A Woven Alliance

Tapestry Yesterday, Today and for Tomorrow

Symposium of the ICON Textile Group

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The Dovecot Studios, Edinburgh

Edited by Frances Lennard and Lynn McClean

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Foreword

A Woven Alliance: Tapestry Yesterday, Today and for Tomorrow was a one day symposium held on 21 September 2012 by the Icon Textile Group at the Dovecot Studios, Edinburgh.

2012 was the centenary year for the Dovecot Studios, and the symposium was timed to fit in with their celebratory exhibition *Weaving the Century: Tapestry from the Dovecot Studios 1912 – 2012*, forming an alliance between their history and current work with the textile/tapestry conservation profession.

The focus of the event was on the wider aspects of tapestry conservation, rather than conservation treatment methods. During a busy and stimulating day 9 papers were presented, including a number of posters, on many aspects of tapestry, from historical context to work involving volunteers, from conservation science to dealing with previous restoration.

The symposium showed that the tapestry discipline, both historical and modern, is alive and well, and that conservators and conservation scientists, in coming together with institutions like the Dovecot, can only help to enhance and advance this fascinating subject.

Thanks to all who helped to make the symposium such a success, especially Frances Lennard, Sophie Younger, and Maggie Dobbie; the students at the Centre for Textile Conservation, University of Glasgow; and Jonathan Cleaver and colleagues at the Dovecot Studios.

Lynn McClean
Icon Textile Group Committee

Emblem and icon: Sourcing the *Seasons*

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Introduction

A remarkable and unique set of tapestries can be seen at Hatfield House in Hertfordshire. The set of four pieces depict the Seasons: Spring, Summer, Autumn and Winter. The coat of arms in each tapestry indicates that they were probably commissioned by Sir John Tracey of Toddington in Gloucestershire some time after his marriage in 1590. Sir John was knighted by James I and appointed High Steward in 1601, thereby having the means to commission fine tapestries woven in wool, silk, silver gilt and Dutch gold. The tapestries were acquired for Hatfield by the 2nd Marquess of Salisbury in the nineteenth century. Long thought to be of English manufacture, attributed to the Barcheston looms in Warwickshire, this attribution has recently been challenged (Turner 2012), likewise the evidence for dating which depends on some lettering woven into the upper border of the Winter panel, whose interpretation as a date has also recently been called into question (Bath 2013a).

The general composition of each tapestry is similar. A large figure occupies the centre, a personification of the season, for example, Venus represents Spring and Bacchus Autumn (Figure 1). This main figure is surrounded by a landscape in which groups of smaller figures are seen employed in outdoor labours relevant to that season. Each tapestry has a detailed border comprised of small panels or roundels containing woven emblems with Latin inscriptions. These borders contain what is, arguably, one of the most complex schemes of iconography to be found in any surviving historical textile, and the aim in this paper is to identify some of

the issues that are raised when we study the iconology of such tapestries. Fundamental to any such study is the identification of sources and patterns used by the weavers, and for research in this area it is Anthony Wells-Cole's truly ground-breaking book *Art and Decoration in Elizabethan and Jacobean England* (Wells-Cole 1997) that sets the agenda and, indeed, the bench-mark for such studies. What Wells-Cole shows us is the extraordinary indebtedness of the decorative arts of this period in England to continental prints: there was hardly anything, it seems, that was truly original, and the first thing you have to do when examining what is represented in the applied arts of this period, it seems, is to find out what it copies.

Things are much the same in early-modern ('Renaissance') literature, where the imitation of models (and predominantly classical models) was universally accepted as the key to composition. One of the aims of this paper is, accordingly, to identify some of the strictly literary and rhetorical models for what we find represented in the *Four Seasons* tapestries. This should not surprise us since much of the detail consists of emblems – symbolic images with Latin mottoes, combining word-and-image in sententious units which are thus both visual and verbal.

There are no fewer than 170 emblems woven round the borders to these four tapestries, every one of which poses an iconographical challenge. They have never been properly described or decoded, however, largely because they have not been at all adequately sourced. The author has now identified sources for nearly all of these emblems in contemporary emblem books, all of which will be illustrated and analysed in a forthcoming book on them (Bath 2013b). This paper simply offers a foretaste of findings which will be more extensively documented and analysed in the book.

The iconography

The main panels of the *Seasons* tapestries have long been known to copy a set of prints by Antwerp engraver, Maarten de Vos. Whenever we identify the print or pattern used by an artist we are surely justified in crying 'Eureka!', but it is only when we begin to ask how the artist, or designer, has handled his sources that we can begin to draw any conclusions about his working practices or artistic intentions. For this reason we shall look at one or two emblems that either copy their identifiable sources faithfully or else make significant changes to the

source picture: we can maybe then begin to draw some conclusions about how these tapestries were designed or used, and what they represent.

If we look at the '*Gravis est iactura temporis'* emblem taken from the *Summer* tapestry, we see an emblem showing a young man lying underneath a winged clock and grasping its weights (Figure 2). The Latin motto means simply 'Wasting time is a bad idea'. As always with emblems, you have to do a bit of work to see how the picture relates to the motto – how the image illustrates the adage. The clock is winged, we might suggest, because time, proverbially, flies; and the young man hangs onto its weights to slow it down – youth, we might think, is often mis-spent if young men refuse to grow up. Figure 3 shows the emblem that this copies. We can see immediately that the tapestry copies the woodcut very faithfully in this case, and the English epigram – written by English poet and emblematist Thomas Combe – confirms the interpretation suggested. Combe's *Theater of Fine Devices* is one of the earliest and one of the rarest of English emblem books, first printed in London in 1593 and surviving in only two known copies, one in the Huntington Library, Ca, the other in Glasgow. Combe is, however, translating a French emblem book *Le Theatre des bons engins* composed by Guillaume de la Perrière and first printed in Paris in 1540. Figure 4 shows how this emblem was illustrated in the French, Paris, editions. From this we can see that the tapestry is closer to Combe's woodcut than it is to this French original, where the young man sits with his legs crossed, and not – as in Combe's picture and in the tapestry – with them apart.

Why should that matter? It is certainly of no iconological significance, but it might tempt us to jump to the conclusion that this English tapestry, woven in 1611 for Sir John Tracy, used the English version of this emblem book rather than any continental source. But a fuller investigation of the bibliography of this book reveals that Combe used for all of his illustrations the woodcuts that had appeared in French reprints of La Perrière's *Theatre des bons engins* that were published by Jean de Tournes in Lyons, with a new set of re-carved woodcuts. Although the differences may be slight, this discovery could have at least some consequences for our assumptions not only about which emblem books were circulating in England at this time, but also about how these early 'English' tapestries used their 'continental' sources.

Finally we might notice one thing about this woven emblem on the tapestry that is completely original, for absolutely none of the many editions of Guillaume de La Perrière's *Theatre des bons engins* that were

published at home or abroad uses Latin mottoes for the emblems. The designer of these tapestries therefore had to find, or compose for himself, the Latin motto *GRAVIS EST IACTURA TEMPORIS* ('Wasting time is serious') that we read below the emblematic picture of the young man who is stopping the clock on the tapestry. This has implications for any assumptions we might have about who it was that designed the tapestries and, consequently, their processes of production.

An emblem that makes much more dramatic and interesting changes to its print-source is Figure 5, '*Pro Ignotis'*. Here we see the Trojan horse at the gates of the city of Troy, from whose battlements Helen looks down somewhat apprehensively – one knows that this is Helen because her name appears carved on the battlements over which she is leaning. The motto may be translated 'Take trouble over the unknown', which we should probably interpret as a warning about the dangers of raising one's guard against a hidden threat – this Trojan horse, after all, is full of Greek warriors. The tapestry copies in this case an emblem by a Hungarian humanist, Joannes Sambucus, who spent most of his life working in the court of the Hapsburg emperors in Vienna and whose *Emblemata* was first published in Antwerp in 1564. Sambucus's Latin emblems are the source for no fewer than 23 of the 170 emblems that we see on the tapestries.

There is one obvious change which the tapestry makes to Sambucus's picture for this emblem, and it is an alteration which shows particularly well the mentality of its designer (Figure 6). The figure in Sambucus' woodcut is not Helen herself but rather a statue of her, which may well be why Sambucus' artist has inscribed her name on the wall above it – sculptures often have such identifying titles: people leaning over walls do not. But the reason why Sir John Tracy, or his designer, has replaced Helen's statue with a labelled picture of herself actually standing on the walls of Troy, it is possible to suggest, is because, unlike Sambucus, he is presenting this scene as a *teichoscopia*. '*Teichoscopia*' means 'a view from the walls' (from the Greek τειχίον**,** [texion] 'a wall') and is a narrative strategy in Greek literature when a character describes events as they are actually happening in front of her eyes from such a vantage point (and it is always 'her' eyes).

The *locus classicus* for this was the passage in Homer's *Iliad* book III when Helen is led out onto the walls of Troy to view the battle between her abductor Paris and her husband Menelaus. Homer's Roman successor in epic poetry, Virgil, imitates Homer's technique in another well-known *teichoscopia* by placing Dido on the walls of her tower to curse the fleeing

Aeneas in Book IV of the *Aeneid*. Spanish Golden Age dramatists such as Lope de Vega made notable use of this vantage point for their characters in plays which seldom if ever ignore its strongly Homeric associations.

