede and Mylar have the potential to add to the holding power of a magnetic system.

5.3 Resiliency

Factors related to compression are the specific material's thickness, its manufacturing method, and loft. Each material's manufacturing and structure play a part in how it responds to compression. Textiles are such an example. It is not just the material or fibre composition, it is how the fibres are turned into threads and then woven into a fabric that will cause the results to vary (Collins *et al*. 1990). For paper, fibres are pounded and made into a slurry before being formed into a sheet, and then finished with coatings and fillers. Vulnerable materials include skins, felt, flocked structures, pile weave textiles, and thick papers or textiles. Newer material can withstand longer-term compression better than older material. Other factors include the material's elasticity, thickness, and time under constraint (de Graaf 1980). Surface deformation has been known to occur for works of art on paper if matted for an extended time (Vuori and Dancause 2014).

A term that is used to describe a fibre's ability to return to shape is *resilience*. Resilience is a ratio of energy of retraction to energy of deformation. It is influenced by temperature, moisture content, rate of strain, retraction and strain history (Dillon 1947). Various fibres are rated from high to low on a scale of resiliency (Norton and Hearle 1962; Ballard 1995) (See Table 4). Cellulosic as a group have a low resiliency. This may partially explain why paper conservators often see compression as a result of a mount with magnets. Polyester and wool are on the opposite end of the scale.

6. CONCLUSIONS

The physics of magnet behaviour is not straightforward. Enhanced understanding of magnetic forces is needed among conservators. This is especially the case now that the use of rare earth magnets has gained in popularity. These magnets, with their powerful strength for their size, can easily magnify behaviour. Whenever a magnet is used, its behaviour is not just due to the magnet itself, but as a factor in a three-part system, each part is critical for the optimal functioning of the system. One of the parts of the magnetic system that needs to be better understood and discussed in the conservation field is the field distance ('the gap'), since the specific materials that are positioned between the magnet and ferromagnetic material influence the success of a magnetic system.

Conservators currently use three of the four permanent magnet types discussed. Now Neodymium has replaced ferrite, with the exception of the flexible type that has continued to be used as a tool for mounting of lightweight materials. The importance of storage of magnets, as it impacts their longevity, will need to be increasingly considered, especially as the cost of the stronger Neodymium magnets rises. This will be of further interest as documented systems are developed for reuse.

ACKNOWLEDGEMENTS

I would like to extend my gratitude to the organizers of the ICON 2017 Textile Group for to accepting my abstract that allowed me to attend the meeting held in Bath UK. In addition, I would like to thank all of the conservators who I was able to meet while in the United Kingdom and to others who travelled far to the meeting; and assisted with further research on this constantly fascinating subject.

APPENDIX: Proper Storage of Your Magnets

All permanent magnets require special attention for optimal and continual performance (Table 1). As with any equipment, one should use them with care. Areas of concern are mechanical shock, heat, moisture, and a demagnetized field. All of these are issues of handling and environment, which conservators are especially suited to understand. Depending on the class of magnet, the care will vary slightly, but, with proper care, little decay should be noticed (Figure 7).

Fig. 7. Several examples of methods to store magnet; from individual boxes, Ethafoam lined boxes and contact lens cases. All are useful for protecting magnet collections.

Coercivity (Hc) is the process where a magnetic field is reduced or eliminated. Each permanent magnet has its own coercivity rating. The higher the Hc, the greater the resistance to demagnetization (The Magnet Story 1998). Understanding the Hc of permanent magnets, and that

of other materials and equipment nearby, is necessary when working with strong magnets. Rare earth magnets currently have the highest coercivity values.

In 2011, the author undertook a survey of 230 conservators related to their use of magnets. One of the survey questions focused specifically on how conservators stored their magnets. As a response, here are a few rules of thumb:

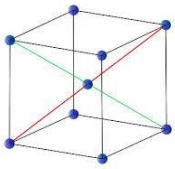
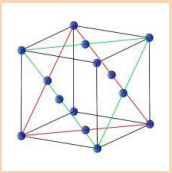
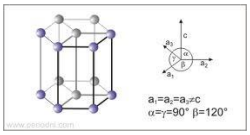
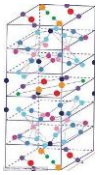
1. Separate the rare earths from all other types of permanent magnets.
2. Provide cushioning between the magnets and prevent any shock.
3. Keep away from all heat sources.

Some types of permanent magnets influence or weaken other magnets. One such case is when ceramic (including flexible type) or samarium magnets are demagnetized by neodymium magnets. As a result, neodymium rare-earth magnets should always be stored away from other magnet types. Similarly, electronics systems that rely on magnets to hold information, such as hard drives and disks, can be altered or demagnetized by a neodymium magnet that is placed nearby. Magnetic strips on credit cards and other cards can also be affected.

Ferrite magnets can be demagnetized when their poles are alternated, a reason to carefully stack the magnets. This is especially the case with the bonded flexible type; sliding a magnet side-ways perpendicular to the polar rows demagnetizes the array. Alnico type magnets are unique in that they can be remagnetized by realigning the internal domains via another strong magnetic field. This is not the case with other magnets, especially neodymium ones, where once demagnetized, the magnetism cannot be recovered.

Each type of permanent magnet should be segregated and spaced well outside other magnetic fields. As more magnets are concentrated together, the field increases. A safe approach is to separate each type in the work area.

Table 1: Magnet Fact Sheet

Type	Alnico	Ferrite or Ceramic		Rare Earth	
		Block-shape, non-bonded	Flexible-bonded	Samarium-Cobalt	Neodymium
Date Introduced	1935	1951	1960s	1969	1983
Chemical Structure	AlNiFeCo	Fe_2O_3		$SmCo_2$	$Nd_2Fe_{14}B$
Structure	Body-centred cubic 	Face-centred 		Hexagonal crystal structure 	Multi-phase structure; tetragonal crystal structure 
Strength of Magnetic Field) (Br(T))	0.6-1.4	0.2-0.4		0.8-1.1	1.0-1.4
(Br(gauss)	12,500	3,900		10,500	12,800
Temperature at which demagnetized (Curie temperature) (Tc)	700-860°C (1,292° - 1,580° F)	450°C (842° F)		720°C (1,328° F)	310-400°C (590°-752° F)
Maximum Working Temperature (TMax)	540° C (1004° F)	300° C (572° F)	**Flexible Magnet** 180° C (356° F)	300° C (572° F)	150° C (302° F)
Energy (BH)max (kJ/m^3)	10-88	10-40	9-17	120-200	200-440 / 540-1,350
Maximum Energy (mills of Gauss – Ørsteds) Mgoe	1	8	1.1-1.5	16-29	50
Demagnetizing Field (coercivity) (Hci) (kA/m)	275	100 - 300	200 - 240	600 – 2,000	600-2000
Storage	Use keeper for horseshoe shape	Group by size; stack, orienting north to south; Wrap to prevent abrasion Keep away from Rare Earth magnets.		Group by size; stack, orienting north to south; place separator between	Group by size; stack, orienting north to south; place separator between
Mechanical Shock Tolerance	Very resistant to shock	Brittle, chip or crack easily	Very resistant	Brittle and chip or crack easily. Best to separate with a cushioning material.	Brittle and chip or crack easily. Best to separate with a cushioning material.
Moisture/Oxidation	Resistant to corrosion	Resistant to corrosion	Resistant to corrosion	Relatively resistant to corrosion.	Corrodes easily and requires a coating. Neodymium magnets

					must be coated to prevent oxidation.
Common use and comments	First man-made permanent magnet. Also referred to as a cast magnet. Used in engines and generators. Can be easily demagnetized. When repetitively placed north-pole-to-north-pole ends together, it quickly weakens itself.	Electronic inductors, transformers, and electromagnets. Ferrite powders are used to coat magnetic recording taps.	Commonly referred to refrigerator magnets	Hard drives, printers and other computer components. Can be demagnetized by NdFeB magnets. But they do not weaken others.	Used predominately in the Green energy, hybrid cars, wind turbines, earphones, and cell phones. Tough to demagnetize. However, they can easily demagnetize other classes of magnets like SmCo or Alnico, or Ferrite.
Manufacturing Method	Cast or sintered	Sintered	**Flexible** bonded (rigid or flexible)	Reduction Diffusion and Melting Process	Sintered or bonded (rigid or flexible)
Source of raw material	Uses Colbalt from Zaire.	By-product from industry		Uses Colbalt from Zaire.	Uses Rare-earths from China

Table 2: Various materials tested (Billot 2016)

Comparison of the two magnets (1/2" x 1/8" disc; 13mm x 3mm.)

	Thickness (in.)	N42	*Converted*	N52	*Converted*
Control	0	317.8	*11.21 oz*	342.4	*12.07*
Mylar	0.003	307.4	*10.83*	293.2	*10.34*
Tissue paper	0.0036	240.2	*8.47 oz*	270.6	*9.54*
Muslin	0.011	214.4	*7.6*	235.8	*8.31*
Twill tape	0.02	209.4	*7.37*	224	*7.9*
Ultra-suede	0.025	317.4	*11.19*	343.8	*12.13*
Polyester Batting	0.095	213.8	*7.54*	230.6	*8.13*

Ranked in order of weight held (grams)

Material in Gap	N42
Control	317.8
Ultra-suede	317.4
Mylar	307.4
Tissue paper	240.2
Muslin	214.4
Polyester Batting	213.8
Twill tape	209.4

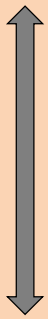
Material in Gap	N52
Ultra-suede	343.8
Control	342.4
Mylar	293.2
Tissue paper	270.6
Muslin	235.8
Polyester Batting	230.6
Twill tape	224

Table 3: Material order of the triboelectric series**.**

Charge	*Material*	*Notes*
+ + +	Air	
	Polyurethane foam	
	Hair	
	Nylon, Dry skin	Dry skin has the greatest tendency to give up electrons and becoming highly positive in charge.
	Glass	This is why TV screens collect dust on their surfaces.
	Acrylic, Lucite	This is why these materials are not used to frame pastels.
	Leather	
	Rabbit's fur	Fur is often used to create static electricity.
	Quartz	
	Mica	
	Lead	Surprisingly close to cat fur.
	Cat's fur	
	Silk	
	Aluminium	
	Paper	
	Cotton	Best for non-static clothes
	Wool	
NEUTRAL		
	Steel	Not useful for static electricity
	Wood	Attracts some electrons, but is almost neutral
	Amber	
	Sealing wax	
	Polystyrene	
	Rubber balloon	
	Resins	
	Hard rubber	
	Nickel, Copper	
	Sulphur	
	Brass, Silver	

	Gold, Platinum	
	Acetate, Rayon	
	Synthetic rubber	
	Polyester	
	Styrene and Polystyrene	Why packing peanuts seems to stick to everything.
	Plastic wrap	A.k.a. “Cling” wrap
	Polyethylene	
	Polypropylene	
	Vinyl, PVC	
	Silicon	
	Teflon	Teflon has the greatest tendency of gathering electrons on its surface and becoming highly negative in charge.
	Silicone rubber	
- - -	Ebonite	

Table 4: General Resiliency Ranking by Material

Material	Resiliency
Polyester	High
Wool	
Nylon	
Acrylic	
Olefin (PE, PP)	
Triacetate	
Silk	
Acetate (secondary)	
Cotton	
Rayon	
Flax	Low or poor

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Pre-Reformation ecclesiastical embroidered fragments at Hardwick Hall and their various disguises

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1. INTRODUCTION

This paper discusses a collection of fragments of ecclesiastical embroidery from the late 15th and early 16th centuries that belonged to Elizabeth, Countess of Shrewsbury, known as Bess of Hardwick.
It begins with a brief overview of the life of Bess and her collection, before outlining previous and ongoing research, and putting forward new suggestions for a chronology of alterations to the textiles, and changes in their use. It offers a case study indicating how a patient and rigorous approach to understanding the full history of a group of objects before and during conservation can result in important new insights. A number of curators and conservators (in particular Santina Levey, Ksynia Marko, and Emma Slocombe, as will be noted below), have worked with May Berkouwer since 2001 and together they have opened new avenues for research.

2. HARDWICK HALL

In about 1583, Bess acquired the house in which she had been born at Hardwick, near Chesterfield in Derbyshire, and she made it her home after the breakdown of her marriage to George, 6th Earl of Shrewsbury. Using her vast fortune she expanded the building, creating a substantial mansion. The ruins of this building survive, and are now in the care of English Heritage.

In 1590, on the death of Shrewsbury, Bess began an even more ambitious project, commissioning a spectacular and innovative design from Robert Smythson. The New Hardwick Hall was positioned beside the Old Hardwick Hall, and her household occupied both buildings. The Smythson house passed to the National Trust in 1959, together with its exceptional Elizabethan and Jacobean furnishings.

Embroidered fragments taken from Late Medieval vestments are a striking feature of the interiors at Hardwick, and they have been displayed throughout the house. Many were grouped together in mixtures of styles when they were mounted in plain mahogany or heavier black frames in the early 20th century. There are also numerous pieces in store, mainly those in poorer condition, alongside those removed from display during the course of this project.

3. BESS OF HARDWICK

Bess lived an extraordinary and long life. She was born in 1521 or 1522, and died in 1608, well into her eighties. Through a series of marriages, she rose from the middle ranks of the Derbyshire gentry to the highest level of the nobility, and by the time of her death she was both outstandingly wealthy and very well connected. She had amassed large collections of fashionable furniture and sumptuous textiles.

She married four times. Her first marriage was in 1543 to her cousin Robert Barlow. He died within a few months of the wedding, leaving her a modest income.

In 1547 she married Sir William Cavendish, who had made a fortune as one of the commissioners for the Dissolution of the Monasteries, and who brought Bess into the orbit of the royal court. The couple had eight children, and they acquired Chatsworth, about twenty miles from Hardwick. This house is still owned by the Cavendish family.

Bess married her third husband, the courtier and landowner Sir William St. Loe, in 1559. When he died in 1564/5 she inherited many of his estates and chattels, including valuable ecclesiastical embroideries that he, like William Cavendish, had acquired during the dissolution of the monasteries. Although at the time of the Reformation Catholic imagery was suppressed, the monetary value and craftsmanship of many sacred artefacts was well recognized, and there was an active market for their sale and reuse.

Bess married her fourth husband, the Earl of Shrewsbury, in 1567: his name gave her the initials ES which feature so prominently in the parapets of Hardwick Hall. Shrewsbury had the unenviable task of guarding the Catholic Mary Queen of Scots in his Midlands houses. Mary and Bess were in close contact for nearly twenty years, and they, together with the gentlewomen of their households (Catholic and Protestant) undertook a number of joint embroidery projects.[i]

4. THE CONSERVATION PROJECT

The conservation treatment of the collection of ecclesiastical embroidery fragments has progressed in stages, beginning in 2001 with the assessment of a small group of pieces in poor condition, and a series of trials. Following the success of cleaning and stitching treatments the work was extended and more pieces were treated (description of the conservation is outside the scope of this paper).

From the outset this project expressly included the close examination of any evidence of past construction or use, to be noted and preserved, and to be made available for curatorial research. The intention was always to reveal the origin and history of these embroideries, and to better understand the puzzling evidence.

In 2007 all the fragments were brought together at May Berkouwer Textile Conservation studio so that Santina Levey and May Berkouwer might study them all together, to allow an overview, and for connections between the pieces to be made.

5. THE RESEARCH BY SANTINA LEVEY

Santina Levey's in-depth study of the Hardwick textiles resulted in the first publication on the subject in 1998. She examined the inventory of 1601 which records the contents of Chatsworth, Hardwick Old Hall and Hardwick New Hall, and she successfully identified many surviving pieces.[ii] Her further research resulted in the seminal catalogue, *The Embroideries at Hardwick Hall*, published in 2007.

The many ecclesiastical fragments at Hardwick were not readily identified from the few references in the 1601 inventory and Levey decided the subject should be addressed in a separate publication, which sadly was not completed prior to her death.

6. THE COLLECTION OF FRAGMENTS

The embroideries in this collection are complete or partial orphreys and copehoods taken from copes. Ecclesiastical vestments came in sets of a range of items including the ceremonial cloaks known as copes. Medieval copes were usually semi-circular in shape, and draped over the shoulders so that the straight sides came together at the front. The sides of the front opening were normally edged with applied bands of silk and gold embroidery depicting religious imagery such as saints and patrons; these bands are known as orphreys. The backs of medieval copes are embellished with a shield-shaped embroidery, referred to as a copehood.[iii]

Copes were made from highly valuable brocades or velvets, often scattered with gold embroidered motifs. The orphreys and copehoods were produced separately by professional embroiderers and applied onto the copes during their construction. Once copes became defunct, the appliqué embroidered elements were readily removed to be re-used elsewhere.

Examination of the Hardwick collection *en masse* revealed that the pieces were taken from a minimum of twenty-five copes belonging to at least nine different sets of vestments, identified by Levey according to their style, materials and embroidery techniques:

- The largest and most complete set, referred to as A, has five pairs of complete orphreys, each with four orphrey panels, as well as five copehoods, although one is joined up with fragments of other types (see Figures 1&2).
- Two other main groups, B and C, each included enough fragments to make up at least six copehoods. There are also some thirty individual orphrey panels, but few complete orphreys.
- The other six types are represented in smaller numbers.

Figure 1. ‘Type A’ orphrey with four image panels. After conservation it was returned to Hardwick Hall on a storage tray and stacked in conservation boxes.

Figure 2. 'Type A' copehood depicting Maria and Child, after conservation. The picture shows how the copehood was cut into two rectangular pieces, which were later reassembled with numerous small fragments to recreate the missing lower point, for the 20th c display.

Most of the embroideries are English and a product of the thriving industry of *Opus Anglicanum,* although a few pieces are Flemish work. Many are of very high quality. Some fragments have been cut into irregular shapes and sewn together as patchworks whilst others remain separated. This has made them difficult to interpret.

There are a number of individual appliqué figures, which were originally part of the orphreys.

One orphrey fragment alone survives in almost unfaded condition, illustrating how colourful the embroideries once were. Even this one is cut across the face of the depicted figure, evidence that the ecclesiastical embroideries were deliberately cut at an early date, and before any fading had occurred.

There are two strips of blue velvet with applied flower motifs, and some larger pieces in a very fragmented state, probably taken from the larger field of a cope (see 6.1 below for the suggestion that the larger ones relate to the pulpit in the chapel of the New Hardwick Hall).

4. THE HISTORY OF THE EMBROIDERIES

There are various ideas about the origin and later use of the collection:

- Bess removed the embroidered motifs and used the rich and expensive ground fabrics of the copes for other projects (some carried out with Mary Queen of Scots).
- The imagery on the embroideries became unacceptable after the Reformation. Rather than destroy them it would appear that Bess valued them, hence their survival.
- The imagery was deliberately defaced by cutting in line with Reformation iconoclasm. Levey has proposed that Bess would not have taken this step.[iv]

In the early 20th century many of the fragments were collectively mounted and framed by Lady Evelyn, Duchess of Devonshire. Conservation involved removal of the fragments from their frames when several key discoveries were made that added to the evidence of the history of the embroideries, raising new questions and inviting new theories:

- The copehoods had been cut horizontally across the centre, and again along the bottom, making the fragments approximately rectangular, thus easier to use for patchwork?
- It became apparent that the cut figures had been re-joined prior to any fading occurring; the 5 mm turnings of the seams are comparatively unfaded.
- One patchwork of five pairs of orphreys showed a particular pattern of damage: each orphrey depicts four figures set one above the other, and in each case the third figure was the most damaged. These figures were notably more soiled, worn and faded, indicating a use prior to framing.
- This same pattern of damage was observed on a number of other copehood and orphrey fragments (see Figure 3).
- Several of the larger patchwork hangings have linen linings. These were evidently cut with scissors, the cutting lines coinciding with those across the embroideries. This proves that the patchworks of embroideries existed as lined textiles which were later cut and then re-configured.

Figure 3. One of the severely faded and worn fragments with the distinctive shape cut out to fit the altar rail. This piece was made up from at least six orphreys and shows extensive fading and wear, alongside the additional soiling pattern on the third panel down.

5. NEW PHOTOGRAPHIC EVIDENCE

It was clear that while these early observations during conservation were historically significant, they could not be fully understood. However, by the time treatment of the first part of the collection had been completed, and the textiles were returned to Hardwick Hall in the summer of 2015, the National Trust had come into the possession of a photograph, donated by the son of a late housekeeper at Hardwick. The picture may have been taken for *Country Life Magazine* around 1900. It shows the current altar rail in the chapel draped with the ecclesiastical embroideries. In the image they appear already faded and damaged (see Figure 4).

Figure 4. The photograph of the Chapel at Hardwick Hall c. 1900 which came to light in 2015. It shows the altar rail and pulpit draped with ecclesiastical textiles, already severely faded.

6. THE USE OF THE EMBROIDERIES IN THE CHAPEL AT HARDWICK

During Bess's lifetime, the chapel at Hardwick was on the floor below where it is now, and at double the height it occupied the space across two floors. The chapel was altered around 1800 to occupy only the upper part of the original chapel and it was thus reduced in height. The pulpit and altar rail were brought up from below and reinstalled.

6.1 PURSUING THE EVIDENCE OF THE C.1900 PHOTOGRAPH

The new photographic evidence shows that by the turn of the 20th century the ecclesiastical embroideries were being used to cover the altar rail.

A model of the U-shaped altar rail was made at the studio to explore this connection further. Draping a flat piece of fabric over the model, and cutting it in the corners to fit the U-shape of the altar rail resulted in diagonal shapes matching those in the embroidery fragments, and which previously had confounded interpretation. The experiment led to several conclusions:

- The odd shapes of many of the fragments in the collection could now be explained as the result of the alteration of a flat textile into a cover for the altar rail. This information is crucial for working out the earlier position of separated fragments.
- The pattern of fading, soiling and wear on the third panel down of the orphreys (described above) matched the sloped surface of the altar rail at Hardwick. Both the surface and the damaged band are 27 cm wide, showing how the hanging was draped over the altar rail; this can be compared to the photograph and aid locating the various fragments (see Figure 4).
- The lining and the patchwork of embroidery had been cut through in one, so it can be inferred that the embroideries had already been joined and lined before they were cut to fit on the altar rail. The linen of the lining is coarse and early in date, suggesting the joining and lining work could have been done by Bess, or at her instruction, forming the embroideries into large panel hangings (see also 6.2 below).
- Although the photograph is of good quality, the image is not completely clear. Combining what can be seen in the photo with the evidence of existing joins and the the patterns of fading and cutting in the physical objects, has resulted in locating a large proportion of the fragments on the altar rail hanging, as illustrated in the model (see Figure 5).
- The photograph predates the framing known to have been undertaken by Lady Evelyn, Duchess of Devonshire, in the early 20th century, when the deteriorated altar rail covers were removed and the best pieces mounted and framed. The most damaged sections and odd-shaped pieces appear to have been relegated to the attic stores at this time.
- In the same photograph the pulpit is also clearly recognisable and it is covered in textiles reduced to wisps of loose yarn. It is proposed that the pulpit was covered with the longer strips of extremely fragmented velvet with appliqué motifs still found in the collection. This is an area that requires further research, and perhaps another stroke of luck to find more evidence.

6.2 FURTHER DOCUMENTARY RESEARCH

Emma Slocombe, the National Trust Curator for Knole, has given an excellent overview of the textiles related to Bess in her chapter for the National Trust's recent collection of essays *Hardwick Hall: A Great Old Castle of Romance* entitled, 'The Embroidery and Needlework of Bess of Hardwick'[v]. In the light of the discoveries concerning the ecclesiastical textiles, she undertook further research on this part of the collection, revealing the following: [vi]

- There is mention of copes being re-used in the 1540s at Northaw, where Bess lived with her second husband William Cavendish.
- In an exchange between Bess and her husband Shrewsbury, Bess describes how vestments were brought to Chatsworth at the time of the deed of gift by her third husband, Sir William St. Loe, and how her personal embroiderers worked them at Chatsworth.

- The 1601 inventory of Chatsworth lists *'a little quition of Churchwork'*, and two *'little stoole[s] of Churchworke'*, one located in '*My Lady's bedchamber'*, which may indicate the use of a particularly opulent fabric associated with church vestments.
- The 1601 inventory for the New Hall at Hardwick lists *'a Crucefix of imbroidered worke'* displayed together with *'too pictures of our Ladie the Virgin Marie and the three Kinges, the salutation of the Virgin Marie by the Angle'* in the Lower Chapel.
- In 1601, the walls of the Upper Chapel at Hardwick were hung with *'too peeces of hangings imbroidered with pictures Seaven foote and a half deep'*.

6.3 PHYSICAL EVIDENCE FOR THE EARLY USE OF THE EMBROIDERIES

Many of the embroidered fragments have now been returned to Hardwick, but, building on the more recent findings, research to understand the early configurations of the textiles continues at the studio. The images seen on the 1900 photograph have been studied carefully and related to the fragments in the collections; photographs of the fragments printed to scale have been collated to find how they once fitted together, checking against the cutting patterns in the lining. Considerable progress has been made. The configuration for a large section of the altar rail has been completed (see Figure 5).

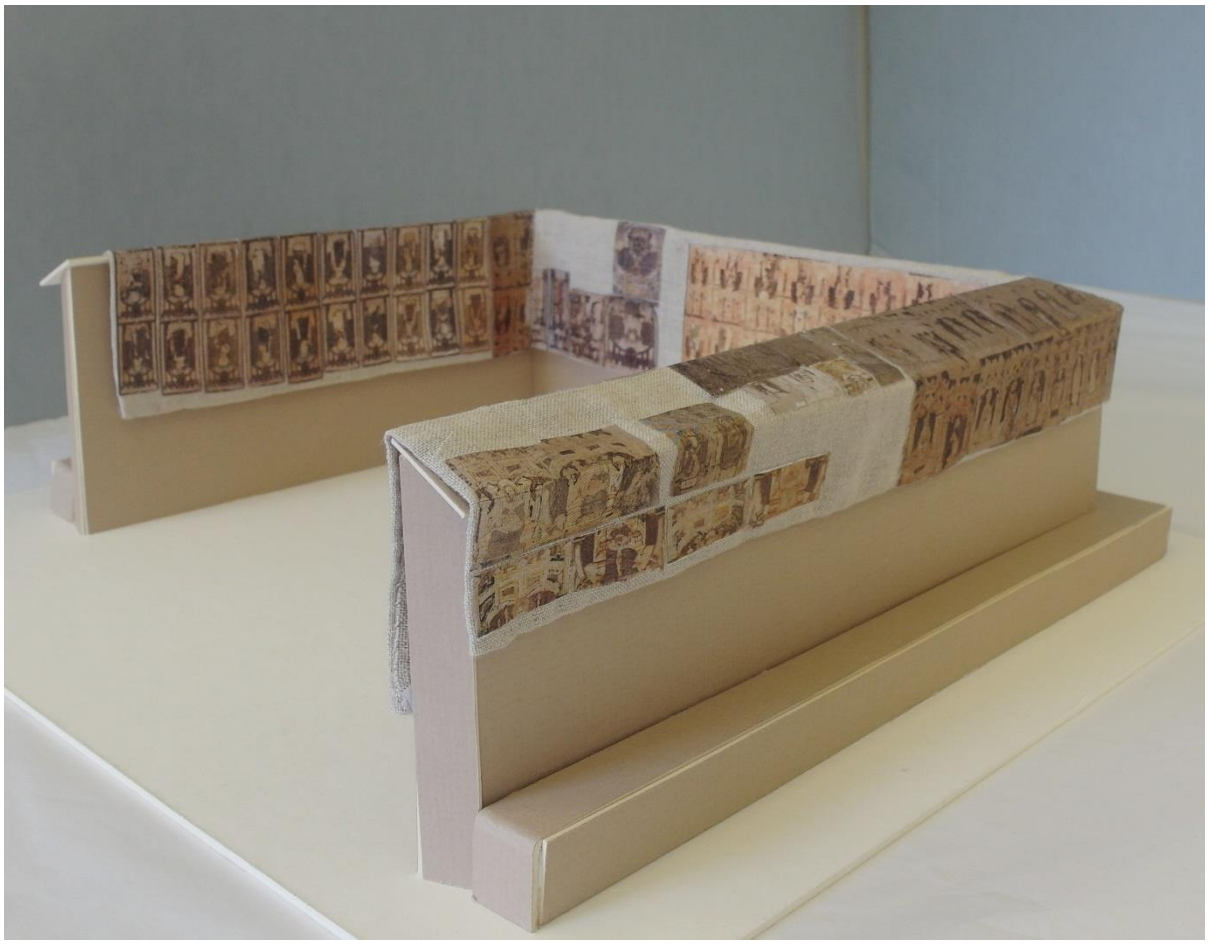

Figure 5. Reconstruction of the altar rail and the drapes, made using photographs on linen, to a 1:10 scale, MBTC Studio 2017

The altar rail cover incorporated many orphreys joined together, including the panel of five pairs of orphreys (type A) which are each approximately 130 cm long; this equates to approximately 4½ feet, which is still 3 feet short of the 7½ feet mentioned in the inventory.[vii] The lower edge of these larger pieces can be shown to be cut, not hemmed or finished, showing that it was once longer. The next step will be to search the remaining material for the missing 3 feet and thus confirm whether this is part of Bess's hangings in her chapel.

Findings such as these lead to new questions and interpretations: if the chapel at Hardwick Hall in Bess's time was twice the height of the current chapel, and the inventory describes the upper chapel hung with *'two pieces of hangings embroidered with pictures Seven foot and a half deep'*, as Slocombe has pointed out, then might this refer to hangings made up of the orphreys and copehoods together? Were such hangings made up by Bess's embroiderers at Chatsworth? And did this creation include the cutting or re-joining as well? Did these hangings once hang at Chatsworth?