These episodes, and the teichoscopic narrative technique, nearly always occur at dramaturgic moments when the trustworthiness of women's judgement is at issue, which may well be why Sir John Tracy's designer chose to introduce it into this emblem illustrating the folly of fighting over what Sambucus characterises as a thoughtless and worthless woman. Because of its Homeric basis *teichoscopia* is also used when issues of war and peace are involved, moments when, as Sambucus's motto suggests, one should take particular trouble not to be caught out. If we are inclined to doubt whether Tracy, or his designer, could possibly have been motivated in adapting his source picture by such a – to our eyes – obscure rhetorical device, we should perhaps bear in mind that a knowledge of rhetoric would have been routinely instilled in grammar school pupils at this time in England. Jacobean schoolboys, after all, learned their Latin by studying grammar and rhetoric, and by memorizing the kind of proverbial sayings or classical *adagia* that supplied nearly all these emblems with their mottos. The change to Sambucus's picture was certainly not unmotivated, and Helen's gesture in the tapestry (if not in the woodcut) is clearly demonstrative: what we might call 'a deictic *teichoscopia'*.

This may seem a highly tendentious reading of the way the tapestry is adapting its source engraving. Could early viewers possibly have recognised it as representing an obscure rhetorical trope with an unpronounceable Greek name? Could they even have understood many of the emblems on these tapestries? We can, however, get some purchase on this question by looking at a few of the emblems that feature animals. Animal lore often preserves some curious and obscure traditions, though it was always likely to be more familiar when it had been absorbed into fables or proverbs (Figure 7). In the emblem '*Ictus piscator sapit*' (The fisherman knows what he has caught) we see an angler by a river; it is unclear what, if anything, he has caught. However, the motto is an adage which Erasmus cites as '*Ictus piscator sapiet'* (The fisherman will sense the catch) (*Adagia*, 1.1.29). Richard Taverner, in his *Proverbes* (1539) explains this proverb thus:

> 'The fisher stryken woll be wise. A certayne fisherman, when he had drawen up his nette, and began now to take in his hands ye fishes which he had caught, chaunced to take up also a Scorpion, which

> forthwith strake him. Well quod he, nowe that I am stryken I woll beware.' (fol. 2^{v})

It seems unlikely that any viewer of this emblem on the tapestry would have supposed that this fisherman standing on his river bank had caught a scorpion, and Taverner relates the proverb to fishing with nets, not angling with rods, which is, as it happens, exactly what we see pictured in another emblem from La Perrière that is copied on the Autumn tapestry where it has the motto '*In nihilum redacta spes*' (Hope reduced to nothingness) (Figure 8). A fisherman in a boat is shown hauling in his net, but is surprised to see no fish but a scorpion; as La Perrière's epigram explains, this shows that people who have inflated expectations should anticipate major disappointments (Figure 9). Clearly this is the same fable whose moral is summed up in the '*Ictus piscator sapit*' emblem, which suggests that the tapestry designer, or Sir John Tracy, recognised the Erasmian source of La Perrière's emblem and used it as a motto for this emblem of his own devising in which the fisherman simply senses that he has made a catch. That Tracy (or his designer) had a fixation on this topic is suggested by another emblem on the *Summer* tapestry, which shows a fisherman again in his boat hauling in his net – it is not easy to identify what has caught in it, though it could well be another scorpion, which would certainly fit the motto, '*Ex malis et bonis mundus*' (The world is made up of bad and good things).

What this paper tries to show is simply what we can learn from studying the way the tapestry handles its sources. Weavers at this period often owned a certain number of off-the-shelf pattern prints for use in the design of tapestries, but they are unlikely to have had access to the large number of emblems, from at least four different emblem books, which are woven round the borders to these extraordinary tapestries. The changes which the tapestry frequently makes to both its emblematic pictures and also, on occasions, to the accompanying mottoes can only have been made by a reasonably well-educated designer or, most probably, by the owner who commissioned them, Sir John Tracy. They were clearly not unmotivated, but appear to have adapted the visual language to suit their own purpose and understanding.

If the above analysis of the emblem showing Helen standing on the battlements seems highly learned and tendentious, one might insist that it is supported by the way many of the other emblems on these tapestries handle their identifiable sources, where they make changes which can be

shown to be influenced not only by their designer's, or owner's, understanding of the received iconography of the images he has chosen, but also by his familiarity with the literary and rhetorical lines of transmission through which so many of these topics came down to educated readers and householders in the sixteenth and early-seventeenth centuries. Those lines of transmission in the remaining 168 emblems, and indeed in the central *Seasons* panels themselves, will be fully explored in the forthcoming book (Bath 2013b).

References

Bath, M. 2013a. The *Four Seasons* tapestries. *Textile History* 44 (1) pp51-71.

Bath, M. 2013b. *The Four Seasons Tapestries at Hatfield House*. London: Archetype
(in press).

Taverner, R. 1530. *Prouerbes or Adagies Gathered out of the Chiliades of Erasmus*

by Richarde Tauerner. London: Richard Bankes.

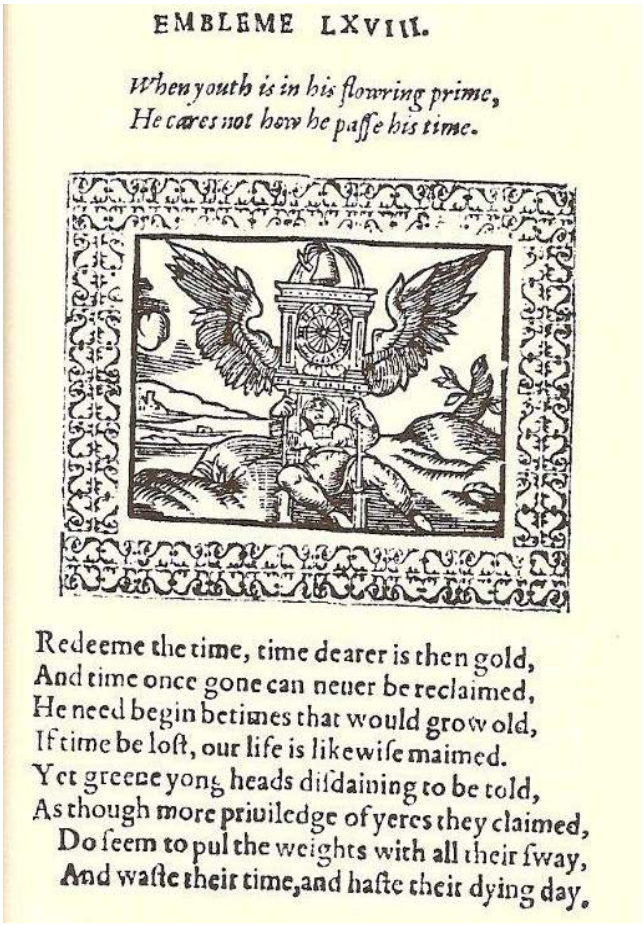
Turner, H. l. 2012. A case of mistaken identity: The "Sheldon" *Four Seasons* tapestries at Hatfield House reconsidered. *Emblematica: An Interdisciplinary Journal for Emblem Studies*, 19, pp1-28.

Wells-Cole, A. 1997. *Art and Decoration in Elizabethan and Jacobean England: The*

Influence of Continental Prints. New Haven: Yale University Press.

Figure 1
Hatfield House, *Four Seasons* tapestries, *Autumn* tapestry.

Figure 2
Hatfield House, *Four Seasons* tapestries, detail from border of *Summer* showing the emblem '*Gravis est iactura temporis'* (Wasting time is serious).



EMBLEME LXVIII.

When youth is in his flowring prime,
He cares not how he paſſe his time.

Redeeme the time, time dearer is then gold,
And time once gone can neuer be reclaimed,
He need begin betimes that would grow old,
If time be loſt, our life is likewiſe maimed.
Yet greene yong heads diſdaining to be told,
As though more priuiledge of yeres they claimed,
Do ſeem to pul the weights with all their ſway,
And waſte their time, and haſte their dying day.

Figure 3
Thomas Combe, *The Theater of Fine Devices*, London: Richard Field, 1614, emblem no. 68; an earlier edition of Combe's translation of La Perrière was entered in
the Stationers' Register in 1593.

Figure 4

Guillaume de La Perrière, *Theatre des bons engins*, Paris: Denis Janot, 1544,

emblem no. 71.

Figure 5

Hatfield House, *Four Seasons* tapestries, detail from border of *Spring* showing the emblem '*Pro ignotis sumere laborem'* (Take trouble over the unknown).

Figure 6

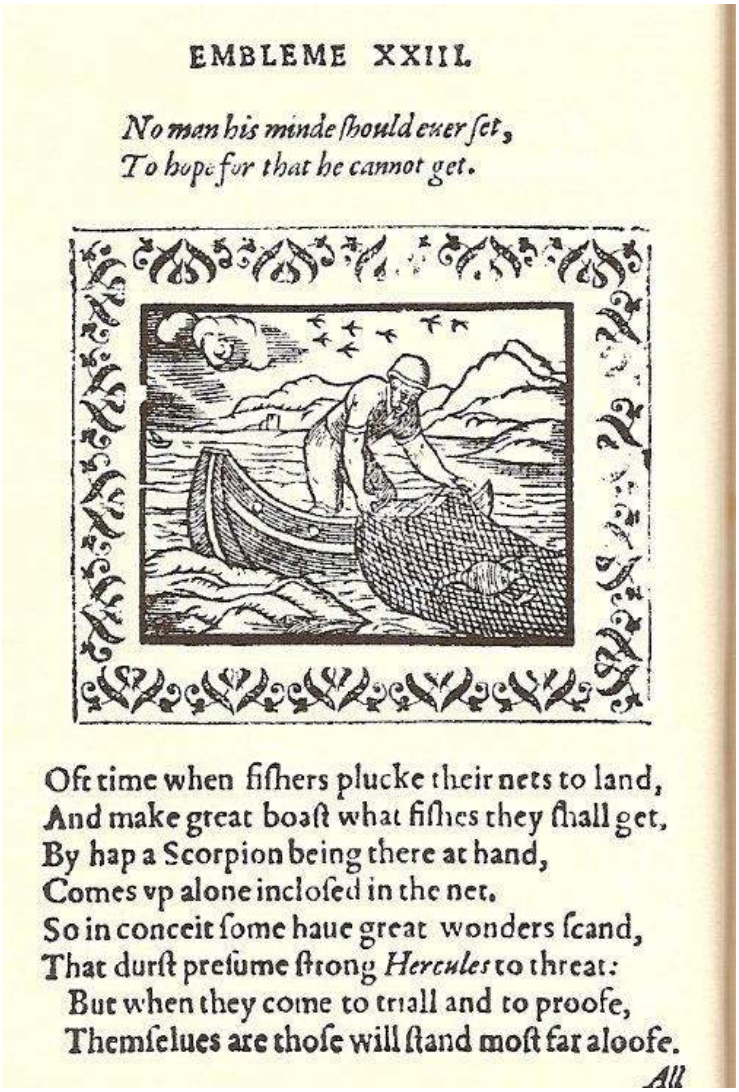
Joannes Sambucus, *Emblemata*, Antwerp 1566, p.163, '*Pro ignotis sumere laborem'*.