7. CONCLUSION

Mysteries remain, and with so many new questions, new answers may yet be found. For example, it is not clear when the two long hangings were made, nor when they were adapted to fit the altar rail, or whether Bess instructed the radical cutting of the embroideries that defaced the figures. It is also worth considering that some of the pieces may have been moved between Chatsworth and Hardwick, as we know Bess did with her possessions.

Perhaps the most intriguing observation is that Bess's use of these textiles flies in the face of the accepted view that it was too provocative and dangerous to display the sacred imagery of pre-Reformation embroideries.

While much remains to be understood, it is clear that significant progress can be made by careful observation during conservation, and by patiently bringing together physical and documentary evidence. Our conservator's role can be pivotal to enhancing curatorial research.

I would like to thank the National Trust staff at Hardwick Hall; Ksynia Marko, National Trust Textile Conservation Advisor; Emma Slocombe National Trust Curator and in particular Santina Levey. I also am very grateful to Crosby Stevens and Ksynia Marko for their help in editing this article.

8. FINAL WORD

Since the presentation of this paper Santina Margaret Levey sadly passed away on 26 August 2017, and this article is dedicated to her memory, scholarship, dedication and ability to bring the character of Bess of Hardwick to life.

[i] See Lovell (2006).

[ii] See Levey (2007), pp. 392-4 for inventories relating to the Cavendish properties.

[iii] Johnstone (2002).

[iv] Levey, Private conversations.

[v] Slocombe, in Adshead and Taylor (2016), pp. 110-132.

[vi] For the inventory references see ibid., pp. 110-132.

[vii] For the inventory references see ibid., pp. 110-132.

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Letting Go: the management of three major textile conservation projects

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In July 2016 the Masterplan 3 project opened at the National Museum of Scotland (NMS) in Edinburgh. This latest phase in the major re-development involved the refurbishment of ten galleries, and was the winner of the Museum and Heritage Awards 'Permanent Exhibition' category in 2017. Four of these galleries display objects from the Art & Design collections, and all contain textiles in varying numbers. While the majority are in the Fashion & Style gallery, with over 85 costume figures as well as flat textiles and accessories, it is the 'Art of Living' gallery that houses the three objects that are the subject of this paper:

- a 16th century tapestry which required wet cleaning and stitched support without removal of historic linings, sending the object out to the private sector for both parts of the treatment
- a 17th century table carpet which required a patterned patch for display, working with an external digital print team
- an 18th century sofa which required a complete re-upholstery, bringing a contract conservator in to treat it in the NMS labs

All fit the remit of the gallery, which shows the decorative art as expressions of beauty, taste, power and devotion.

Each of these objects required consideration of the best method in which to manage the projects, and achieve the best possible treatment to meet the deadline. This required the lead conservator to assess the treatment options and identify how to use external expertise most effectively when in-house skills and resources were either not available or appropriate. This paper will consider the issues evaluated for each of these three conservation projects.

Background

The dress and textile collection at NMS comprises over 80,000 objects, as well as textiles in World Cultures, Scottish history and military collections. In addition to the on-going programme of gallery development projects the textile conservators play a key role in delivering the temporary exhibitions and loans programmes, as well as undertaking general care of collections work and providing specialist advice

The textile conservation section at National Museums Scotland has undergone a number of changes in staffing numbers over the years, from a core team of 3 permanent, full time textile conservators in 1998 to the full time equivalent (FTE) of 1.4 from 2011. At the time of writing this situation has changed again, to 2.4 FTE with the successful recruitment of one fulltime, permanent Assistant Textile Conservator.

It is due to these active programmes that the demand for textile conservation has often outstripped the resource available. Over the years this has been resolved by bringing in conservators on contract, once a business case has been produced detailing of the need and length of the contract

required to address it. The surveys of textiles for the MasterPlan 3 project indicated that two contract posts would be required to supplement the in-house resource to ensure completion to deadline. The contracts totalled 3 years additional resource. This was supplemented by a costume mounting post for one year, due to the large number of garments requiring display preparation. The core team went from the full time equivalent of 1.4 to 4.4 for the project.

This additional resource enabled the majority of objects to be treated, mounted and installed successfully. However it was apparent that the 3 objects (tapestry, carpet and sofa) presented a different sort of challenge, and could not be dealt with as part of the work programme.

Until this project no textile conservation work had been contracted out from NMS in recent years. Although a recognised alternative means of dealing with resourcing issues when appropriate, there were a number of factors that had generally precluded it: it was often considered too late in the process and there was generally insufficient time then available to prepare and organise in terms of 'managing' the process including estimating the requirement, tendering, and then contracting out. Previous projects for which contracting had been considered had also been of many multiples of objects, which would increase all of the factors required to manage the project. Furthermore, the impact would not just be on the conservation team, but also for example on the registrars, who manage the process as if the object is a loan and deal with transport and the security arrangements.

It had generally seemed simpler if the objects remained at NMS, with the professionals brought in on contract to undertake treatments. In addition, it was necessary to take into account that colleagues in the private sector also have work programmes, and couldn't be necessarily fit in with the museums often very tight deadlines – there had to be sufficient planning on the museum's part to enable effective communication to achieve a situation to the mutual benefit of both parties.

The benefits of bringing in contract staff were felt to be:

- The work would be done in the lab where appropriate supervision and control could be achieved
- A position could potentially be offered to an early career conservator, giving them an opportunity to get museum experience and contribute to a project.
- No risk to the object from transportation
- Potential cost savings e.g. for transport/insurance

However it was clear that this would not be possible in this case for a number of reasons, and this caused a rethink of how to approach some projects and treatments. An open and flexible approach was required as the needs of each object were very different.

Letting go: completely out of sight

The 'Triumph of Prudence' tapestry (A.1898.324) was woven in Flanders in about 1520 – 1528. It was selected early on in the development of the galleries. It had previously been on display in in the former European gallery until 2006, but been in storage ever since. The tapestry had many stitched repairs predating its acquisition by the museum, a painted border that was done by the museum decorator at the point of acquisition in 1898, and had been cleaned at the Dovecot Tapestry Studio in the 1970's. Its condition indicated that it now required further cleaning and support treatment.

It was obvious that a full tapestry conservation treatment could not be carried out by the NMS conservators. Although members of the team had experience of tapestry conservation none had concentrated solely on this specialist area. Neither was the space nor the correct equipment, e.g. a tapestry frame, available. It was clear that the tapestry would have to be sent out for treatment by

professional tapestry conservation colleagues. This would be a two stage process: wet cleaning followed by support treatment.

It was decided early on in the process that the tapestry would be sent to De Wit Royal Manufacturers in Belgium for wet cleaning, and that this part of the process would be managed by the NMS Principal Textile Conservator. This was seen as a useful learning experience, as NMS had not previously worked with De Wit Royal Manufacturers, and was also made on the basis that it would save money as NMS resources would be used to prepare the tapestry for wet cleaning.

The procurement process would therefore only be required for the support treatment aspect of the projects NMS is a public body there are guidelines for procurement which must be followed, meeting the need for transparency, accountability and value for money. Preparation for the procurement took time, as it was important that the process was followed correctly, and that accurate and useful information was supplied to potential conservators. The tapestry was first examined by the in-house team, with assistance from Karen Thompson of the Centre for Textile Conservation, who acted as consultant to ensure the information supplied in the tender was appropriate. (Figure 1) The tender had to detail the requirements for treatment and display. Working with an external consultant was a good way of ensuring that there was a structured outline for the treatment proposal and a time estimate, which was an important step, as it was required to inform the budget planning for the project.

Figure 1. Lynn McClean and Karen Thompson examining the 'Triumph of Prudence' tapestry

Preparation of the tender document was a difficult process, in terms of knowing what information to include that would be useful to those submitting tenders, and ensuring that the budget suggested for the treatment would be adequate. This is an aspect of the tendering process that requires consideration and perhaps training specific to conservators, to ensure that what is provided meets the needs of both parties, but in particular is useful to those submitting a tender.

This process was a major learning curve for the author. Guidance was provided by the NMS Project Manager and the Finance teams, and the standard NMS process followed. If the cost estimate for a service is over £30,000 then formal tender action must be taken and it was clear from the preparatory work that conservation of the tapestry would fall into this category. (Finance Procedures, NMS)

A number of private tapestry conservators were then invited to tender, with applications to be returned by a set deadline. The formal marking process at NMS was followed, and May Berkouwer Textile Conservation was appointed to carry out the support treatment after the wet cleaning. The tapestry was duly surface cleaned and packed for transport prior to the cleaning treatment. This approach did reduce costs, but on reflection it may have been simpler to have had the entire treatment managed through the contractor: it would have meant they built up knowledge of the tapestry and its requirements from the outset, and have the benefit of seeing the project through from beginning to end.

Two visits by the NMS Principal Conservator were built into the support treatment programme, as were the costs and the time in the already busy work programme. The timing of the visits had to fit with the contractors programme to ensure it was useful to both parties.

A further complication was the requirement that the support treatment be filmed for a gallery interactive. (Figure 2) While beneficial in terms of educating the public about conservation and encouraging interest, it has the potential to impact on deadlines and programmes, and needs to be considered early on as part of the whole project.

Figure 2. Filming the support treatment at May Berkouwer Textile Conservation

In addition to the time spend on the tapestry by the contract textile conservator the team at NMS spent over 150 hours, (the full time equivalent of 1.5 months) managing this project. This does not include the time spent by registrars, photography and external consultation. Future projects will benefit from the experience gained, as the fact that the impact on the in-house team is still significant can be accounted for. Put simply it takes a lot of time to plan, organise and manage the procurement of external services. However, when balanced against the time needed to conserve the tapestry and the lack of the correct expertise and equipment at NMS, it was clearly a project where 'letting go' was necessary to make it work, which it did very successfully. The conservation treatment met the brief, was completed to a high standard and to deadline, and the tapestry is now on display in the gallery. (Figure 3) The gallery interactive detailing the treatment works really well and adds much to the display and story about the tapestry.

Figure 3. Installing the tapestry in the 'Art of Living' gallery

Letting Go: the need to reconsider

The Kinghorne table carpet (H.SO 20) dates from 1620, and represents two different ways of 'letting go': both relating to previous treatments. The carpet had undergone treatment in the 1980s when the fragile edges were supported onto linen fabric, and a painted patch support was inserted under a missing area. (Figure 4) While both were providing adequate support it was felt the appearance could be improved by reducing the linen support and covering the edge with dyed nylon net, and using digital technologies to re-do the infill patch.

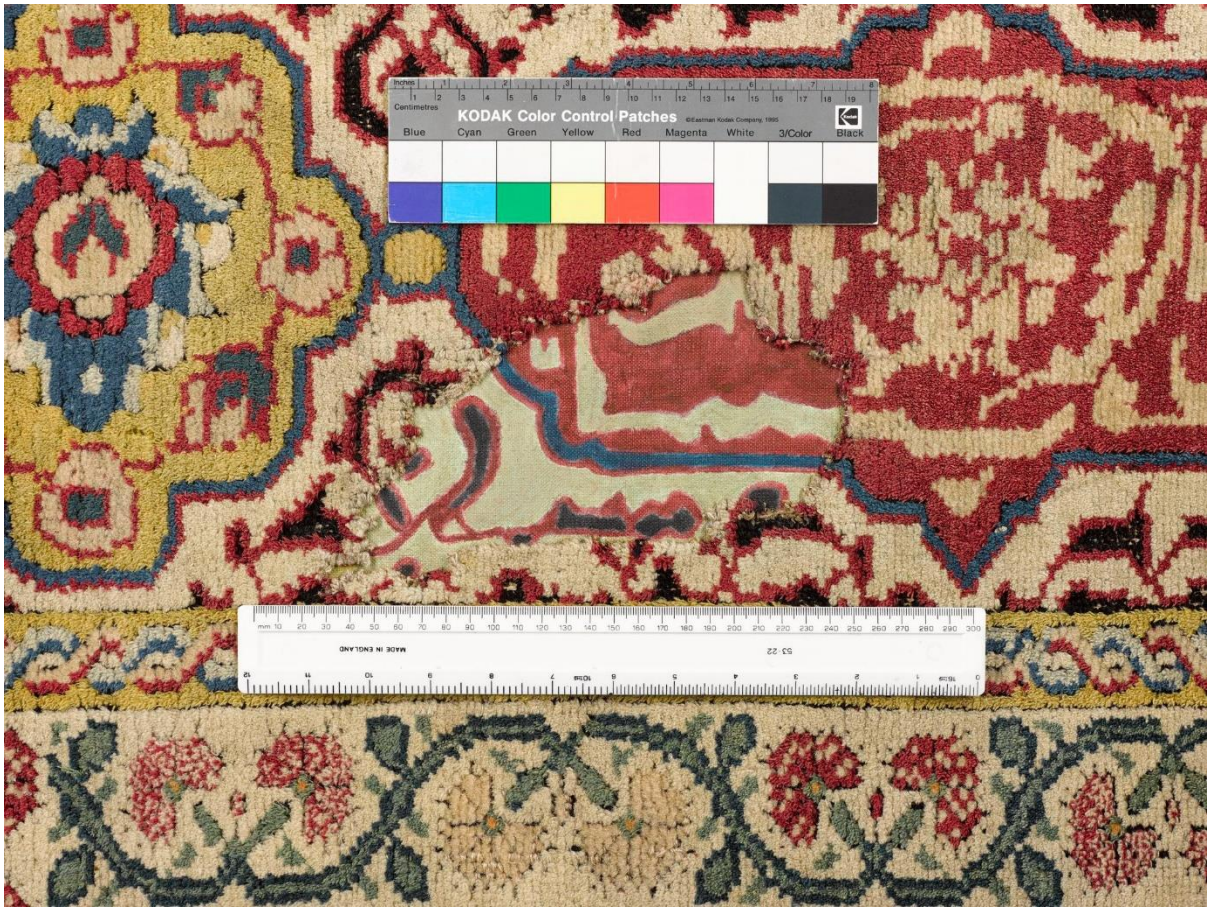

Figure 4. Detail of the painted patch on the Kinghorne carpet

However, it became clear that due to time limitations the proposal was not achievable, and a decision had to be made about how to proceed. After consideration of what would be most suitable and least invasive for the carpet the proposal of improving the edge support by reducing the amount of linen visible was rejected. Much thought was given to whether treatment proposed for the edges was really necessary, and whether it was worth putting the fragile edges of the carpet through another treatment for what were essentially aesthetic reasons.

It was felt that replacing the painted patch with a digital infill should be pursued. The previous repair was visually distracting, and as the carpet was to be displayed in a large, purpose built table case it was felt that this was an appropriate course of action, which could be completed in the time available.