Figure 7

Hatfield House, *Four Seasons* tapestries, detail from border of *Summer* showing the emblem '*Ictus piscator sapit*' (The fisherman knows what he has caught).

Figure 8

Hatfield House, *Four Seasons* tapestries, detail from border of *Autumn* showing the emblem '*In nihilum redacta spes'* (Hope reduced to nothingness).



EMBLEME XXIII.

No man his minde ſhould euer ſet,
To hope for that he cannot get.

Oft time when fiſhers plucke their nets to land,
And make great boaſt what fiſhes they ſhall get,
By hap a Scorpion being there at hand,
Comes vp alone incloſed in the net.
So in conceit ſome haue great wonders ſcand,
That durſt preſume ſtrong *Hercules* to threat:
But when they come to triall and to proofe,
Themſelues are thoſe will ſtand moſt far aloofe.

All

Figure 9

Thomas Combe, *The Theater of Fine Devices*, London: Richard Field, 1614, emblem no. 23. © Huntington Library, Ca.

A future plan for tapestries: the re-display of a tapestry collection

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Introduction

The paper will focus on three major refurbishment projects at the Victoria and Albert Museum (V&A): The British Galleries 1500-1900, opened in November 2001, The Medieval and Renaissance Galleries: 300-1600, opened in December 2009 and The European Galleries 1600-1800, due to open in the autumn 2014. These projects are part of the V&A FuturePlan which aims to transform the museum by redisplaying the collections and revitalising the visitor experience. Each is a major collaborative enterprise bringing together many departments across the museum, and specialized staff from outside the V&A. A brief history of the V&A and the tapestry collections is necessary in order to gauge the impact FuturePlan has had. The paper will expose the planning involved, the conservation and curatorial input, design issues in relation to environmental control and lighting, gallery interactives and the impact on the Collections-On-Line database.

Why the V&A?

The V&A was established with three clear aims which have fundamentally remained unchanged:

- to show works from ancient cultures to modern times.
- to display in tandem works of British provinces alongside those from abroad.
- to encourage the appreciation and the practice of good design.

Profits from The Great Exhibition of 1851 secured the present site thanks to the support of Prince Albert, and objects from The Great Exhibition became part of the growing collection. Prince Albert died in 1861, and in 1899 Queen Victoria renamed the museum the Victoria and Albert Museum (V&A 2012).

The tapestry collection

Historically tapestries have been part of the collection and on public display since 1856. Within a present collection of some 2.7 million objects, the tapestry collection spans a vast geographical and chronological range (Figure 1). There are 300 large tapestries, the same again of tapestry fragments and small objects of tapestry-

technique, and tapestry objects of non-European origin. The Furniture, Textiles and Fashion curatorial department (FTF) is responsible for the largest portion. This includes the historical European collection, that from the Americas, and all modern and contemporary works. The Asian curatorial department is responsible for the rest of the material including that from the Middle East, South Asia, and the Far East.

The care of the collection was initially carried out by a dedicated team of seamstresses. Sometimes other textile workshops were employed such as the Foundation for the Restoration of Antique Textiles in Harlem, which was commissioned to repair the *Devonshire Hunting Tapestries* between 1958 and 1966. Since the 1960s V&A textile conservation has evolved and become professionally strong and scientifically based. Today the museum has two textile conservation studios: the main one in South Kensington and a second newly refurbished studio at Blythe House, West London (Figure 2). Following a generous lead grant from the Clothworkers' Foundation and the subsequent support of individual benefactors, The Clothworkers' Centre for Textile and Fashion Study and Conservation at Blythe House in Kensington Olympia will open in late summer 2013. Each studio has a large tapestry frame as a permanent feature, although tapestries are not continually worked on. Tapestry conservation is linked to projects and to availability of resources.

Display of the collection before FuturePlan

1 The Gothic Primary and Gothic Tapestry Court Galleries

By the mid twentieth century the first galleries dedicated to tapestry were established (Wingfield Digby 1980). The Gothic Primary Gallery exhibited smaller works, and these were glazed.[1] Workshops from Arras and Tournai and from the Swiss and French workshops were represented.[2] In 1957, after the acquisition of the four *Devonshire Hunting Tapestries*, the Gothic Tapestry Court was created. The Devonshire tapestries, possibly woven in Arras or Tournai in the mid

[1] Personal communication. Wendy Hefford and Lynda Hillyer, both now retired, as well as present colleagues from V&ATextiles and Science Conservation departments and from the Furniture, Textiles and Furniture (FTF) and Asian Curatorial sections contributed with valuable recollections and information.

[2] A list of some likely tapestries displayed in The Gothic Primary Gallery: *The Buzzard*, Alsace, possibly Strasburg c1470-90, 0.76m x 3.76m (V&A 4509-1858); The *Labours of the Month*, Alsace, mid fifteenth century, 0.39m x 2.73m (V&A 6-1867); *The Adoration of the Infant Saviour*, Brussels c. 1500, 1.52m x 1.99m (V&A 1-1889); a *Verdure*, Flemish c 1500, 1.82m x 2.05m (V&A 232-1894); *The Descent from the Cross*, Arras early fifteenth century, 1.12m x 3.02m (V&A T.1-1921); *The Confirmation*, Tournai 1470-75, 1.85m x 1.19m (part) (V&A T.131-1931); and *Wild Men with Animals*, Swiss Lucerne or Basel mid fifteenth century, 0.89m x 2.24m (V&A T.117-1937). Personal communication: email from Wendy Hefford to Susana Hunter, 2012.

1400s, are significant for the early date.[3] Combined they covered some 40m of gallery wall-space.

The Gothic Tapestry Court was an air-conditioned and sizeable space, with sufficient height to exhibit large hangings. Displayed alongside the Devonshire group were the great *Troy* tapestry (Tournai, late 1400s), referred to as the gem of these galleries and measuring over 4m x 7m (Asselberghs 1969), and three tapestries from an original set of six of the *Triumphs of Petrarch* (Brussels, 1500-1510), with an average size of 4m x 8m each. The Gothic Tapestry Court allowed these works to be displayed side by side. There was a third space, a corridor-like-gallery, for the temporary display of Flemish works from the mid fifteenth to the mid sixteenth century. Amongst them were the significant sixteenth century armorial Verdure *The Arms of Giovio of Como*, woven in Bruges and measuring approximately 2m x 7m, *Susana and the Elders* (Tournai, c.1500) measuring 4m x 3m, and two tapestries from the *Story of Esther* (Brussels, mid sixteenth century) measuring 3m x 4m each.

Tapestries were hoisted into position and hung from a metal rod inserted through a linen sleeve or linen tabs sewn along the top edge of the tapestries. Gallery walls were covered in dark brown cloth. Adjustable strip lighting was used to illuminate the works. A rotation programme of three years was implemented in the Gothic Primary and the corridor-gallery only.

The three galleries were adjacent to each other on the ground floor and easy for the public to access. Combined they exhibited the most celebrated pieces of the European classical tapestry tradition found in the museum's collection. A rotation programme enabled the display of newly acquired works, which influenced funding positively as the display of new works within a year of purchase was often a pre-requisite. From a conservator's point of view, a rotation plan provided the scope for an ongoing tapestry conservation programme. These galleries underwent refurbishment between 1987 and 1988, but were closed down a year later in 1989.

2 The 'New' Tapestry Gallery

Between 1966 and 1972 a new air conditioned space in the first floor of the museum was developed. Gallery 94 (G94) measures 288m², much smaller than the Gothic Tapestry Court, considerably curtailing the display of more than one set of large tapestries alongside each other. Nevertheless G94 provided a much wanted space for the display of new acquisitions, as well as a space for rotations. Tapestry conservation work continued at a pace during this time, with a team of three tapestry conservators working on the

[3] Personal communication: email from Wendy Hefford to Susana Hunter, 2012.

collection almost exclusively. Tapestry conservation had a separate studio space to that of general textile conservation; wet cleaning as well as full conservation stitching treatments was carried out.

In 2007, G94 was refurbished. The old hanging method of metal rods through linen sleeves still present in some of the tapestries was replaced by Velcro® and wooden battens. All the tapestries were to hang freely and unglazed. A much improved manual winch system was implemented, making re-hanging a more straightforward task. The gallery was stripped of its original brown wall coverings, and a deep blue tone for the walls was the new choice of curators and designers. Light levels are kept at 50 lux.Two graphic panels are located at either end of the gallery. For security and conservation reasons a solid barrier maintains a 0.9m distance between the visitor and the hangings (Figure 3).

Where else can we find tapestry within the V&A?

1 Raphael Carton Gallery

The Raphael Cartoon Gallery was established in 1950 and refurbished in 1992. It houses the set of seven Raphael cartoons on loan from the Crown since 1895, alongside *The Miraculous Draft of Fishes* tapestry (Mortlake, 1637-38) on loan from the Trustees of the 9th Duke of Buccleuch's Chattles fund. The size and height of the gallery makes it an exemplary space for the display of the cartoons and tapestry side by side (the average size for these works is 3.4m x 4.8m). Combined, cartoons and tapestry provide visitors with the opportunity to appreciate the level of interpretative skill involved in the craftsmanship of classical tapestry weaving.

In 2009 the Raphael Cartoon Gallery was host to a loan from the Vatican Museum of four tapestries from the set the *Acts of the Apostles*, woven in Brussels in the early sixteenth century (Evans and Browne 2010). The loan tapestries had Velcro® sewn along the top edge for display. They were hung on temporary-raised walls, on plinths using a pulley system. It was the first time since the early sixteenth century that the tapestries woven from these cartoons were reunited.

2 Textile Study Rooms & Gallery 101

Tapestries from the Gothic collection were occasionally displayed in Gallery 101. More recently, and up its closure in 2007, Gallery 101 featured modern and contemporary textile displays including tapestry. Adjacent to the former Textile Study rooms, these two spaces created a niche for the study of textile art and craft.

3 The T.T. Tsui Gallery of Chinese Art and the new Clothworkers' Centre for Textile and Fashion Study and Conservation

Works of tapestry technique are also on display in the Chinese gallery. The Clothworker's Centre at Blythe House, West London, will house the contents of the former Textile Study rooms. The development will include a spacious public study room for appointments, a seminar room and new, up-to-date storage for the collection of textiles and fashion as well as the newly refurbished textile conservation studio.

FuturePlan

The FuturePlan is the V&A's intellectual and physical redevelopment programme. FuturePlan Projects are delivered by teams drawn together from relevant departments across the museum. These teams are managed by the Projects and Design division.

Phase One, The British Galleries: 1500-1900, opened in November 2001. This was the largest display project undertaken by the museum for 50 years (Humphreys 1998). There are 15 galleries over two floors, roughly 10% of the Museum's entire display space. The £32 million project, partly funded by the Heritage Lottery Fund, was completed over five years. 3,000 objects, of which 13 are tapestries, offer the very best of historic British decorative art in chronological order from the reign of Henry VIII to that of Queen Victoria. Major names in the history of British design are represented: with regards to tapestry, the Sheldon and Mortlake workshops and works designed by William Morris.

Once the team of curators had finalized the objects list, textile conservation carried out the assessment of objects and submitted the conservation hours required. A photography list for publication and a rotation list were also drawn up. It was agreed from the start that all large pieces would go on open display. Smaller works were cased, such as a group of Sheldon works e.g. a long seventeenth century Sheldon tapestry bed valance (V&A T.117-1934) displayed at an angle and partially rolled at either end to allow an easy rotation.

The level of conservation needs of the tapestries varied, from the replacing of Velcro® on the sixteenth century *Arms of Leicester* Mortlake tapestry (V&A 459-1993) and surface cleaning with low powered suction, to full conservation and wet cleaning treatment as with Vanderbank's late seventeenth century Soho Chinoiserie *After the Indian Manner* (V&A 402-1906), or the mid seventeenth century Mortlake *Vulcan and Venus* (V&A T.170-1970) (Figure 4).

The galleries were to focus on the people who produced the works and on the consumers who used these objects. Sections such as ‘What was new?’, ‘Who decided what was fashionable?’ and ‘How did styles develop?’ expanded the curatorial brief. Period rooms were introduced, not as exhibits, but allowing the visitor to enter them. For instance the 1595 tapestry *The Judgement of Paris* (V&A T.310-1920) hangs in the panelled room rescued by the museum in 1894 from a seventeenth century house facing demolition in Bromley-by-Bow, London. The tapestry, commissioned by a rich London merchant, illustrates the work of the Sheldon workshops. It was destined for domestic use but was nevertheless woven with great detail and is of good quality. The tapestry is shown behind period furniture which acts as a barrier but allows good viewing (Figure 5). Vanderbank’s *After the Indian Manner* tapestry is in a case with the great Melville bed. Records from Melville House list a series of similar tapestries which may have hung in the rooms of the house in Fife. The inclusion of this tapestry next to the bed suggests a former disposition of the room, how it would have been arranged and seen by its occupants.

The British Galleries are air conditioned and the windows are tripled glazed. Some windows are exposed and fitted with museum quality UV laminated glass. Blinds are used to address seasonal variations of light levels. Light levels are kept at 50 lux for all textiles with yearly spot checks of light levels. Integrated Pest Management (IPM) is applied, with quarterly checks of insect traps in the galleries by conservation and curatorial teams. The air conditioning system filters incoming air. Maintenance of the filters and light fittings is by appointed contractors who report to science conservation.

The V&A is the only national museum to have been funded for educational purposes, and the new British Galleries continues this tradition. These galleries were the first major space within the V&A to have been designed with the learning needs of a wide variety of audiences in mind. A series of videos, audio programmes and interactives was introduced to help visitors look at displays with greater understanding. There are audio programmes for the *Vulcan and Venus* tapestry and for *Angeli Ministrates*, a 1894 Morris & Co. tapestry (V&A 459-1993). An interactive ‘How a tapestry is made’ gives visitors a ‘hands-on experience’, and for those who seek more in depth information there are two study areas with access to the Collections-On-Line database and facilities to print.

The second major project, part of Phase One, The Medieval and Renaissance Galleries: 300-1600, opened in December 2009. The project entailed the renovation of a complete wing to the east of the Museum, ten galleries and approximately 2,000 objects of which 11 are tapestries. A £30 million project, also partly funded by the Heritage Lottery Fund, the galleries tell the story of European art

and culture from the decline of the Roman Empire to the end of the Renaissance period. Early planning began in 2002 with the task of developing the concept. By 2004 a more concrete list was drawn up and conservation assessments could begin. Practical conservation treatments began in 2006. Conservation treatments of the tapestries varied from a remedial approach for safe handling and long term display, to full conservation treatments which included extensive removal of old repairs, wet cleaning and many hours of couching stitching. The *Troy* tapestry was taken to De Wit Manufacture for wet cleaning treatment, followed by 3,500 hours of conservation work in the V&A textile conservation studio.

During the preparation works, textile conservation was called upon to contribute towards imaginative Learning & Interpretation displays such as *The Devonshire Tapestry* interactive. West Dean Tapestry Studio was commissioned to weave replicas of part of the original to illustrate aspects of the object and its historical background. 'Less is more' was the overriding design brief: the vision was to create a stunning display which showed objects at their best allowing the visitor to explore and learn at their own place. (Motture 2009)

Tapestries were to be shown as individual works and on their own as much as possible within the context of their own narrative. So the great *Troy* tapestry illustrates the interest in the ideals of the classical world while the *Verdure of Giovio of Como* placed in a recreated domestic interior illustrates the taste for northern decorative objects (Figure 6). The *Life of Man* tapestry designed by Vasari, possibly for the Palazzo Vecchio in Florence, reflects the intellectual sophistication of the late sixteenth century (Figure 7).

Early on in the planning it was decided that all large tapestries would be on open display and selected smaller works cased. The number of textile objects on open display was carefully considered when deciding to adopt a passive method of environmental control. A desire to achieve greater energy efficiency and a reduction of running costs were contributing factors to veer away from the choice of an air conditioning system. Three years of data collated through the 'Object Centred Environmental Analysis Network' (OCEAN) was used when developing the procedure for the galleries' climate. Although non-air conditioned galleries are in the majority across the museum, a significant factor in the Medieval & Renaissance galleries was the increased number of objects on open display. All incoming air is not only filtered but regulated in relation to the air indoors. Temperature and moisture content in the incoming air is contrasted to those of the indoor air and set to balance each other according to the museum's broad climate range of 18°-25°C, 40-65% RH (Pretzel 2009; CIE 2004).

Phase Two of FuturePlan will see the opening of the European Galleries: 1600-1800, in the autumn of 2014. The seven galleries are located in one level to the west of the museum. The budget of £12.5 million is partly funded by the Heritage Lottery Fund. Objects chosen from across the collections will represent the arts of Europe in chronological order. Outstanding examples of the decorative arts and the fine arts will illustrate the flow of ideas, power and commerce, as well as the changing Europe at the time, and the role of Britain within the European context and beyond.

The decant of the galleries was completed by December 2010. Throughout 2011 the curatorial content was developed, and conservation treatments started in 2012 on a selected group of objects as part of a touring exhibition *Princely Treasures: European Masterpieces 1600-1800* destined to promote the new European Galleries (Figure 8). Amongst this initial selection of works were two important tapestries: the first a representation of July combined with a view of the Chateaux des Vincennes, one of a set of *The Months* or *The Royal Residences*, designed by Charles Le Brun and woven at the Gobelins in 1670-1700. This tapestry in good overall condition needed only remedial work for display and safe travel to three international venues.[4] The second one, *The March* from *The Arts of War* series is a finely woven tapestry, Brussels, early eighteenth century (V&A T.283-1972) (Figure 9). It was woven by Judocus des Vos, one of the most prestigious and prolific Flemish weavers of his time. This tapestry is believed to be from a set which once belonged to Augustus the Strong of Saxony, and depicts an aspect of army life. The tapestry measures 4m x 7m approximately and required 350 hours of conservation work. *The March* is one of seven tapestries destined for the new European Galleries which were taken to the De Wit Manufacture Royale des Tapisseries in Mechelen, Belgium, for wet cleaning treatment.