The Centre for Advanced Textiles (CAT), which is part of Glasgow School of Art, took on the project. An initial visit was made at the start of the process so that fabric could be selected and discussions held about the requirements. The time needed to get the patch made was surprisingly short, as images and information could be sent by email. Once printed a variety of patches were posted to the museum so that size and colours could be checked against the object. (Figure 5) The final result was very impressive: the patch fitted well with the pattern and colour and the selected cotton fabric provided good support for the area of loss. (Figure 6) The team at the CAT were also incredibly helpful in allowing us access to film the printing for another gallery interactive.

Figure 5. Matching and selecting the digital patch

Figure 6. After conservation, detailing the digital patch

Letting go: keeping it close to home

The Spencer sofa or settee (K.2012.27) was designed by John Vardy in about 1758 for the Palm Room at Spencer House in London. The sofa had undergone many changes over the years, and at the time of acquisition was covered with a blue cotton fabric and no longer had the correct historical profile. (Figure 7)

The sofa again could not be treated in-house. Upholstery conservation is a specialist area of textile conservation, and while existing staff could carry out conservation type repairs, undertaking a full treatment on the sofa was not a possible course of action.

Although the sofa had undergone significant work in the past it was felt to be vital that any more work should be based on sound museum and conservation principles. Initial thoughts were to work with a traditional upholsterer, but discussion with colleagues indicated that this was unlikely to achieve the required outcome and therefore the project was more suited to an upholstery conservator. This further demonstrates the importance of using professional networks for information and advice. In this case the large size of the sofa and the difficulty in moving it was a factor in deciding to have the work done at the National Museums Collection Centre, and employ a contract upholstery conservator. As it was not clear what would be discovered when the fabrics were stripped back and how we might want to proceed it was felt that this balanced well against the potential costs of the conservator and curator having to travel to the sofa, and in the end this proved to be right course of action. Self-employed upholstery conservator Heather Porter was contracted to take on the project. As the process was again to be filmed for an interactive it was also important

that the object stayed on site, as otherwise this would have had a large impact on the budget and filming.

Figure 7. The Spencer sofa, before conservation treatment

This method of working had a number of advantages, not just in terms of reducing costs, but NMS conservators were on hand if assistance was required (e.g. the furniture conservator helped with an issue with the frame); the curator and lead conservator were on hand to discuss the process and the extent of intervention; the NMS photographers were in the same building to record the process; and the film maker was able to set up the time-lapse camera, leave it on site and come in at short notice to film and record the work for the interactive. There was also no risk involved in transporting the sofa.

Keeping the sofa on site had definite benefits in terms of managing and overseeing the project. The treatment and transformation of the sofa was achieved successfully, and the sofa is impressive in its new home in the gallery. (Figure 8)

Figure 8. After treatment, the Spencer sofa on display

'Letting go' has been a success in terms of these projects, and has demonstrated the possibilities and benefits of different ways of working. Collaboration between the private sector and the museum can be very effective and successful, and should be considered depending on the nature of the work required and the resources available. In challenging times it is important to be open to all possibilities and situations, considering both contracts and outsourcing depending on the circumstances. Much has been learnt from these projects which will be of benefit for future projects.

Acknowledgements

My thanks go to all those who helped with the projects at NMS, and to colleagues in the profession for all their advice and support.

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The Benefit of Hindsight: Lessons learnt from delivering a capital project

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The Whitworth, University of Manchester re-opened in February 2015 after a long and phased capital project that expanded and re-configured the gallery's building and its facilities. The gallery acquired four new display spaces, new systems of environmental control and lighting, new stores and upgraded facilities including technician workshops, conservation workroom, collection access areas and a learning studio. My talk will cover the aims of the project, how we delivered it, and an assessment of the experience – two years later.

‘No perspex’: 102 shoes, 2 months and a shoe designer with a very clear vision

Janie Lightfoot ACR & Jessica Burgess

Janie Lightfoot Textiles

When presented with 202 shoes; those embellished with pompoms, crystals, buckles, ribbons, bows, tassels, and coral; thigh high boots; straps with heavy adornments; and those that had been worn for the movie Marie Antoinette (just a few of Mr Blahník’s favourites from a career spanning over 40 years) it soon became apparent how much Mr Blahník dislikes any visible mount that would interfere with his designs, particularly Perspex® mounts.

The shoes had been selected for a retrospective exhibition *Manolo Blahnik: The Art Of The Shoe*, travelling to 5 cities; Milan, St. Petersburg at The Hermitage, Prague, Madrid and to end at The Bata Shoe Museum in Toronto, over a two-year period. The brief for the exhibition was the shoes needed to be displayed with no visible stands and certainly no Perspex®, could it be done? Additional problems that were faced included having no knowledge of the venues’ exhibition spaces or their intended designs, so it was important to cover all eventualities.

The collection was divided up into two categories; the shoes that could stand sufficiently alone, such as a court shoe or a sturdy platform, and those that required a little help.
It was determined that 79 single shoes and 11 pairs needed some sort of mount.

Set with the task to defy gravity, two of the most challenging shoes were selected to see if it was possible. The first was *Trellis*, a pink suede, knee-high sandal boot, decorated with roses. The height of the boot, with a heavily adorned shaft, meant it was very top heavy; the ankle was narrow, offering little structure to support the weight above, plus the heel cap provided a very small surface area for the boot to balance upon. (Figure 1)

Figure 1. *Trellis* before mounting

The second was *Osaka*, a sandal with very narrow straps, heavy decorative stars weighing these down, and long, loose laces that tie around the leg, all ordinarily supported by the foot and ankle. (Figure 2)

Figure 2. *Osaka* before mounting

Several designs were drawn up and many materials were tested, including aluminium rods in a variety of thicknesses, piano wire, aluminium strips and tubing, aluminium mesh, horsehair braid (crin), and Rigilene® (polyester boning) in different widths. To make the mounts as discrete as possible, methods of covering the rods, wires and boning in colour-matched fabric were tested, and the idea of powder coating the metal was explored.

Preliminary mounts for *Trellis* were devised using an aluminium strip for the spine and the other components were made up of Rigilene®, which created a skeleton for the boot. However, it was found that the boot dipped at the front and the horizontal straps were not perpendicular to the vertical. The weight of the internal structure was pulling it all forward, it was too heavy. In attempt to make it lighter the mount was stripped down to just Rigilene® rings to support the horizontal straps but this offered little support to the verticals causing the ankle to buckle. (Figure 3)

Figure 3. An early prototype for *Trellis*

The straps of *Osaka* could be sufficiently supported with Rigilene®, but the loose laces required something more substantial. Therefore, an oval Perspex® base was cut in the studio, this provided a base for an upright to be anchored into. Initially this was made using an aluminium rod, which

accommodated the weight at the back. Despite the mount functioning successfully, it did not fulfil the invisible aspect of the brief. (Figure 4)

Figure 4. A base and upright prototype supporting *Tortora*

Therefore, it was becoming more and more apparent that Perspex® may be the only option for this aspect of the project. Dauphin Acrylic Design were contacted and following a meeting at their high-tech workshops in Oxfordshire, there were some doubts of the feasibility from their team. With great encouragement from Janie and four hours later the beginning of a suitable design was coming together.

Returning to Manolo Blahník's head office, with the two prototypes constructed out of Rigilene® and Perspex®, there was much relief when Mr. Blahník's face beamed. The Non-Disclosure Agreement was signed and the legal terms and conditions were finalised. It was within this part of the process that it again reinforced the importance of making sure that all legal issues are completely worked out at the beginning, not just for this project but for all projects.

Having established that a lightweight framework was required, and that polyester boning was the most effective way of supporting the shoes, it was now a question of making them as invisible as possible. The method had to be modified for each shoe.

The supports were covered in fabric colour-matched to the lining; due to the scale of the project it was not feasible to dye for each shoe. The studio stock was used where possible but it is not often lime green and fuchsia feature in conservation work, so these were sourced from a number of fabric suppliers. Perhaps, because the colour palette was contemporary and unsoiled, this proved to be surprisingly easy. The exact width required to cover a certain width of boning was calculated so a formula could be applied, helping speed up the process. The widths of the straps varied so the

polyester boning needed to be adapted accordingly, this was done using 4, 8 and 12mm commercially available widths.

In instances where the strap was thicker, two, sometimes three or four, of the most suitable widths were stitched together. This was done by slightly overlapping the edges, they were machine stitched together, first with a row of running stitch, followed by zigzag. To support straps with particularly heavy adornments, it was necessary to double up the Rigilene® providing a more solid form.

There was also the problem of securing the prepared supports in place, without stitching into the shoe. Finally, this was achieved by stitching lengths of thread to the end of the strips, these were then carried under the sole and cast off on the other side. This provided the tension required to maintain the arch of a strap.

The bases to secure the uprights were designed to follow closely along the outside line of the shoe, in order to make them as discrete as possible. It became apparent that the collection followed a formula and that similar lasts had been used over the decades, it was therefore possible to divide these into four categories. The team at Dauphin Acrylic Design could cut these in their workshop in batches, rather than having to make a bespoke base for each shoe. This helped reduce time and cost. To further refine the design of the bases, a groove was carved out to allow the heel to be slightly countersunk, ensuring that the shoe was in exactly the right location for the strap to be held in the correction position by the rod. (Figure 5)

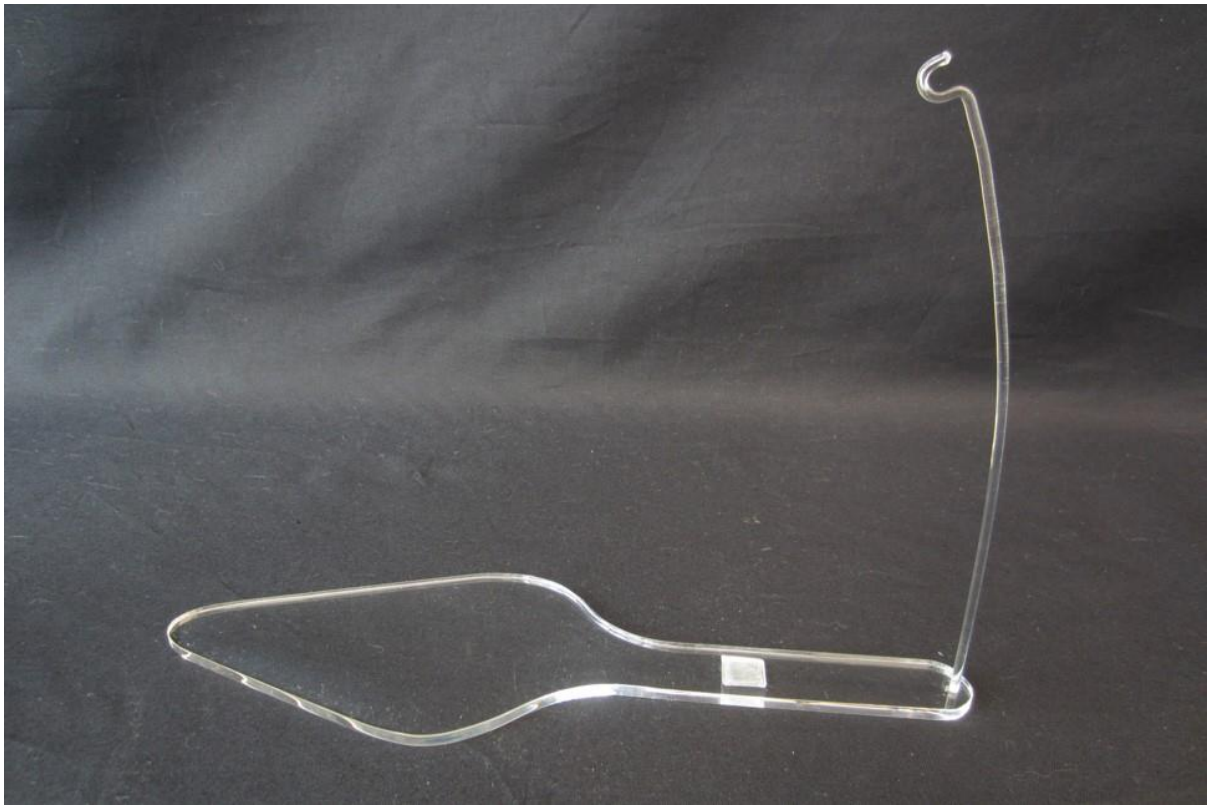


Figure 5. Final design for the base and upright

The final design for *Trellis* was devised by extending a Perspex® ring from a 10mm Perspex® rod, which was anchored into a base. The top strap was secured to the ring with colour-matched threads, which could be hidden behind the roses. By creating a more solid form for the top, while keeping the Rigilene® rings supporting the horizontal straps lightweight, prevented the boot from dropping.

Osaka was supported using a 4mm strip of Rigilene®, which was covered in grey cotton. This sufficiently supported the main straps, but it was too thick for the lace, so the central section was stripped down to one strand of polyester. Threads were carried under shank and additional stitching carried over the straps at intervals. In this instance, we were able to hide them under the stars. The cross formation at the front of the shoe helped to provide a strong form allowing it to stand up on its own. However, due to the length of time that the shoe was going on display it was felt that it would be better for a Perspex® rod be used as a precautionary measure. (Figure 6)

Figure 6. *Osaka* after mounting

Aubrey, a shoe with little structure, comprised of a tulle tube filled with leather flowers, intended to run up the wearers shin, and loose ribbons to tie around the leg, presented a number of obvious challenges. Due to the height and lack of structure, a Perspex® strip was required, this was bent into the toe and made to follow the arch of the foot and up the shin. Holes were then drilled at the point where the ribbons were attached and Rigilene® loops were stitched in place. The loops were made in different sizes to indicate the shape of an invisible leg. The ribbons were then secured to the Rigilene® loops. These remained perpendicular without any further support. (Figures 7 & 8)

Figure 7. *Aubrey* before mounting

Figure 8. *Aubrey* after mounting

Arunium, a particular favourite of Mr. Blahník's, had been of some concern from the outset of the project, due to its weight and complicated ankle strap, reliant on a foot to fill the void to hold it in place. However, having learnt from the principles applied to *Osaka*, the cross formation of the straps at the front of the shoe was a strong shape. So, in fact this shoe turned out to be one of the easiest. A double layer of Rigilene® was used and two strips were butted up to mirror the width of the strap. This was then covered and threads were attached at the ends and carried under the shank, as outlined with *Osaka*. The shoe was then closely monitored for several weeks, every morning it was tentatively checked, convinced it would have dropped, but there was no movement. Having lowered the expectations of Manolo Blahník's team they were delighted to see *Arunium* standing free. (Figures 9 & 10)

Figure 9. *Arunium* before mounting

Figure 10. *Arunium* after mounting

Colona presented a number of different issues, as the straps were elastic and keeping these taught proved difficult; Rigilene® slipped out of place, Melinex was not rigid enough. Perspex® proved to be the only option; a cuff was commissioned, but this looked as though it was part of the shoe, so the gaps were meticulously measured and cut out. The back was supported by constructing a cage out of aluminium rods, which were covered in green silk.

Folloni also required a slightly different style of mount. The arch of the strap could be supported with Rigilene®, but the weight of the gems pulled it down, so a structure was designed, where a Perspex® strut ran up the heel breast, at the top of which a cup was secured, allowing the strap to rest in the correct position.

As an aside, shortly after the project was completed, there was an enquiry to help with the display of Christopher Bruce's ballet shoes, from the Rambert Dance Company Archive, for an exhibition at Lowry gallery. The archivist was keen for the inside of the shoes to be seen, highlighting what a pair of ballet shoes endure. So, a similar method was implemented by supporting the straps, as if there were an invisible foot in place, while allowing the inside to be seen.

Boxes and Labels

While work was progressing on the supports, much thought had been given on how to create the ultimate travelling box. A box strong enough to withstand two years of travelling around the world; a box that was of conservation standard and would give total support for the shoes and boots; a box that would house any other components such as display stands; a box that would be user friendly, as many people would be handling not only the boxes but the objects as well.

Schempp® boxes, manufactured in Germany, proved to be the most suitable option. Their material specification was sound and the samples that were sent were substantial enough to withstand a lot of handling and travel. (Figure 11)

MB – Retrospective Exhibition

Box Samples and Initial Dimensions

SB21 of corrugated card 3.0 mm

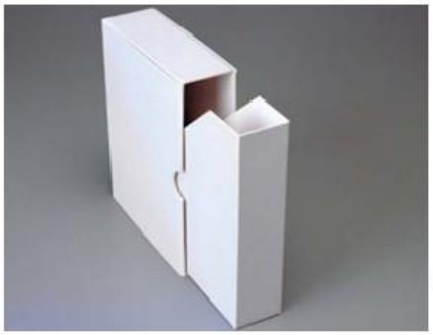
Length	Height	Width	Total
140	15	40	3
90	15	30	1

Fisherman, 9 to 5 and Linda boots

SB53 Slipcase with integrated box

Length	Height	Width	Total
30	70	15	2
30	60	15	5
30	50	15	1
30	40	15	7
30	30	15	18
30	20	15	29
30	20	15	11
TBC*			2

**TBC items*



are Cosus and Carmencita

Figure 11. Schempp® box specifications

The textile box was chosen for the thigh-high boots, and a modified version of the magazine style box was used for the rest of the collection. The sizes were adapted accordingly, the dimensions of the shoes varied quite a lot but in order to keep things simple dimensions were standardized when possible; the width and depth remained the same, and the height was the only variable, making things easier for the shippers.

A loop was attached to the front of the boxes to allow the inner box to glide out smoothly, this was made of 2.5cm herringbone tape. All the boxes were labelled, Timecare® holders were adhered to the top left corner of the front of the box. The client supplied the inserts, which provided details such as an image, the exhibition category, a reference number and the name of the shoe. It was also important to devise a way to alert customs and excise that certain shoes were made of sensitive materials and animal parts. Therefore, an animal paw print label was adhered to the boxes that housed shoes requiring CITES certificates. (Figure 12)

Figure 12. Box labels showing shoe details and CITES identification

Each box was customised by lining it with Plastazote®, to secure the shoes in place while in transit. They were countersunk by cutting a well in the layer positioned on the bottom of the boxes. After testing a number of ways to cut the Plastazote®, hot wires being one of the ways, but this left rough edges, it was concluded that all knives blunted quickly, so cheap snap blades were the most efficient and cost effective solution.

Varying thicknesses of Plastazote® were used to build up the layers more efficiently to hold the shoe in place. A glue gun with conservation grade adhesive was used to adhere the layers together. Once the shoe was slid into the well, a second section of Plastazote® was constructed, this slotted over the front of the shoe locking it in place. When uprights were deemed too fine for travel, they were removed and slotted into an allocated hole in the corner of the box. A heavier duty hook was secured into the back of the box to accommodate the straps securely. Additional modifications were made to certain boxes, cotton ties were secured where extra support was required, wedges were inserted to prevent boots tipping and barriers were created to protect particularly vulnerable adornments. (Figure 13)

Figure 13. Customising the boxes with Plastazote®

The thigh-high boots, known as *Fisherman's Boots* and *9 to 5*, required a full-length textile box each, a silhouette of these was cut out in the Plastazote®, allowing the boot to slot comfortably in place. Grooves were also carved out either side to accommodate ones' hands, making it easier to take the boots out of the boxes. For display, internal forms were constructed out of Plastazote®, interlined and covered in cotton colour-matched to the lining. These were made in two components, one for the foot, the second for the leg. (Figure 14)

Figure 14. Customised box housing one of the *Fisherman's Boots*

Anxiously awaiting news of the safe arrival of the collection in Milan, there was much relief when the shoes had been successfully installed at the Palazzo Morando. The exhibition proved to be a great success, gaining much media attention. They are now on their second leg of the journey, currently on display in The Hermitage, St. Petersburg (re-phrase this, they are no longer at the Hermitage). So far, all the supports have withstood the travelling and several months on display. Although condition checks are carried out as the shoes arrive and leave each venue, there are plans to carry out a thorough assessment of the collection halfway through the tour, to ensure that the shoes remain stable and the supports remain in the correction position.

To conclude, having started with complex designs and measuring methods, a wide variety of materials were explored, mounts were made and re-made, but in fact what was found was, that the most effective method was the simplest, it had to be modified each time but the principles were the same. An initial stumbling block was adding too much weight; a structure intending to provide support disrupted the balance. Yet, if it was too light it did not provide enough structure. Once the equilibrium was found, it could be applied accordingly.

The most complex parts of the project were: -

1. The quantity, keeping track of *Popea, Tortura, Permin, Tersilla, Principe di Lampedusa, Tarquinius*; one could go on, the details for each shoe, colour-matched materials, bases, uprights, boxes, condition reports. Meticulous order and labelling was required, communication was key.

2. Mr Blahník's attention to detail; this would challenge any conservator, he would spot something from the other side of the room. It was necessary to become attuned to what was important to him.

3. Working with a company who were new to conservation, from an industry that is immediate, hands on, disposable, 'anything is possible'. Communicating why something wasn't feasible on an object that was not only owned by the client, but designed by them, could have been a challenge. However, fortunately the Manolo Blahník team are keenly aware of their heritage and eager to learn.

Despite not maintaining within the parameters of the brief of 'No Perspex' – we hope Mr. Blahník's fears were successfully dispelled. (Figure 15)

Figure 15. No Perspex!

Acknowledgements

Manolo Blahník, Evangeline Blahník, Chris Massingham and Jamie Prieto for the wonderful opportunity and their help throughout the project.

Dauphin Acrylic Design, in particular Alex Abbot, Levan and Sophie for their patience and masterful Perspex® skills.

A huge thank you to the team, particular thanks goes to Maria Antao and Elizabeth Cherry – 'Rigilene dream team' and Jennifer Beasley and Kate Klinger – 'box queens'. And to Zute Lightfoot for the beautiful photographs.

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Tel: +44 (0)1254 708068
https://www.minervacrafts.com/

Aluminium Rods and Strips
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The Arches

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A Mummy Shroud Revisited

Irene Kirkwood, Textile Conservator

In **2013** the Curator of Ancient Mediterranean re-discovered a paper wrapped parcel tied with string in the Collections Centre stores of National Museum Scotland (NMS). It was labelled 'from Tomb of Sebauf—Rhind Collection'.

Alexander Henry Rhind (1833—1863) was a Scottish archaeologist who discovered an intact Roman-era family burial in a tomb at Thebes (modern Luxor) in 1857.

The curator requested that a textile conservator be present when the string was cut and the parcel opened to reveal a variety of textiles. A reddish dyed linen textile was especially intriguing as a painted image could be glimpsed within the folds.

The paper wrapped parcel was brought to textile conservation so that the individual textiles could be separated out, unfolded, photographed, documented and identified.

The shroud depicts the deceased as the god Osiris, ruler of the afterlife, holding his symbols of power, the crook and flail and wearing Osiris' crown. The inscription down the front identifies the deceased as Aaemka, son of Montsuef and Tanuat, who were the two main occupants of this tomb.

The reddish textile was placed on a large screen in a humidity chamber set up in the wet cleaning table. The screen allowed the circulation of water vapour. As the humidity was raised the folded textile became more flexible and was slowly unfolded. A full-length painted shroud was gradually revealed over several hours.

After the shroud was documented and photographed, it was packed away in a large box and returned to store.

In **2016** the shroud was requested for display in a temporary exhibition 'The Tomb: Ancient Egyptian Burial' from 31st March to 3rd September 2017.

The shroud was returned to textile conservation so the condition could be reassessed, treatment options explored, and display options discussed with the curator and designer. It was agreed that due to the fragility of the shroud it should be displayed horizontally on a fabric covered board and after the exhibition it will remain on this board.

1.

2.

3.

4.

The condition of the shroud posed a number of conservation challenges. There are two large dark stained areas along one edge which are very brittle. (1) Around the collar area, green paint has caused degradation of the linen and many small painted areas have dropped out. (2) There were old repairs using thick paper adhered onto the reverse of the collar and head area, and behind four long tears around the lower edge. (3) The rigid convex face is distorted and creased and the painted crown is severely damaged with areas of loss. (4)

5.

The adhesive attaching the thick paper was found to soften in water. A variety of techniques were used to apply moisture to aid removal depending on how well the paper was adhered contact humidification using Goretex and damp blotting paper, ultrasonic humidifier and direct application of water using wet cotton swabs rolled over the paper.
Once the paper had been removed from the head and shoulder area it was found that the face contained the remains of rigid linen bandages. (5)

6.

The most challenging aspect of the conservation of the shroud was the support of the fragmented painted crown. (6) This was due to the restricted access to areas obscured by the hard linen bandage on the inside of the face and the difficulty of realigning fragments adjacent to the head as the face was so severely distorted.

A variety of adhesives and support materials were tested for the support of this area and the brittle stained linen.

7.

It was decided to use 15% Klucel G (hydropropyl cellulose) dissolved in 50:50 water:industrial denatured alcohol brushed onto Japanese paper. The paper was wet cut to the required shape and applied to damaged areas whilst still tacky to the touch, then gently tamped in place with firm silicone tipped brush or blunt sable brush. (7)
The Japanese paper had been pre-dyed using fibre reactive dyes then further toning achieved with water colour where required. (If time had permitted the author would have preferred to dye the paper only.)
This technique was first used to support the stained brittle areas and worked well .

At the crown small support patches of Japanese paper were brushed with the adhesive and applied to the reverse, starting at the top of the crown (8) and gradually working towards the forehead, bringing the fragments together where possible. The Japanese paper in-filled the missing area (9)

8.

The shroud was given a full support onto dyed nylon net, stitched using silk thread. The nylon net support was brought to the obverse around the edges to enclose the frayed edges of the linen and to encase the long tears at the feet. The flexible nature of the nylon net gave adequate support to the linen whilst accommodating the inherent creases and undulations in the linen.

9.

Mounting

The shaped face and crown of the shroud did not lie comfortably on a flat surface. A gently curved oval mount was made using Fosshape 300 (low melt polyester felt), covered with cotton fabric. The curved mount was positioned on the mount board and stitched in position. The shroud was positioned on the fabric covered mount board with the aid of a template drawn onto silicone coated polyester film. The curved mount raised the forehead about 15mm which gave a gentler slope to the crown. Minimal stitching was required to attach the shroud to the board as it is to be displayed horizontally.

10.

The shroud after conservation treatment, mounted on a padded board.

A Coat of Many Colours: Conserving an 18th Century Technicolour Dream Coat

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CST.1.292.A
Before Conservation

Introduction

During my internship year I was charged with the conservation of a late 18thC coat of brown cut and voided silk velvet, adorned with polychrome floral embroidery and appliquéd net (CST.1.292.A). The coat is part of a two-piece suit (habit à la française) from The Bowes Museum collection, selected for display in the Fashion and Textile Gallery. The garment was shown in the 2013 exhibition *Henry Poole & Co.* as an example of 18thC bespoke male tailoring.

Little is known about this garment's provenance, but it is typically Parisian in style. The numerous embroidery workshops located in the capital during the second half of the 18thC were famed for their luxury formalwear. Customers would travel to the city to select their elaborate pre-embroidered panels at astonishing expense (as much as six hundred francs per *aune*),[1] which would then be cut, pieced and finished to fit the wearer 'à la disposition'.[2]

1. 'The Decoration of Men's Fashion in Eighteenth-Century France,' The Metropolitan Museum of Art, accessed March 16, 2017, http://www.metmuseum.org/blogs/now-at-the-met/2015/elaborate-embroidery.
2. Akiko Fukai, *Fashion: A History from the 18th to the 20th Century: The Collection of the Kyoto Costume Institute* (Taschen, 2002), 72.

Conservation Issues

1. Natural Material Disintegration

The coat was in exceptional condition bar a serious case of disintegration to the appliquéd net. The overall consistency and severity of the damage in comparison with the rest of the coat's pristine embellishment suggested that the net had been treated at the manufacturing stage with a process that had accelerated its rate of degradation.

Details Showing Damage to Appliquéd Net Before Conservation

2. Historic Man-Made Intervention

The coat had undergone a few minor adaptations in its lifetime including the insertion of mysterious brown ribbed silk panels to the underarms and addition of button holes cutting through the embroidery.

Coats of this style and period were rarely designed to fasten at the front – if they did it would likely have been two meticulously stitch-finished button holes, occasionally with the addition of further decorative (non-functional) button-holes to compliment, expose and frame an equally exquisite waistcoat rather than the rough-cut version we see here.

Mysterious Underarm Inserts

Rough-Cut Button Holes

It is not unusual to see such adaptations. Many garments finally laid to rest in museums have lived two or three lives. They may have been subject to restoration by the original owner to get a little more wear out of an expensive fabric or modified to keep pace with the fashionable silhouette. Much of what is still in existence has, at some point, been used as theatre costume or done time as fancy dress, adapted and adjusted to fit wearer and occasion.

The question is, how do we decide which alterations to keep and which to erase?

The Treatment

1. Stalling, Securing and Masking Natural Material Deterioration

Stitching Conservation Net Overlays in Progress

The Practical Challenge

Nylon net was dyed to match the original appliquéd net. A Melinex® template was taken from each area of damage and nylon net patches were cut to size and secured with stitching along the couched appliquéd net outlines. This was to prevent holes in the original appliquéd net from worsening and provide a little aesthetic infill for the areas of loss.

Left to Right: Cuff Detail Before Conservation, Conservation Net Pinned in Place, Detail After Conservation

2. Historic Man-Made Intervention – Should It Stay or Should It Go? How and Why?

The Theoretical Challenge

Our role as conservators is to preserve pieces for the future and this may include preserving evidence of use (and re-use), not necessarily to return garments to 'perfect' condition. However, the decision to 'leave it be' is not always an easy one. The brown twill silk patch anomalies set into the outside underarms were fragile, splitting and fairly visually intrusive. Yet it was difficult to decipher when, where and why the restorative work had been done and therefore whether it could, or would, be deemed historically significant.