A total of ten tapestries are planned for display in the new galleries. Gobelins and the other Paris workshops of the Louvre and Faubourg Saint Marcel will be represented, as well as the workshops of Beauvais and Mortlake. Amongst the selected works are *Diana before the Assembly of the Gods* (Faubourg Saint Marcel, 1620) woven after earlier designs by Toussaint Dubreuil (1561-1602) and measuring 3.66m x 6.40m and *The Infant Moses Trampling on the Pharoah's Crown,* part of the set of *The Story of Moses* (Gobelins, 1683-87) after paintings by Nicolas Poussin and Charles Le Brun. It measures 3m x 5.3m. Lastly, a seventeenth century tapestry from Colonial Peru is one of a number of works from beyond Europe which

[4] *Princely Treasures: European Masterpieces1600-1800* tour venues: The National Museum of Korea, Seoul, Korea; The Art Gallery of Western Australia, Perth, Australia; Oklahoma City Museum of Art, USA. The exhibition also toured to The National Arts Museum of Belarus and the Nesvizh National Museum of History and Culture, in Minsk, Belarus, although no tapestries travelled to the venues in Belarus.

will illustrate the growing connections across the world developed in the late seventeenth century and onwards through colonialisation. This tapestry panel will be displayed glazed. A passive approach to environmental control will be implemented. Under the new radical design of the galleries, the space will regain its original height, very suitable for the display of large tapestries. The 1899 Aston Webb original windows will feature prominently, and a combination of light diffusion blinds, louvered shutters and museum quality UV laminated glass will be used. Throughout FuturePlan projects Collections-On -Line has continued to evolve. The V&A website has become a key tool for reaching global audiences and sharing our resources internationally.

Conclusion

The FuturePlan initiative has had a tremendous effect on the way the tapestry collections have been re-displayed, and the way in which visitors have come to enjoy and learn from the collection. By the autumn of 2014, the new galleries combined will have displayed a total of 34 large tapestries, and a number of smaller tapestry works.

Tapestry conservation in the V&A has managed to continue despite a challenging economic climate, a demanding work programme of major exhibitions, tour schedules and loan commitments. Nevertheless, the addition of the The Clothworker's Centre for Textile and Fashion Study and Conservation with a permanent tapestry frame for full conservation treatments, as well as large table space for remedial work and for linings could provide more possibilities.

The FuturePlan Phase Two Exhibition Road project with 1000 square metres of new purpose-built gallery space may provide the opportunity for an exhibition devoted to the pinnacle of tapestry weaving in England, The Mortlake Tapestry Manufacture, the perfect framework for Wendy Hefford's forthcoming publication *From Mortlake to Soho. English Tapestries from 1618-1782*, the culmination of over 20 years of research.[5] In addition the redesign of the former exhibition spaces and adjacent rooms to house a new Fashion and Textile Quarter may contribute towards the proposed New Tapestry Gallery , a space in which to display what is regarded as the best museum tapestry collection in the country[6] alongside a wider chronological and geographical range of tapestry-technique works from our collections.[7]

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[5] Browne, C. Proposal for a Mortlake Tapestry Manufacture Exhibition. Internal V&A document, 2008.

[6] Personal communication: email from Wendy Hefford to Susana Hunter, 2012.

[7] Browne, C. Proposal for a new V&A Tapestry Gallery. Internal V&A document, 2007.

In the interim the presence of tapestry in major V&A exhibitions and the continuing demand for tapestry as loans to venues in the UK and abroad is a welcomed focus towards a continuing conservation programme and display of a very important collection.

References

Asselberghs, J.P. 1969. Charles VIII's Trojan War tapestry. London: *V&A Museum Year Book*, p80.

Evans, M. and Browne, C. eds. 2010. *Raphael. Cartoons and Tapestries for the Sistine Chapel*. London: V&A.

Hefford, W. 2007. *The Devonshire Hunting Tapestries.* Available: http://www.vam.ac.uk/v-and-a masterpieces-series. [Accessed October 2012].

Humphreys, N. 1998. The New British Galleries at the V&A. *V&A Conservation Journal,* 27, pp4-7.

International Commission on Illumination (CIE). 2004. *Control of Damage to Museum Objects by Optical Radiation*. Vienna: CIE 157: 2004.

Motture, P. 2009. Designs on the future: Developing the new Medieval & Renaissance Galleries. *V&A Conservation Journal*, 58, pp4-6.

Pretzel, B. 2009. What's the difference? Climate comparisons for the Medieval & Renaissance Galleries. *V&A Conservation Journal*, 58, pp16-18.

Victoria and Albert Museum. 2012. A*rchitectural history of the V&A 1836-1854.* Available: http://www.vam.ac.uk/content/articles/a/architectural-history-of-the-v-and-a-1836-1854. [Accessed October 2012].

Wingfield Digby, G.F. with Hefford, W. 1980. *The Tapestry Collection: Medieval and Renaissance*. London: Victoria and Albert Museum.

Suppliers

Velcro®	McCulloch and Wallis London www.maculloch-wallis.co.uk

The British Galleries hanging mechanism for the tapestries

Borley Brothers Engineering
www.borley-brothers.co.uk/contact.html

The Medieval and Renaissance Galleries hanging mechanism for the tapestries

Protosheet Engineering Limited
www.protosheet.co.uk

Gallery 94 hanging mechanism

Protosheet Engineering Limited and V&A Technical Services

www.protosheet.co.uk

Tapestry cleaning De Wit Manufacture Royale des Tapisseries
http://www.dewit.be

Replica tapestry weaving

West Dean Tapestry Studio
West Sussex
www.westdean.org.uk/Tapestry/TapestryHomepage.aspx

Figure 1

Kesi screen panel, 1600 (V&A T.844-1919).
© Victoria and Albert Museum

Figure 2
The textile conservation studio at *The Clothworkers' Centre for Textile and Fashion Study and Conservation* at Blythe House.
© Victoria and Albert Museum

Figure 3
The newly refurbished Tapestry Gallery, also known as Gallery 94, in 2007.

Figure 4
Vulcan and Venus, Mortlake 1620-1625, 4.53m x 5.78m (V&A T.170-1978),
on display in The British Galleries: 1500-1900.

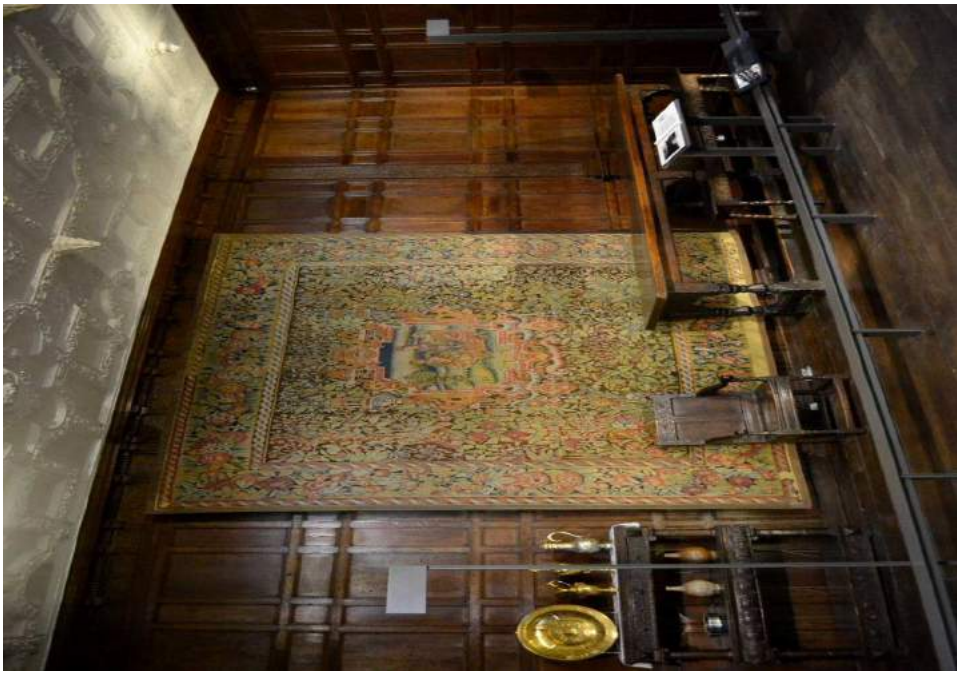

Figure 5
Panelled room from a house in Bromley-by-Bow, London.
Tapestry from Sheldon workshops, about 1595, 3.21m x 3.60m.

Figure 6
Verdure with the Arms of Giovio of Como, Bruges 1540-55, 2.18m x 6.72m
(V&A 256-1895), displayed in The Medieval and Renaissance Galleries: 300-1600.

Figure 7
Manhood from *The Life of Man*, Florence 1565, 4.67m x 4.40m (V&A T.110-1975).

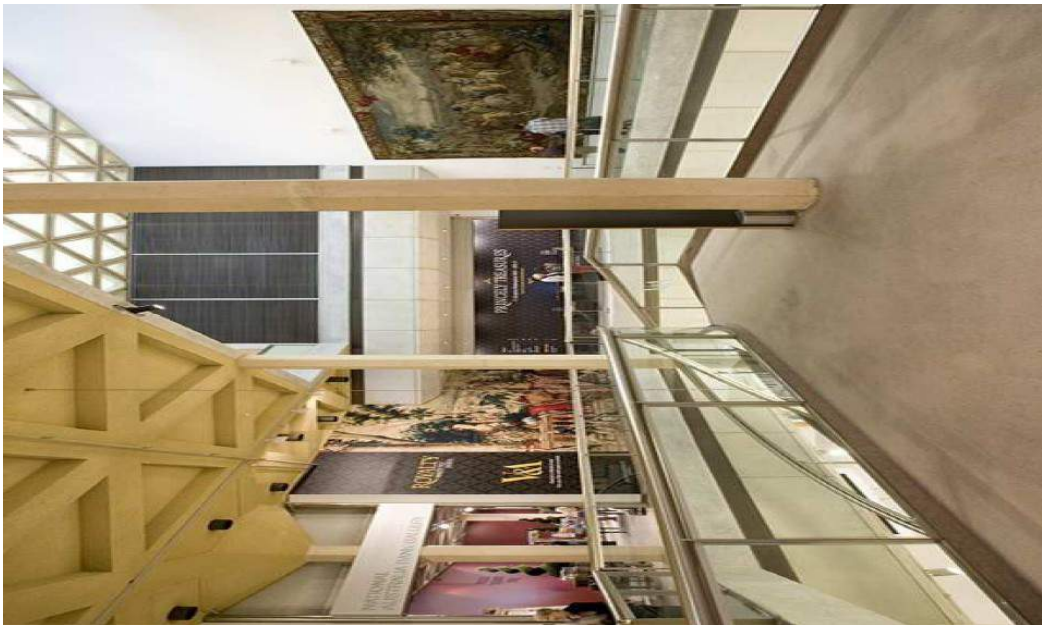

Figure 8
The March tapestry (right) on display during the tour of *Princely Treasures: European Masterpieces 1600-1800.*
© Victoria and Albert Museum

Figure 9
The March, Brussels 1718-19, 4.20m x 6.20m (V&A T.283-1972).
© Victoria and Albert Museum

Manufacture, analysis and conservation strategies for tapestries

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Introduction

In recent years there has been focused research investigating large-scale decorative textiles, particularly tapestries, and our understanding of how these textiles deteriorate, and how to monitor this process, has improved and continues to evolve. The main aim of this research is to study the mechanical properties of tapestries, and establish the impact of any associated conservation support strategies. This integrated research approach has involved weaving of model tapestry materials, ageing, tensile testing and finite element analysis (FEA) to investigate mechanical deformation.

Several projects have recently shed light on the chemical changes occurring to the fibres in a tapestry as it ages which contribute to their deterioration (Quye 2009; Luxford 2009; Hallett and Howell 2005). In general, less work has been done in the field of assessing the mechanical properties of tapestries and the effect of conservation techniques, which this project has addressed. Work carried out during the 1990s began to look at the mechanical effects of humidity on large textiles, and then the effect of linings (Howell 1996; Bilson et al. 1997; de Graaff and Boersma 1998). In addition another project has also focused on the mechanical properties of tapestries and how these can be monitored over time using engineering methods (Dulieu-Barton et al. 2005).

There is no one universal rule in conservation when it comes to supporting tapestries. Many different methods are used, some of which are conflicting in their approach. The most common materials used as a support fabric are linen and cotton which are used mainly because of their response to environmental changes, their mechanical strength, availability and cost. An extensive survey and scientific investigation was carried out in 1996 by the Netherlands Institute for Cultural Heritage (ICN) which addressed the issues of cotton vs. linen as a support fabric; however, no conclusive decision as to the more effective fabric was reached (de Graaff and Boersma 1998). This was the first survey of its type which addressed differences in tapestry conservation; specifically support methods.

In 1999 a survey of tapestry conservation methods and their evolution was carried out in the United States which revealed that the primary support method used in the USA was ‘strapping’, whilst a full support is referred to as the ‘English Method’ (Breeze 2001).

The tapestry collection at Hampton Court Palace (HCP) provided the materials resource in this collaborative research. A recent study at HCP assessed the effect of stitching techniques on the physical properties of fabric (Asai et al. 2008) and has provided the basis for the questions and methods used in this study. This previous work found that interventive conservation in the form of support is vital for historic tapestries with the level of intervention also being important. Although maximum intervention - with full support fabric and couching - reduced deformation of samples, less intervention also had a significant effect in decreasing damage.

The study reported on here aimed to use the results and conclusions from this research and extend the work to a full-scale tapestry using more extensive characterization of fabric properties, simulated artificial ageing of samples and the application of digital modelling to the scale of a full-sized historic tapestry.

Manufacture and ageing of samples

1 Manufacture of samples

In order to develop an accurate digital model, specific key physical parameters, ranging from the simple dimensions of the object to the complex varying tensile behaviour of the fabric, need to be established. As there is little reference material available for actual historic tapestries and authentic tapestries could not be used for physical testing, it was necessary to create relevant replica samples.

The Monitoring of Damage to Historic Tapestries (MODHT) project created replica tapestry fabric which was approved by conservators and other professionals in the field and provided the materials resource for simulated ageing studies (Quye 2009; Hacke 2006). These dyed and un-dyed samples were woven on a mechanical shuttle loom to re-create a tapestry weave and in this current project the ‘fabric authenticity’ has been further improved by increasing the cover factor of the tapestry sample. Again these replica samples were validated using small reference samples from historical fabric, and previous data generated by the MODHT project. The two primary samples produced were wool-wool (wool warp, wool weft), and wool-silk (wool warp, silk weft) tapestry fabrics.

Replica fabric was produced on a Northrop Shuttle Loom using 158 Tex, 3-ply, un-dyed English wool yarns and un-dyed 66 Tex 2-ply Italian silk yarns. The weave structure is a tapestry weave: weft completely covers warp.

To provide further validation of the reproduction fabrics, a comparison of fabric weave crimp was undertaken as it is recognised that this parameter has an important effect on fabric behaviour and local stress distribution (Hearle et al. 1969). The crimp values of historic samples showed the same pattern as the reproduction fabric.

2 Ageing study

Both wool-wool and wool-silk samples were aged in a Xenotest 150S Light Ageing Chamber with an Atlas Xenon lamp and a filter with UV cut-off at 320nm. The spectral distribution closely resembles that of sunlight according to the CIE 85/1989. Relative humidity was maintained at 65% within the chamber, and while the temperature was not fixed, monitors showed it varied between 18ºC and 22ºC. The illumination provided by the lamp was 180,000 lux[1] and 10 samples (five wool-wool, five wool-silk) were aged for 500 hours with a total exposure of 90 Mega lux hours. This is approximately the equivalent of 400 years of exposure in the Great Hall at Hampton Court Palace.

RH ageing was carried out in a Binder MKF 240 environmental chamber for both wool-wool and wool-silk samples. Samples were exposed to 100,170 and 240 cycles. Ten samples were placed in the chamber hanging under a weight equivalent to that of a historic hanging tapestry to investigate the effect of RH ageing under strain (Figure 1). RH was cycled between 20% and 90%, with an hour 'fixed soak' at each extreme and a half hour ramp between. The temperature was set at a constant of 80°C to accelerate the effects of deterioration according to the Arrhenius equation (Luxford and Thickett 2011).

Mechanical analysis

1 Experimental parameters

To characterise the physical properties of a tapestry, samples were tensile tested in both the warp and weft direction. Ultimate tensile strength, extension to failure and stiffness were calculated for both directions. Samples were uni-axially tensile tested on an Instron 4411 in a conditioned room at 65% ± 5% RH and 20ºC ± 2 ºC. Samples were conditioned for 24 hours prior to testing. Tests were performed at a constant rate of extension of 200mm/min using a load cell of 5kN and a gauge length of 50mm, sample width 50mm.

Results presented are the average of a minimum of five replicate measurements. As well as artificially ageing samples, historic tapestry samples were also tested. These samples were chosen from the archives at Hampton Court Palace and although the exact provenance of the samples is not known, they do represent the techniques and materials used in tapestry weaving between the sixteenth and eighteenth century in Europe. Ten samples were chosen and these range in warp and weft counts, from 4 warps/10mm to 8 warps/10mm, where the warps are un-dyed wool and the weft are between 80-90% wool with the remainder in silk.

2 Results

Previous work has used light ageing as a method for simulating deterioration of tapestry fabric (Quye 2009; Luxford 2009; Perkins et al.

[1] Personal communication with Ian Gibb, Historic Royal Palaces, September 2010.

2011) highlighting its effect on the strength of fibres and the associated bulk fabric strength. The effect of 500 hours ageing on both the weft (load-bearing) and warp (transverse) directions for wool-wool fabrics (Figure 2) was a loss of overall strength, the ageing process having a larger effect on the loss of strength in the weft direction than in the warp. Although there was a change in stiffness for both directions these changes are small and for the warp direction within the error-range. In general, the aged curves follow a similar path to the un-aged fabric curves except they rupture at a lower force and therefore extension.

3 Effect of relative humidity cyclic ageing

Recent research has highlighted the importance of relative humidity in the deterioration of textile materials (Quye 2009; Luxford 2009; Dulieu-Barton et al. 2005; Luxford and Thickett 2011). Therefore using only light for accelerated ageing to simulate deterioration no longer accurately depicts the entire and complex mechanism of tapestry deterioration. Figure 5 compares the different ageing conditions for all wool-wool fabrics and indicates there is a loss of ultimate tensile strength and a reduction in stiffness with both light and humidity/heat based ageing processes. The RH ageing produces an increase in stiffness with increasing number of cycles which is a trend that may continue with an even greater number of cycles. The linear behaviour of the fabric is of most interest as most hanging textiles are subject to small stresses and displacements and therefore the stiffness change is an important parameter in this deformation region.

4 Effect of ageing under strain

Samples were placed under strain in the RH environmental chamber for the duration of testing (240 cycles). A comparison of the effect of ageing under strain and not under strain for wool-wool and wool-silk samples (Figure 3) shows the effect of ageing under strain was a significant increase in stiffness. This increase in stiffness in effect means that for the same magnitude of force applied, there is less extension of the fabric.