Underarm Inserts Before Conservation

Underarm Patch Stitch Support in Progress

This is when it is vital to have curatorial input in the conservation decision-making process. In consultation with The Bowes Museum curators it was decided to support the splitting brown patches with additional patches of dyed brown silk habotai inserted below, then couch-stitched over the top.

Conclusion

The treatment of this coat, while dexterously tricky, was in itself fairly routine. The real challenge was instead how to negotiate the delicate balance of visual spectacle against story and support when all have equal part to play. The two conservation issues, one – the natural material disintegration, the second – a man-made intervention, inspired discussion between curators and conservators on what we should be preserving and how best to stall the inevitable passage of time.

Many thanks to The Bowes Museum and ICON for hosting and administering my internship, Katy Smith (textile conservator at The Bowes Museum and ICON supervisor), Joanna Hashagen and Hannah Jackson (curator and assistant curator of fashion and textiles at The Bowes Museum) for ongoing support and advice.

Coat Detail After Conservation

THE BOWES MUSEUM

Further Research

The Costume Society Blog, 'Should It Stay or Should It Go: Historic Alterations to Costume in the Museum,' http://costumesociety.org.uk/blog/post/should-it-stay-or-should-it-go-historic-alterations-to-costume-in-the-museu.
The Bowes Museum's Blog, 'A Coat of Many Colours: Conserving an 18th Century Technicolour Dream Coat,' https://thebowesmuseum.wordpress.com/2016/05/24/a-coat-of-many-colours-conserving-an-18th-century-technicolour-dream-coat/.

The conservation of two degraded silk colours (1777-79)

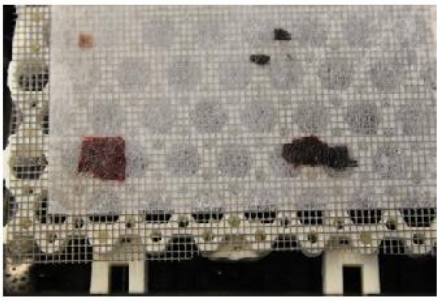
The East India Volunteer Colours hung in the Military Committee Room at the India Office, Whitehall until 1963. It is probable that the flags moved again in 1967 when the India Office Library and Records moved from Whitehall to Orbit House, Blackfriars Road and finally moving to St Pancras around 1998.

It is likely that the flags had been stored in the same condition for over 50 years. The British Library employed a textile conservator, Liz Rose in 2015 and it was a condition of her role that these priority objects were conserved. Once conservation is complete this will enable access, display and research.

In April 2015 the flags were removed from their storage and unrolled. A risk assessment was carried out prior to the unrolling as it was felt that 'sooty' soiling may contaminate the conservation studio. Portable screens were placed around the work space to isolate the flags from the rest of the studio as a precautionary measure.

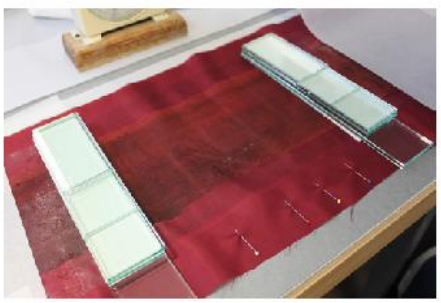
Central embroidery revealing coloured wool after surface cleaning. This embroidery was removed from the flag and wet cleaned separately using a Dehypon LS45® (x3 CMC) and no SCMC: it was not submerged in the wash solution.

The central embroideries were removed from both flags before wet cleaning.
After a risk assessment, it was concluded that the wet cleaning of these degraded and extremely fragile silk, metal thread and sequin embroideries would be deleterious to the object.



The washing protocol was tested. Technotiles® were used as a porous platform, fly mesh used as a cushion and the silk was sandwiched between 2 x layers of 19gsm Reemay®. The action of wetting the silk encased in Reemay® caused it to stick together and hold the object in position throughout the cleaning process (protocol curtesy of the National Trust).

During wet cleaning the surfactant and water were drizzled over flag from sponges and through fingers to prevent further damage to the degraded silk. Sponging was not used as this re-distributed the dirt back into the wash solution and rinse water. Liquid was removed using 3M Sorbent®.



The degraded silk pole sleeves were washed using the same protocol. Consolidation of degraded silk pole sleeve has been achieved using dyed nylon net coated with 15% Lascaux® 360/498 w/v 1:2 50/50 acetone/ water and activated with acetone.

To aide interpretation, the flag has been laid on a digitally printed image which infills the areas of silk loss. Various versions of the printed cotton were Oddy tested and the colours selected were found to be stable for long term storage. The cotton performed better after 3 washes. The flags will be mounted on large padded boards made from Dibond® and will be ready for display.

Studies in Consolidation: Treating Matt paint on Spanish Civil War banners

Jenny van Enckevort ACR and Zoë Lanceley

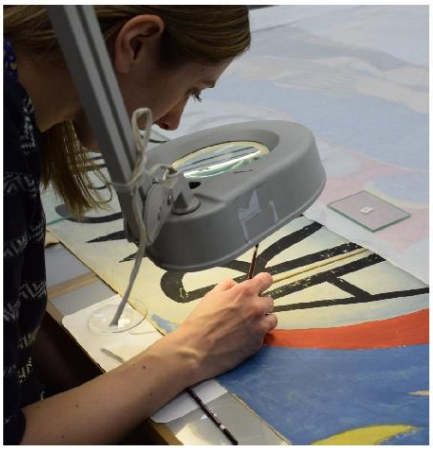
As student conservators we are encouraged to experiment with new materials and techniques all the time but when entering the real world you often find there is less time to undertake research. This is especially true when working in a busy studio which looks after a museum collection and takes on private work as income generation. The majority of banners we treat at the People's History Museum are made with oil or acrylic paint so when a recent project came up to consolidate matt paint on six Spanish Civil War banners belonging to the Marx Memorial Library, it seemed like the perfect opportunity to try out different treatments, techniques and new materials.

Paint before treatment

Matt paint is characterised as having a high pigment to binder ratio which often leads to problems such as powdering, flaking or crumbling. A suitable consolidant would be one which achieves good adhesion between paint particles and the substrate without altering the matt appearance. The aim was to find an appropriate solution by first making samples and then testing a range of adhesives and methods of application. The samples were prepared by Zoë using scoured unbleached calico cut into 8cm x 10cm rectangles providing enough space for the paint and notes below. The paint was chosen to best match the type present on the banners, this decision was made based on optical examination of the banners as we did not have access to equipment for specific material analysis. Daler Rowney designers gouache was chosen as a good quality commercial paint in colours closest to some of the problem areas on the banners; Lamp Black, Cool Grey and Brilliant Blue. Equal numbers of samples were made in each colour for testing and the samples were scrunched slightly to replicate the damage caused to the paint surface by folding and manipulation. In this case flaking and abrasion rather than powdering.

Test samples after consolidants had been applied and isinglass before preparation

Paint after treatment



During consolidation treatment

Consolidants were chosen after reviewing conservation literature on similar treatments and going back to our university notes. The following adhesives were prepared at concentrations suitable for each material's working properties. Wheat starch paste, meythl cellulose, isinglass, gelatine and were made up in de-ionised water, Klucel G in IMS and de-ionised water, Beva 371 in white spirit and Paraliod B72 in acetone.

Initial tests were carried out to gauge how the consolidants behaved in contact with matt paint. All the adhesives tested were effective consolidants but had varying affects on the appearance of the paint on drying. As expected, the synthetic polymers considerably darkened the paint and appeared quite shiny. Klucel G and Methylcellulose were also quite shiny. Wheat starch paste, Isinglass and Gelatine all performed well so were tested again on each colour to see how they compared.

The black paint on the un-treated samples was very saturated and an optical change was noticed with most of the consolidants. This is possibly due to the adhesive filling gaps between the pigment and smoothing the surface The black paint on the banner has a smoother surface so the samples were significantly different to the object. Therefore tests on the object were the next step. Small areas of flaking paint were treated with isinglass and gelatine both at 2% in de-ionised water. Wheat starch was discounted at this stage because it was felt that the bond strength was not enough to anchor the flakes. The adhesives were applied with a small squirrel hair brush using a long arm microscope to ensure accurate application and visual examination of the area as each adhesive dried.

Isinglass was found to be most successful as the bond was strong enough to secure the flakes without significantly altering the appearance of the paint surface. At the point of writing this poster three of the banners have been treated, only one of which required consolidation. The other banners in the group present slightly different problems so it was useful to test a number of consolidants and adapt the treatments as required. In conclusion the project has improved our knowledge and confidence in treating this type of paint, the work will also go on to benefit the banners in the museums' collection with similar problems.

The Arms & Justice for Spain banner after treatment

Banners belonging to the Marx Memorial Library & Workers School
Project supported by The Textile Society and the GFTU Educational Trust

‘Pitching’ Tipu’s tent at the V&A

Elizabeth-Anne Haldane, Senior Textile Conservator and Richard Ashbridge, Technical Services Team Manager, Victoria and Albert Museum

Tipu’s tent on display at the V&A Photograph: ©Justin Tallis/AFP/Getty Images

Introduction

The Fabric of India, held at the V&A from 3rdOctober 2015 – 10th January 2016, was the Museum’s first major exhibition to focus entirely on handmade textiles from India. A highlight of the exhibition was an 18th century tent on loan to the V&A from The National Trust. The tent once belonged to Tipu Sultan, ruler of Mysore, although it pre-dates his rule (1782-99) and is thought to have been made around 1725-50 based on the design of the chintz interior. After Tipu Sultan was defeated by the British is 1799, it was acquired by Lord Clive and taken to Powis Castle where it is now part of the Clive Museum. The tent consists of a separate canopy and walls made from cotton that would originally have fastened together with a series of rope latchets. At Powis Castle some of the wall panels, complete with their original internal bamboo poles, are displayed with a section of reproduction canopy. The real canopy, which has a circumference of 25 metres, had not been displayed since the 1980s and its exact shape was an unknown quantity. It was the responsibility of the V&A as the borrower to devise an appropriate mounting system that would safely support the tent but also allow visitors to walk underneath the canopy to experience the full glory of the tent, which is highly patterned inside but plain on the outside.

Tent structure

The tent was examined at Powis Castle by Elizabeth-Anne Haldane and Rachel Langley, Senior Textile Conservator for The National Trust to establish its condition and to discuss the feasibility of displaying it at the V&A. Peter Andrews, scholar of historic tents, also attended and advised on the structure. The canopy is constructed from three layers of fabric stitched together to form channels for guy ropes and a network of heavy weight strengthening tapes which run from the centre of the canopy to the perimeter, each ending with a leather reinforced tab. The top of the canopy consists of a leather reinforced opening where a central pole, now lost, would have been inserted to raise the tent. During this visit extensive measurements were taken, and a paper pattern made of the apex of the canopy so that a toile could be fabricated at the V&A to facilitate mount-making. Ideas for the canopy mount were discussed, including where the object needed support and which original fixings could be used. The walls displayed at Powis are attached to a timber structure with Velcro fastening, so a similar system was planned for the V&A installation.

Rope latchets at canopy perimeter, linked together

Leather socket on wall for latchet

Canopy showing guy rope channels

Leather reinforced tab at canopy perimeter

Leather reinforced canopy centre

Canopy mount

The canopy was brought to the V&A early to prepare the mount. This was also an opportunity for the project team to view the canopy and discuss display methods with a specialist rigging company who were able to advise what would be possible using the existing lighting rig in the exhibition space. The final design consisted of an octagonal ring suspended at eight points from the lighting rig above, and a second smaller padded ring to suspend the apex. Eight adjustable cotton tapes were used to connect the inner and the outer rings, these ran along the guy rope lines to provide support and help shape the billowing fabric.

The octagonal ring was designed with a bespoke metal bracket at each of the eight corners. As the canopy has a hanging fringe each of the brackets required an extended downward arm with a flattened horizontal plate to give a fixing point to the suspension cables. The brackets were made from square tube so that timber battens could be slotted into each section to complete the ring. A perforated Dibond rail with Plastazote cushioning was attached to the timber. The rope latchets on the canopy perimeter were threaded through the holes in sequence to attach it to the mount. The central ring was raised independently of the outer ring to adjust the curvature of the roof, once this distance was set and locked it was possible to move the canopy up and down as one unit by moving the mechanised lighting rig, allowing the walls to be installed below. Finally the canopy was lowered down until it connected with the walls giving the illusion of a complete tent.

Detail of octagonal ring with holes for latchets

Attaching canopy to ring

Detail of metal bracket

Canopy raised up during installation of walls

View showing suspension cables from lighting rig

Top support ring

Wall supports

View from inside the tent Photograph: V&A Photo Studio

Acknowledgments

The display of the tent was the result of 18 months of planning and involved a wide team of people from both inside and outside the Museum to achieve the final result. Thank you to all the National Trust staff involved in the project, Peter Andrews, exhibition designer Gitta Geswendtner, Unusual Rigging, KPK Sheet Metal and to everyone at the V&A involved in the project, many of whom you can see in the time lapse video documenting the mounting of the tent, which can be accessed here

http://www.vam.ac.uk/blog/fabric-of-india/guest-post-raising-the-roof-mounting-tipus-tent

Planning, preparation and packing: reflections on the Snowshill Manor project

Michele Bartlett, Conservator South West, National Trust
(formerly Project Conservator for the Snowshill project)

Introduction

National Trust's Snowshill Manor in Gloucestershire is home to Charles Wade's collection of over 25,000 objects. It is diverse and inspiring: the eclectic and densely packed displays include rooms devoted to transport (life-size and models), musical instruments and Samurai armour as well as rooms featuring a mixture of objects - polychrome sculpture, vernacular furniture, lacquer cabinets, ceramics and textiles to name but a few.

Between 2001- 2005, the planning and implementation of a major project took place to improve and upgrade services to the Manor. For the National Trust, the complexity lay in the preparation, packing and removal of the collection. The reinstatement to its historic home after the building works would be considered a success if the collection looked as though it had never left.

The project was completed on time and on budget and the aim here is to offer a practical insight into some aspects of the planning and to reflect on lessons learnt.

Planning

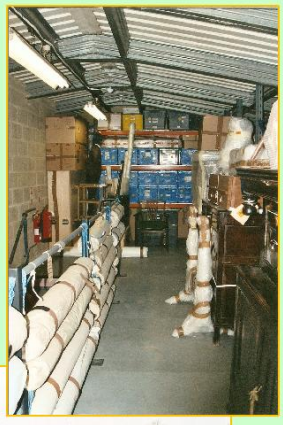
Thinking time to plan and learn from past and existing projects is vital. At Snowshill, a project conservator was employed to carry out the planning and implementation stages. To begin with, a full assessment of the collection both on display and in storage was undertaken. This involved assessing the size, material type and condition to inform packing and storage needs. Robust wooden free-standing furniture could be simply blanketed whereas some of the Samurai armour exhibited fragile, split textiles (below) that required more careful consideration.

The National Trust's team of specialist advisers visited the Manor during the planning process and completed a bespoke packing questionnaire to inform particular queries. The responses also contributed to working out the packing timetables, where co-ordination of over 100 people was needed.

The collection was thoroughly documented using quite simple but effective methods – the digital age has moved on quickly in the past decade and offers more sophisticated tools. Each room had a dedicated A3 ring-binder containing photographic montages, drawings to scale of the most complex displays and plans with all floor items measured and recorded. A trial and evaluation was carried out to ensure that the documentation methods would work. The plans were also annotated during the packing with notes that would help with reinstatement, such as replacement fixtures and fittings. Packing labels (above) were photocopies of inventory cards, bearing a full object record and colour-coded according to room location to help with the return leg.

Budget

Costs for all aspects of the project were calculated by researching the different elements needed for the packing, transport, storage and reinstatement of the contents. These included labour (and welfare) costs as well as materials, boxes and bespoke cases, equipment for packing stations, container hire and the storage fit-out.



Investigating the planned route to the transport vehicles was also a priority (above). A 80m covered walkway was constructed to provide a smooth platform and more critically, an all-weather route – essential for a winter timetable. Additional in situ protection and barrier matting was introduced at the Manor's entrance to protect the historic floors.

Packing

Some examples of packing from top clockwise… Attaching existing display brackets (checked for condition) to base supports and then securing wide soft webbing at points over the object. Snaking polyethylene sheeting around ceramics to create secure nests. Using vented crates for objects that need 'tying-in' with safety-belts of polyethylene or wadding wrapped in tissue and soft cotton tape – this is fed through the vent and tied off from the outside without pressure to the object. Compartmental trays and polyester film to enable visible packing - stacking options are reduced with the use of film but here, the sturdy crate was needed to support the sculpture.

Registered charity no. 205846
Acknowledgements: with thanks to all those who worked on the project.

STASHc: Sharing Safe Storage Solutions

Lisa Goldberg and Rachael Perkins Arenstein

STASHc Editorial Committee

lgoldberg@stny.rr.com and rachael@amartconservation.com

STASH
Storage Techniques for Art, Science and History

Introducing STASHc

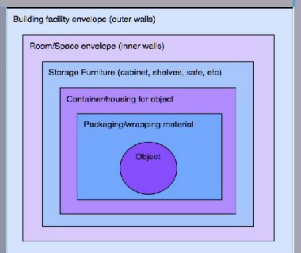
www.STASHc.com can be used to provide museum professionals and volunteers with specific designs and ideas for object-level storage solutions.

STASHc provides information and tools so that institutions of all types, sizes and resource levels can create safe and appropriate storage solutions. These solutions, written by and for collection care professionals can help put a storage reorganization plan into action by providing a panoply of ideas and potential choices. Multiple examples for individual object types demonstrate that there is no single best solution for storage; it is about meeting the needs for your collection, in your space, with your resources. The articles posted on STASHc present varied solutions and opportunities for adaptation and use.

STASHc can be used in conjunction with other online storage assessment and planning resources such as **RE-ORG** (http://www.iccrom.org/).

Using STASHc

STASHc presents a compendium of solutions that can be browsed for ideas about how you can re-store your collections. The site is organized by storage configuration and relates directly to the nested storage model that many museum professionals use when considering levels of protective care.



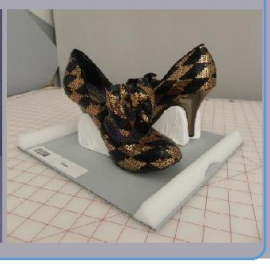
➢The **Solutions** section is organized in a tiered structure. Find the storage configuration that best suits your collection needs, and browse for ideas among the list of titled entries.

➢The **Resources** section provides helpful tools for sourcing and constructing storage solutions, including a glossary, unit and conversion tools, as well as a **Materials, Supplies and Tools** chart to find appropriate vendors.

➢The online **Submission** form facilitates new entries.

➢The **STASH News** blog addresses broader storage themes and issues. Recent posts cover labeling and visible storage.

➢The **About Us** section details members of the site's editorial committee, which is composed of Conservators, Collections Managers, Registrars, Mountmakers, Preparators, Archivists and Librarians. The site is also sponsored by vendors of preservation products.



STASHc SYNERGY

Evaluate your storage space configuration and individual item storage. Look at your current storage configuration and determine which collection components have the highest need for re-housing, and for which you have time and space to make improvements. The RE-ORG site can help with this process.

✓Once you've defined the problem, assess what you've got to determine the next steps:

- How many items do you have?
- What materials are the items composed of?
- How much space do you have for their storage?
- How frequently are they used?
- What is the level of training and experience of staff or collections users?

✓Assessing potential improvements or new ideas:

- Use the sidebar of storage configurations to find the solution that most closely matches your collection component. Then browse for ideas among the list of titled entries!

✓ Adapting and improving on similar solutions - each article on STASHc is specific to a situation and object type. Think about how you can reproduce, modify or improve on a published solution to suit your particular needs; you can adapt any of these solutions by evaluating:

- What is similar about object type, size, number and scale?
- What are the properties of the materials you are hoping to use or include in your storage solution?
- Are there specific handling or use concerns that you want to address in your solution that are different than those presented by the STASHc article you are looking at?
- Are there environmental issues specific to your institution or situation that you need to consider in making design or material choice decisions for your solution?

✓Make a template or pattern:

- Creating a template or pattern can often help streamline the process. You may become aware that you need a different material, technique for manufacture, or a completely different solution. Often times, modifications in process result from experimentation at this stage.

✓Create it!

- Set up a work station and system for creating your solution. Thinking about the process will save you time and will often result in modifications that can make the entire project flow more smoothly.

✓Let us know about it!

Improvements can be reported in several ways:

- The **Comments** section at the end of each STASHc solution can be used to add new information or commentary.
- The **News** section on the home page can be used to begin a discussion about a storage solution idea that spans more than one category of storage solutions. An example might be discussion about the choice of a particular storage material.
- A new STASHc article can be submitted for a solution that improves upon a design in significant ways.

TEXTILES are represented in multiple categories on the STASHc site; including containers such as storage cabinets, shelving units, boxes and other enclosures, and internal supports such as roller tubes, malleable/padded forms, mannequins and hangers. BROWSE freely for INSPIRATIONS, IDEAS and IMPROVEMENTS!

Acknowledgements

STASHc is sponsored by the Foundation for the American Institute for Conservation of Historic and Artistic Works (FAIC). Thanks are due to the vision of Carolyn L Rose and Amparo R De Torres, the editors of the 1992 volume, *Storage of Natural History Collections: Ideas and Practical Solutions*, and to all the authors who agreed to have their print contributions formatted for this site. Thank you to recent participants in STASH Flash Sessions at the AIC Annual Meetings for contributing new solutions to the site. The Society for the Preservation of Natural History Collections (SPNHC) originally published the 1992 volume, and past SPNHC officers Jean-Marc Gagnon, Chris Norris and Susan Butts were critical in supporting this project. The American Institute for Conservation of Historic and Artistic Works (AIC) and AIC's Collections Care Network (CCN) have provided support and oversight. National Museum of the American Indian, Smithsonian Institution and American Museum of Natural History and the Philadelphia Museum of Art for images.

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University of Glasgow

Centre for Textile Conservation and Technical Art History
Dissertation Topics - Class of 2017

Alternative reducing agents to sodium dithionite for solubilising iron stains

Beth Knight - 2182313K@student.gla.ac.uk

Rust stains on textiles degrade fibres and are notoriously difficult to remove unless they are first chemically reduced. The reducing agent sodium dithionite (also known as sodium hydrosulfite) can help solubilise these stains, often in combination with a chelator - a technique mostly used in paper conservation. Sodium dithionite is not widely implemented in textile conservation because of its health and safety concerns, rapid deterioration in water, and incompatibility with wool. Few textile conservation case studies involving sodium dithionite have been published and little research has been undertaken to find safer and more stable alternatives. Reducing agents specifically for iron are used in industrial applications and may be feasible for textile conservation. This research will explore if other reducing agents can solubilise rust stains on cotton and wool. Their working properties will be compared to sodium dithionite with the aim of developing an effective and safe method of removing rust stains on textiles.

Beth Knight surface cleaning.

An investigation into the effects of solvent vapour on soiled textiles when used to activate adhesives

Aisling Macken - 2128671M@student.gla.ac.uk

Adhesive coated crepeline is used in textile conservation as a method of supporting and protecting areas of damage, and the adhesive can be activated using either heat or organic solvent vapour. Soiling from historic textiles is generally removed before the application of an adhesive support, however this is not always possible. My intended field of research aims to look at the potential solubilisation of ingrained soiling by solvent vapours when applied through two different membranes: Reemay® (random spunbonded polyester) and Gore-Tex® (polytetrafluoroethylene).

Pattern books: a textile and paper affaire: Documentation of two pattern books with exploration of options for treatment.

Cristina Prelle - 2112421S@student.gla.ac.uk

Pattern books, or sample books, house enormous amounts of valuable information regarding manufacturing processes and business practices in the 19th century. Samples found in such folios provide access to past pigments and dyestuffs, as well as techniques of construction and printing. The analysis of this information can help conservators and historians explore the provenance of certain materials, manufacturing technologies, and gain a better understanding of business relationships throughout the industry. The focus of this research will be to investigate issues that conservators are faced with when treating pattern or sample books, exploring the interdisciplinary approach between paper and textile specialities for their long term preservation.

Bevan O'Daly stitching.

Moving away from nylon net: Finding alternative approaches to the conservation of lace.

Bevan O'Daly - 2167907O@student.gla.ac.uk

The use of nylon net is widely accepted as a routine solution to the conservation of lace (stitch and/or adhesive support). However, nylon net can greatly obstruct the interpretation of different types of lacework that may or may not already include a form of net ground in their design. Initial research has found that there are countless publications dedicated to the identification of lace and to lace making, yet literature describing the conservation of lace is comparatively and significantly lacking. This research aims to explore alternative methods of providing non-interventive visual infills and structural supports by drawing upon basic traditional lace making techniques and through experimentation with Gütermann™ Solvy (transparent water-soluble film). This research will be based on the needs of a piece of historic lace in the form of a case study.

Previous dissertations are available upon request.
Contact: Frances Lennard – Frances.Lennard@glasgow.ac.uk

Poster by Bevan O'Daly and Beth Knight

Centre for Textile Conservation and Technical Art History
Dissertation Topics - Class of 2017

A sticky subject: Evaluation of previous conservation treatments on a selection of 19th century costume

Rosie Nuttall - 2188816N@student.gla.ac.uk

The aim of this dissertation topic is to focus on the evaluation of past textile conservation treatments. Primarily, this will involve the investigation of interventive treatments undertaken on a selection of late 19th – early 20th century costumes conserved in the 1970s. I will be asking how these treatments have contributed to the objects' survival, how the treatments have aged, and how the results of my findings might inform future conservation decisions. The research will focus on a select few case studies from the same collection and evaluate the adhesive and stitched support techniques used.

L-R Aisling Macken, Lorna Rowley, Beth Knight, Bevan O'Daly, Ruby Antonowicz-Behnan, Cristina Prelle, Rosie Nuttall, Keira Miller

Characterisation of previous repair techniques on painted banners and evaluate the different approaches to remediate them

Lorna Rowley - 2129081R@student.gla.ac.uk

Although painted banners are now widely found in museum settings, the marching of painted banners also remains a strong living tradition. The preservation of these complex multi-media objects has historically rested with banner owners as well as with conservators. Typical degradation includes substrate splitting at the interface of differing materials, cracking and flaking of painted surfaces, and structural damage from marching in all weathers. Literature regarding the removal of 'repairs' is often focused on individual and period specific case studies. This research aims to examine the multiple approaches taken when conserving banners for museum displays or ongoing use. In characterising and re-evaluating these approaches, this research will assist future treatment approaches.

Ruby Antonowicz-Behnan costume mounting.

An investigation into the use of wet cleaning treatments in the conservation of Pacific region barkcloth

Ruby Antonowicz-Behnan - 2163872A@student.gla.ac.uk

Barkcloth is a non-woven cloth made in many parts of the world including the Pacific islands. It is made from the inner bark of certain trees and is used for ceremonial and everyday dress as well as household items. Barkcloth is a diverse material which can be highly textured and layered or fine and lacelike. It features patterned beaters marks, dyes, pigments, and oils for decoration and waterproofing. The investigation will explore suitable methods for wet cleaning historic barkcloth, paying particular attention to the effects the treatment may have on the decorative finishes mentioned. Tests will be undertaken to explore the suitability of applying textile and paper wet cleaning techniques to washing barkcloth with the intention of providing practical recommendations for treatment.

Materials maketh the mannequin: An investigation into the material properties of papier-mâché torsos used for conservation mounting of contemporary and historic dress

Keira Miller - 2179648M@student.gla.ac.uk

Economic sustainability is an ongoing challenge for museums and the heritage sector, while environmental sustainability is fast becoming a deciding factor in heritage management. Institutions wishing to display dress and textile items regularly face threats to each of these aspects of museum planning when considering which mannequins to purchase for displaying their collections in a manner consistent with conservation guidelines. The outcome of this research will inform the manufacture of a product which can more suitably meet the economic, environmental, and conservation needs of the heritage sector

Previous dissertations are available upon request.
Contact: Frances Lennard – Frances.Lennard@glasgow.ac.uk

Poster by Bevan O'Daly and Beth Knight

THE INSTITUTE OF CONSERVATION

Icon Textile Group Forum 2017

may berkouwer textile conservation
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BEYOND CONSERVATION: Storage Projects in Private Practice

Due to their organic nature, textiles are one of the most sensitive object materials that can be found in collections; being highly vulnerable to humidity, temperature and light as well as physical, chemical and biological agents [1]. Textile conservators, working both in private practice and in museums and institutions, all have the same aim: to preserve textile objects for the future in the best condition possible.

Just as important as the conservation treatment itself, are the environmental and physical conditions the objects are displayed and stored in.

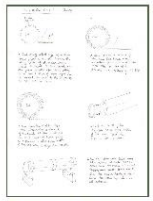
Whilst the bulk of the jobs we carry out in private practice are conservation related, there are many other aspects involved and we can find ourselves involved in projects such as surveys, assessments, research, display and, of course, storage.

Whether working in a private practice, a museum or an institution, the same ethics and guidelines are always followed. Therefore, when initially planning a storage project, choices have to be made regarding materials to be used and the method of storage (flat, rolled, folded, hung, boxed, on trays or padded)[2] and this process will be continuously seen across the different working environments with similar results.

Adaptability is paramount to approaching jobs, and the problem solving of thus, for any conservator in a private practice. Flexibility is needed when dealing with a wide range of clients and objects/collections which each require individual solutions. High standards need to be kept within tight budgets and short deadlines; the key being 100% understanding of the client's needs and resources.

Using our experience at May Berkouwer Textile Conservation, this poster explores the contribution of private conservation practice towards the long and short term storage of objects and collections within institutions and private houses.