This is an important result when applied to tapestries in particular, because many tapestry collections may be hanging for the majority of their lifetimes. Instinctively, conservators and scientists would say that the long term hanging display of tapestries would accelerate their deterioration and this research has provided an initial quantitative measure of this type of damage.

5 Comparison of historic samples with replica aged fabric

Ten wool-wool historic samples were tested in order to ascertain an overall level of deterioration in ‘real’ historic fabric. The results showed that overall, historic samples were much more damaged and weaker than the artificially aged samples. Figure 4 shows the comparison of historic and light-aged fabric (wool-wool) and there is a clear difference between

artificially aged materials and historic fabrics. The reproduction fabrics consistently showed greater strength in the load-bearing direction compared to the transverse.

The overall strength of the historic samples was lower than artificially aged samples showing that historic tapestries are weaker than expected through predictive ageing methods. In contrast the historic samples are also considerably weaker in the weft (load-bearing) direction than the warp (transverse), the opposite of aged reproduction samples (Figure 5). This is likely to be a cumulative effect of all the ageing mechanisms the historic fabrics experience, in particular: photo-degradation, chemical changes due to dyeing and dye degradation, relative humidity damage, ageing under strain, as well as pollution, insect and handling damage. The combination of all of these degradation mechanisms will affect the weft yarns more than the warp yarns with the overall effect being that the load-bearing direction becomes much weaker. This will also affect the overall strength as the weakest direction is also the direction bearing the weight of the object.

Chemical analysis

1 Experimental parameters

Proteomic analysis was carried out on virgin, artificial and historic samples which included gel electrophoresis and mass spectrometry to identify protein structures and changes with ageing. Additionally, electron spin resonance (ESR) was carried out to ascertain which radicals could be detected after the different ageing (and historic) methods. A full description of the chemical methods and analysis will be published at a later date.

2 Results

After proteomic analysis of all samples, the most significant result was the variation in solubility. During the reduction and extraction processes virgin wool and light-aged samples were easily solubilised however, the relative-humidity samples began to demonstrate difficulty in extraction and the historic samples even greater difficulty. Mass spectrometry analysis of the proteins extracted shows that increasing ageing decreases solubility and therefore significant changes in the wool protein structure are taking place. Full discussion of the chemical changes to the wool proteins after ageing is outside the scope of this paper but will be discussed elsewhere.

ESR analysis was used to detect the radicals produced through different ageing processes: both artificial and historical. The results of the artificial ageing analysis supported the proteomic analysis to identify the specific changes taking place in the wool fibre. The results of the historic analysis were unexpected but highlighted a potential future challenge. The major radical detected in the historic samples matched the calibration sample

for soot. This implies that pollution damage is possibly more important than previously thought. However further research is needed in this area.

Questionnaire

A questionnaire of 21 questions was developed to determine the different techniques employed by textile conservators across the world to support large-scale textiles. Questions ranged across the types of materials employed, preparation of support fabric, stitching methods, principles driving conservation, criteria for different treatments and history of the conservation technique. The questionnaire was sent out to 116 textile conservators across the world and was also posted on ConsDistList (http://cool.conservation-us.org/). 60 responses have been received to date, of which 30 were fully completed questionnaires.

The results received from the questionnaire can be broadly grouped into two areas: methods and materials.

1 Methods

The primary purpose of the questionnaire was to research the basic support method used by conservators: full, patch, strapping or other:

Full support	40 %
Patch support	10 %
Full and patch depending on condition	40 %
Strap support	10 %

An equal number of respondents used full support or a combination of full and patch support, although it was clear from the majority of respondents that treatments depended on the condition of the object. Not many could afford the time or costs involved to apply a full support if the condition of the object did not warrant such a treatment. Despite the world-wide nature of the questionnaire, only 10 percent of respondents use a strap support even though it was reported (Breeze 2001) that the strap system is the primary system in use in the USA. However, this is probably a reflection of the number of responses received from the USA compared to those from Europe.

Another area of interest was the development of methods within a studio, and what factors affect methods which are chosen. The percentage breakdown was:

Traditional	30%
Based on current research	30%
Material availability	16%
Cost	12%
Dictated by owner/curator	3%
Restrictions due to resources e.g. time, conservators and space	9%

These results indicate again that tradition and current research both play their part in the current methods which are chosen. Equal proportions of respondents use the traditional methods, proved through experience, whereas half are willing to change their methods based on the current research. Another question found a 50/50 split of conservators as to whether their current method of work was one which had always been used in the studio which indicates around 50 percent of current practitioners do update their methods depending on research.

2 Materials

Participants of the questionnaire also indicated the support fabric material used was:

Linen	55%
Cotton	30 %
Both	15%

The majority of respondents used linen as a support fabric and 30 percent used cotton. The rest (15 percent) who used ‘both’ often stated that they used different material for the patches rather than the primary support material. For instance, one respondent used cotton patches and linen ‘full’ support whereas another used linen patches and cotton straps.

Finite Element Analysis

1 Experimental parameters

Finite Element Analysis (FEA) was used to create a digital model for the structural analysis of hanging tapestries as well as the critical evaluation of conservation support systems. The model was created in the commercial FEA program ABAQUS 6.10 (Dassualt Systemes, 2004-2011) using the shell element STRI3; a 3-node triangular facet thin shell element with 6 degrees of freedom at each node and is ideal for flat geometries (where initial curvature is ignored). A static elastic analysis was used with gravitational loading. Material profiles were created for both wool-wool and wool-silk fabric. The fabrics were defined as orthotropic, with the Young’s Modulus inputted directly from data collected from tensile testing and Poisson’s ratio from the literature (Postle et al. 1988; Alsawaf 1985).

2 Results

The preliminary models represent hanging tapestries of 6m width and 4m height. The tapestries are constrained along the top edge and hang under their own weight (a gravitational load applied to the entire model). Figure 6 shows the S22 stress distribution for a hanging tapestry with no slits. The S22 stress is the stress in the vertical, hanging direction in N/m. It shows that the stress concentrations are in the top corners, and the stress experienced by the tapestry decreases with increasing vertical distance so that the upper third experiences most of the stress whereas the bottom of the tapestry experiences no stress.

The effect of slits on the stress distribution of a tapestry is illustrated in Figure 7, where the slits are all of identical size and introduced prior to the load being applied (100mm long and 20mm high). The areas of stress concentration around a slit are one of the primary reasons remedial conservation is commonly undertaken to sew up slits in tapestries and it can be seen that the maximum stress created by having slits in a tapestry is greater than when the slits are not present. Although the magnitude of the stress still means it is within the elastic region of behaviour of the fabric, areas of stress concentration will accelerate deterioration as seen by the previous results from ageing under strain. It is also an area of weakness which is more likely to fail if the applied force is increased or deterioration of the fabric progresses. The models presented in this paper are for un-aged fabric, more advanced deterioration would be seen if the material values were changed to represent aged or historic fabric.

This model will be developed in the future to include the affect of adding a conservation support system to the reverse of the tapestry: full support, patch support and strapping support. The relative effects these systems have on the stress distribution of the model will allow a better evaluation of their relative reduction of deformation.

Conclusions

This research aims to gain further understanding of the mechanical effects in the display of historic tapestries. A questionnaire has been completed to research methods, materials and principles behind conservation support methods and three primary methods were identified for further study: full support, patch support and strapping. Manufacture and characterization of reproduction fabrics has been completed and three different types of artificial ageing were successfully implemented and compared. An important outcome of this research was that for the first time direct comparison has been made between different ageing methods and scientific evidence showed that ageing under strain contributes towards degradation. A finite element model has been developed simulating successfully the condition of a hanging tapestry. Chemical analysis has established a link between chemical and mechanical degradation by linking a loss in strength and increase in brittleness with a loss in solubility with increasing age. A link between molecular proteins to fabric strength to tapestry behaviour has been established, with future work including development of the FEA model to include conservation strategies and a comparison of ‘clean’ and ‘dirty’ samples by ESR.

Acknowledgements

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References

Alsawaf, F.B. 1985. *A Study in the Mechanical Properties of Fabrics.* PhD thesis. University of Manchester.

Asai, K., Biggs, E., Ewer, P. and Hallett, K. 2008. Tapestry conservation traditions: an analysis of support techniques for large hanging textiles. In J. Bridgland ed. *ICOM-CC 15th Triennial Meeting New Delhi, Preprints.* New Delhi: Allied Publishers, pp967-975.

Breeze, C. M. 2001. The evolution of American tapestry conservation. In *Textile Specialty Group, Postprints of Papers Delivered at the Textile Subgroup Session: American Institute for Conservation Annual Meeting,* 10. Washingon D.C.: AIC, pp75-88.

Bilson, T., Cooke, B. & Howell, D. 1997. Mechanical aspects of lining 'loose-hung' textiles. In *Fabric of an Exhibition - An Interdisciplinary Approach. Preprints of 1st CCI Biennial Conference.* Ottawa: Canadian Conservation Institute, pp63-69.

Consdistlist. http://cool.conservation-us.org/

Dulieu-Barton, J. M., Dokos, L., Eastop, D., Lennard, F., Chambers, A. R. & Sahin, M. 2005. Deformation and strain measurement techniques for the inspection of damage in works of art. *Reviews in Conservation* 6, pp63-73.

Hoffenk de Graaff, J. and Boersma, F. 1998. *Tapestry Conservation: Support Methods and Fabrics for Tapestries*. Amsterdam: Netherlands Institute for Cultural Heritage.

Hacke, A.-M. 2006. *Investigation into the Nature and Ageing of Tapestry Materials*. PhD dissertation, University of Manchester.

Hallett, K. and Howell, D. 2005. Size exclusion chromatography of silk: inferring the tensile strength and assessing the condition of historic tapestries. In J. Bridgland ed. *ICOM-CC 14th Triennial Meeting The Hague, Preprints.* London: James and James, pp911-919.