1860's Burmese map (Maps.Ms.Plans.R.c.1), detail, before conservation



Packing instructions for rolling maps

1860's hand-painted Burmese Maps, Cambridge University Library

Key words: Institutional client, long term storage, small collection of large objects, rolled storage system

In 1910, this group of three fascinating and attractive maps were presented to CUL by ex-Inspector of Schools in Burma, Louis Allan Goss Esq. The colourful maps were painted on cotton fabric and depict the Shan provinces and other districts of Upper Burma.

Following the client requirements, after a minimal conservation treatment, the maps were prepared for long term storage. Previously kept folded in boxes, they are now rolled onto made-to-measure acid-free cardboard rollers, interleaved with acid-free tissue, and wrapped in down-proof cotton covers (to protect them from light and dust) and labelled . In store, the rollers are suspended on blocks thus the maps are safely stored and accessible for research.

1860's Burmese maps in new custom-made rollers, after conservation

19th C samplers study collection, Dacorum Heritage Trust

Key words: Institutional client, small collection, study collection, tight budget, custom-made trays in existing box

A small group of samplers, shown at various venues for educational purposes, were fully conserved and re-stored in their existing archival acid-free box, made to accommodate the transport and handling. For each sampler an acid-free card mounting board with handles was cut to easily fit inside the box: each tray was covered with down-proof cotton fabric and finished with thick acid-free card window mount to allow the samplers to be stacked in the box without the risk of abrasion.

Samplers into custom-made trays, overall view (above) and fitting tray into existing box (below), after conservation

Embroideries at Hardwick Hall House, National Trust

Key words: Institutional client, long term storage and study cases, large collection, variety of sizes, fragile condition, custom-made trays in boxes

Hardwick Hall famously houses one of the most important collections of 16th C embroidery. Amongst these is a significant collection of pre-reformation ecclesiastical fragments which MBTC was privileged to study and conserve.

Once ready to be returned they are prepared for study and storage following the method established for Hardwick Hall.

The embroideries were laid flat onto individual custom-made trays of acid-free museum board covered with cotton poplin and a 10mm Plastazote cut–out mount. Each tray has cotton handles for easy manoeuvring. The trays are stacked into acid-free cardboard boxes, all carefully labelled to minimize handling.

Hardwick Hall embroidery fragment type copehood (CMS 1129568.1) in storage tray, after conservation

Hardwick Hall embroidery fragment type orphrey (CMS 1129538.5) in storage tray, after conservation

Trays are fitted into acid-free cardboard boxes taking care to not overfill them[3]. In case of oversized objects, the same system is carried out creating custom-made acid-free corrugated cardboard trays and boxes.

Museum Room display objects at Ham House, National Trust

Key words: Institutional client, long term storage, miscellaneous collection, adaptation to existing space and storage system, range of storage methods

The Museum Room had showed over 30 objects, including textile interiors, beddings, costume and accessories dating from 17th century onwards since 1970's. When National Trust decided to use the room for another use, MBTC was commissioned to condition check and surface clean the objects, as well as plan and prepare them for long term storage.

Ham House Museum Room [illegible] wedding set packed in archival box

As the textile store at Ham House provides mainly shelving, it was decided to pack the objects into boxes for stacking on the shelves. The diversity of the objects demanded a range of storage options: ready made acid-free storage boxes (PEL), boxes made to measure from acid-free corrugated card (PEL), acid-free cardboard rollers (Klug) and one large item was buffered with acid-free cardboard and polyester wadding.

When possible the objects identified as part of a set were packed together using similar materials and methods.

Ham House Museum Room display objects; mirror, prepared for wrapping with acid-free tissue

19-20th C costume & accessories collection, private client

Key words: Private client, costume and accessories collection, limited storage space and budget, boxes

A small collection of 19-20th century costume including a silk skirt & bodice, a pair of detached lace sleeves, a bridal garland head dress and a couple of pairs of embroidered and velvet slippers came into our hands to be stored properly and safely for long term in the client's home.

Silk damask bodice packed with acid-free tissue in box ready for long term storage

All the costume items were covered and padded out as necessary with acid-free tissue and placed into an archival box for long term storage. On the other hand, each pair of slippers were packed into an acid-free cardboard clamshell box and protected with acid-free tissue paper.

Embroidered slippers packed with acid-free tissue in box ready for long term storage

Oak Drawing Room pair of velvet curtains at Powis Castle & Queen's Antechamber Wall Hangings at Ham House, National Trust

Key words: Institutional client, large items, transport, short term storage

In private practice, most of the packing is not for long but short term storage for transport. Objects need to get in and out of the studio to be conserved and returned to their locations.

Here there are some examples.

QAC Ham House East Wall Hanging in transport box (above) and North Wall Hanging after reinstallement (below), after conservation

ODR Powis Castle right curtain packed for transport in studio, before conservation

A pair of extremely large velvet curtains in the Oak Drawing Room at Powis Castle is part of the interior scheme designed by G. F. Bodley and commissioned by the Earl of Powis in the early 1900's. For transport to the studio a strong box was custom-made, with wooden ribs and polycarbonate panel. The curtains were folded and padded with cotton fabric sheets, acid-free tissue, polyester wadding and long rolls of bubble-wrap for additional padding.

Likewise, the impressive set of blue velvet and golden damask embroidered wall hangings covering the Queen's Antechamber at Ham House since 17th century was taken down and packed for transport in a box. In this case, the textiles were rolled onto a drainpipe prepared with layers of bubble wrap to increase the diameter and covered with acid-free tissue, polyester wadding and finally a layer of Tyvek.

Acknowledgements: With kind permission of NT Ham House, NT Hardwick Hall House, NT Powis Castle, Cambridge University Library, Dacorum Heritage Trust and private client (desired to remain unnamed)

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By María Pardos Mansilla

Filling the Gap: The Benefits of an ICON Internship

Kate Clive-Powell

2015-2016 Textile Conservation ICON Intern at The Bowes Museum

INTRODUCTION After completing the textile conservation MPhil at The University of Glasgow I embarked on a year-long ICON textile conservation internship at The Bowes Museum. This was a useful bridge between my academic training and full time employment as a textile conservator. Every ICON internship is slightly different as each is tailored to the individual's developmental needs.

I will show how the experience has been particularly beneficial to my development and in doing so highlight general advantages of undertaking an ICON internship.

DEVELOPING KNOWELDGE OF FLAT TEXTILES

Undertaking an internship at The Bowes Museum appealed to me because it has a fantastic collection of quilts, textiles which have interested me for a long time. Consequently my internship supervisor and intern advisor ensured that I was given projects through the year that would develop my experience of working with flat textiles.

Toile de Jouy

I treated two pieces of Toile de Jouy (1808) - rare and excellent examples of this type of textile.

Condition: Several small holes & distortions and unravelling edges

Treatment: I dyed samples of cotton lawn to achieve an appropriate coloured fabric to support the areas of loss. I supported 12 holes by securing them to patches of the dyed cotton fabric using a fine polyester thread. I removed the distortions using a combination of humidification and stitching.

Detail of small hole before and after support

Unravelling edge before and after blanket stitching

Discussing Toile de Jouy treatment with general public during tour of studio

18th Century Coverlet - I gained further practice of this method of stitch support when I supported holes in a beautiful 18th century coverlet which is thought to showcase the fabrics produced by a printworks in Preston

Dyeing cotton lawn samples for support patches using Novacron®

One of the holes in the coverlet before dyed patch support (left) and after (right)

Further Experience

I was encouraged by my supervisors to organise short placements elsewhere during the year if there were certain skills that I wanted to develop that The Bowes Museum's conservation department could not accommodate.

I have an interest in Welsh textiles, for this reason I felt that it would be useful to organise a two month placement at St Fagans National History Museum. Two of the objects I worked on there expanded my experience of flat textiles.

19th Century Quilt

Area of wear before nylon net support (left)

After Nylon net support. Holes were not in-filled so quilt's construction and use remains visible (right)

Condition: Large areas of wear on the back with loose edges at risk of catching and worsening.

Treatment: Loose edges were manipulated back into position using gentle humidification. Dyed nylon net was secured over the weak areas to prevent further fabric loss. The net was secured using stitches that followed the original quilting so it would lie flat on the quilt's undulating surface.

Hooky Rug

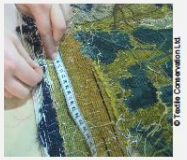
Condition: Three large splits along the edges of its hessian lining. The splits had adhesive residue around them.

Treatment: Adhesive soiling was reduced by dabbing it with a cotton wool swab dampened with white spirit. Nylon net was dyed with Lanaset® to match the colour of the hessian. I stitched this nylon net over the splits to prevent them worsening. The hessian lining was not attached to the mat's filling so I secured the net to strong areas of hessian around the splits.

Before conservation (left) and after (right)

Tapestry Experience - I wanted to gain some tapestry conservation experience, as I had not worked on one before. It was not possible to do this at The Bowes Museum due to space restrictions, so I did a short placement at Textile Conservation Ltd.

I worked on a 16th century Flemish tapestry titled 'The Presentation of Esther' from a set of five belonging to Berkeley Castle. This gave me experience of key steps in preparing a tapestry for conservation work and tapestry conservation stitching.

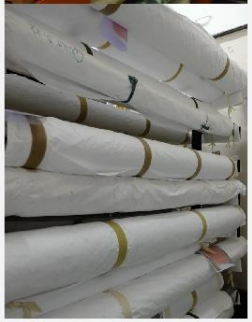


Marking Scrim lines

Storing Flat Textiles

Re-storage project

I worked independently to re-organise The Bowes Museum's rolled textile store. I ensured that all the flat textiles are stored in inert materials, rolled correctly & photographed. This gave me experience of handling a broad range of fragile flat textiles.
I re-rolled shawls, hooky rugs, lace, carpets, quilts, fragments of tapestry and embroideries.



Re-rolling carpet on inert tube interleaved with acid free tissue (above)

(Above) Images of wall units in store before and after re-organisation. Space and funds were limited so the re-rolled textiles had to be stored safely in an economical way.

Example of poorly stored carpet before and after re-rolling (left)

Conclusion: The examples given highlight the following general advantages of doing an ICON internship

- Being given time and space to practice skills learnt at university
- Development of personal interests within conservation
- Filling gaps in practical experience (resulting in a richer portfolio)
- In-depth experience of working within a professional conservation environment
- Broadening of professional network

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ICON THE INSTITUTE OF CONSERVATION

THE BOWES MUSEUM

Faking fibreglass: Pushing Fosshape™ Further

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The V&A's 2016 exhibition Undressed: A Brief History of Underwear explores the role undergarments have played in shaping the fashionable silhouette over the past 300 years. For the costume mounting team this meant developing new techniques that would aid the interpretation and display of close-fitting underwear on fibreglass mannequins.

Our main challenge was how to make visible mannequin adaptations imitate the smooth solid appearance of fibreglass. With advice from Specialist Mount-Maker Shelly Uhlir, we began to experiment with Foamcoat™, a water-based product containing calcium carbonate and silicon dioxide that can be applied as a plaster-like coating to a variety of materials, most commonly foam (1). We knew that Shelly had successfully applied Foamcoat™ to calico and that it had passed Oddy testing on all levels (2). After trialling Foamcoat™ in combination with plaztazote® and buckram we found that fosshape, a non-woven low-melt polyester material, provided the best results (3). Outlined below are some of the key stages involved in 'faking fibreglass'.

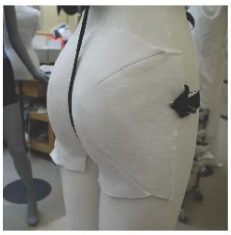
THE PROBLEM – CONTEMPORARY 'BUTT LIFTER'

This contemporary piece of shapewear made of Lycra® is designed to 'uplift' the buttocks. When dressed, the visible joins in the mannequin were unsightly and there was no sense of the enhancement the garment would have on the profile of the body. In order to create the desired effect a false pair of buttocks was required...

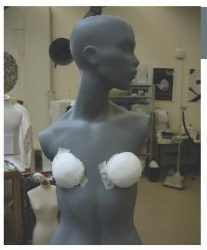
THE PROBLEM –BRA OF BEATEN BRASS

Designed by Helen Newman, this brass bra exposes the bust of the wearer. After trying the bra on a number of mannequins, it was clear that a bespoke bust was required. A mannequin with a flat chest was selected as a starting point for the new bust shape.

STEP ONE-FORMING FOSSHAPE



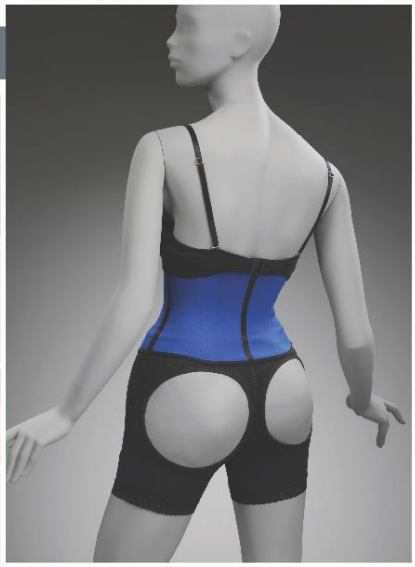
- A larger mannequin with a rounded 'derrière' was selected as the mould for the new buttocks.
- In order to pre-form the fosshape, darts were pinned and machine sewn to follow the curve of the mannequin.
- To set the fosshape, hot steam and pressure were applied using an iron causing it to shrink and harden.
- Once removed, the fosshape was cut into individual buttocks that could be easily inserted between the garment and display mannequin.



- The first step was to carve individual breasts out of plastazote® and temporarily adhere them to the torso.
- Fosshape was then moulded over the plastazote® and pinned into position.
- Hot steam and pressure were applied to take a cast of the underlying bust shape.
- Once set, the fosshape was removed and trimmed to size.
- The new fosshape breasts were then permanently fixed to the torso using a hot melt glue gun.

STEP TWO-FAKING FIBREGLASS

- The first layer of Foamcoat™ was applied directly from the bottle to provide a thick coating. A sculptor's palate knife was used to spread the Foamcoat™ smoothly and evenly over the fosshape. Foamcoat™ needs to be worked quickly as it starts to cure after approximately 10 minutes.
- The Foamcoat™ was left to fully dry. Drying time is between 30 minutes to 2 hours depending on the thickness of application.
- Once dry, the Foamcoat™ was sanded to a smooth finish to match the fibreglass surface. The best results were achieved with slightly dampened sandpaper.
- Two to three more coats were applied following the same method, however subsequent layers were thinned with a drop of water before application.
- The final step was to paint the new body parts to match the real fibreglass. An air-spray paint gun provided even coverage that blended subtly with the rest of the mannequin.



CONCLUSION:

This new technique provides excellent results, as the new 'fake' body parts blend seamlessly with the original mannequin. This in-house solution enabled us to recycle expensive mannequins, making the technique worthy of further development.

Acknowledgements:
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