Hearle, J.W.S, Grosberg, P. and Backer, S. 1969. *Structural Mechanics of Fibers, Yarns and Fabrics.* Volume 1. New York: Wiley-Interscience.

Howell, D. Some mechanical effects of inappropriate humidity on textiles. In J. Bridgland ed. *ICOM-CC 11th Triennial Meeting, Preprints.* London: James and James, pp692-698.

Luxford, N. 2009. *Reducing the Risk of Open Display: Optimising the Preventive Conservation of Historic Silks*. PhD dissertation, University of Southampton & English Heritage.

Luxford, N. and Thickett, D. 2011. Designing accelerated ageing experiments to study silk deterioration in historic houses. *Journal of the Institute of Conservation* 34 (1) pp115-127.

Perkins R., Owens H., Carr C., Hallett K., Gibb I. and Frame K. 2011. *Henry VIII's Tapestries Revealed*. In J. Bridgland ed. ICOM- CC 16th Triennial Conference Lisbon, Preprints. Cd rom format.

Postle, R., Carnaby, G.A. and de Jong, S. 1988. *The Mechanics of Wool Structures*. Chichester: Ellis Horwood.

Quye, A., Hallett, K. and Carretero, C. H. 2009. *Wroughte in Gold and Silk: Preserving the Art of Historic Tapestries*. Edinburgh: NMS Enterprises.

Figure 1
Image of the interior of the Binder humidity chamber with both standard and
under strain samples.

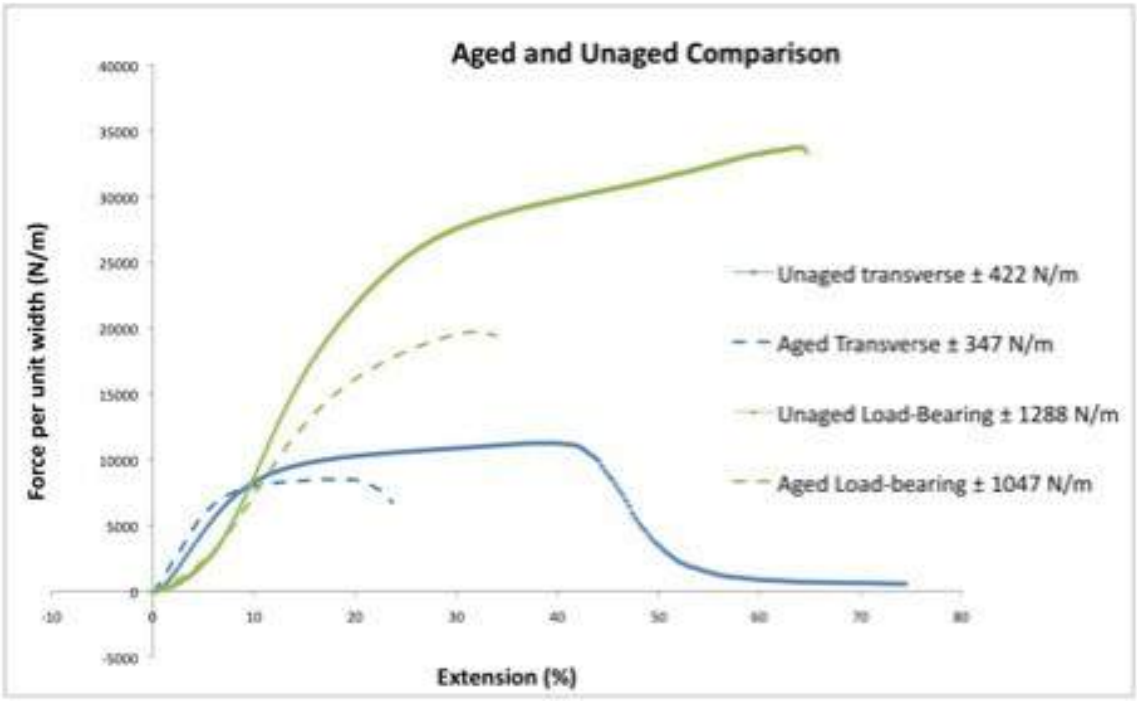

Figure 2
Comparison of un-aged and light aged replica wool-wool fabric.

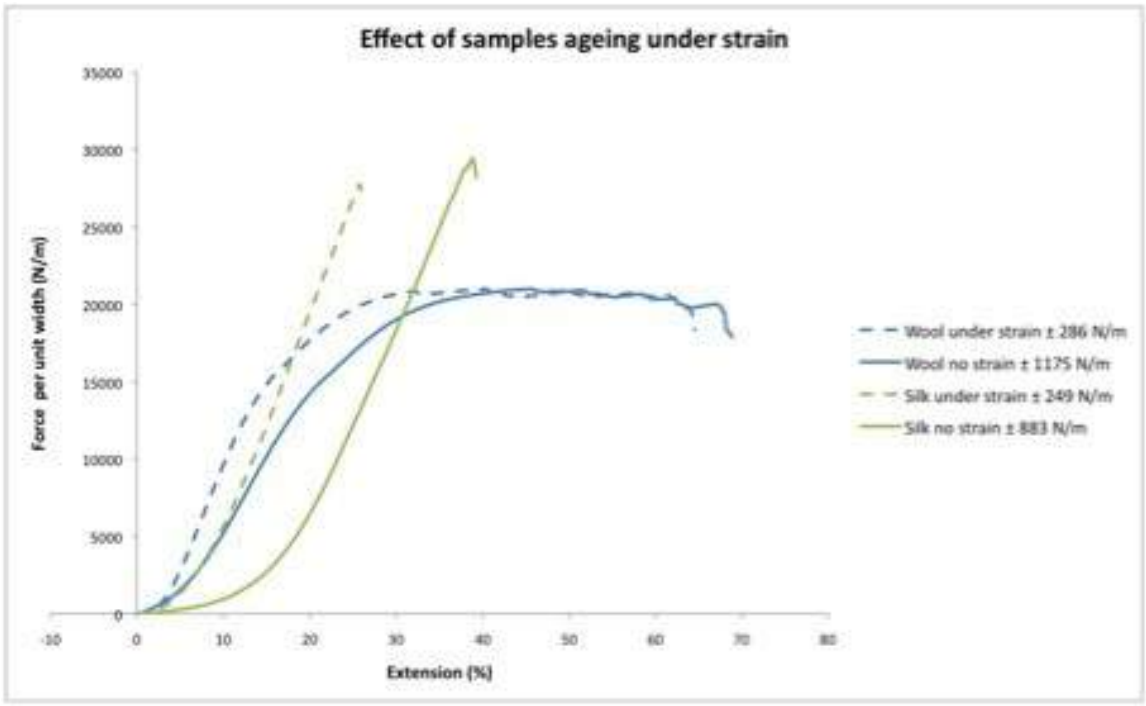

Figure 3
The effect of ageing under strain on wool-wool and wool-silk samples.

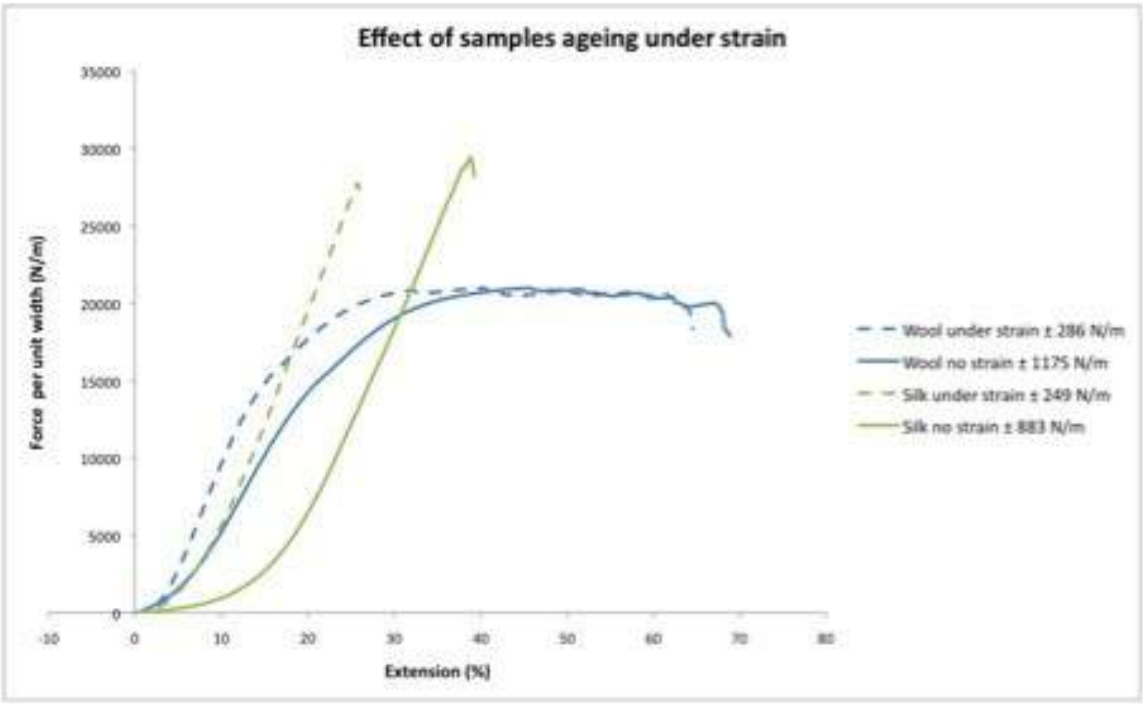

Figure 4
The comparison of tensile behaviour between historic samples and light-aged samples.

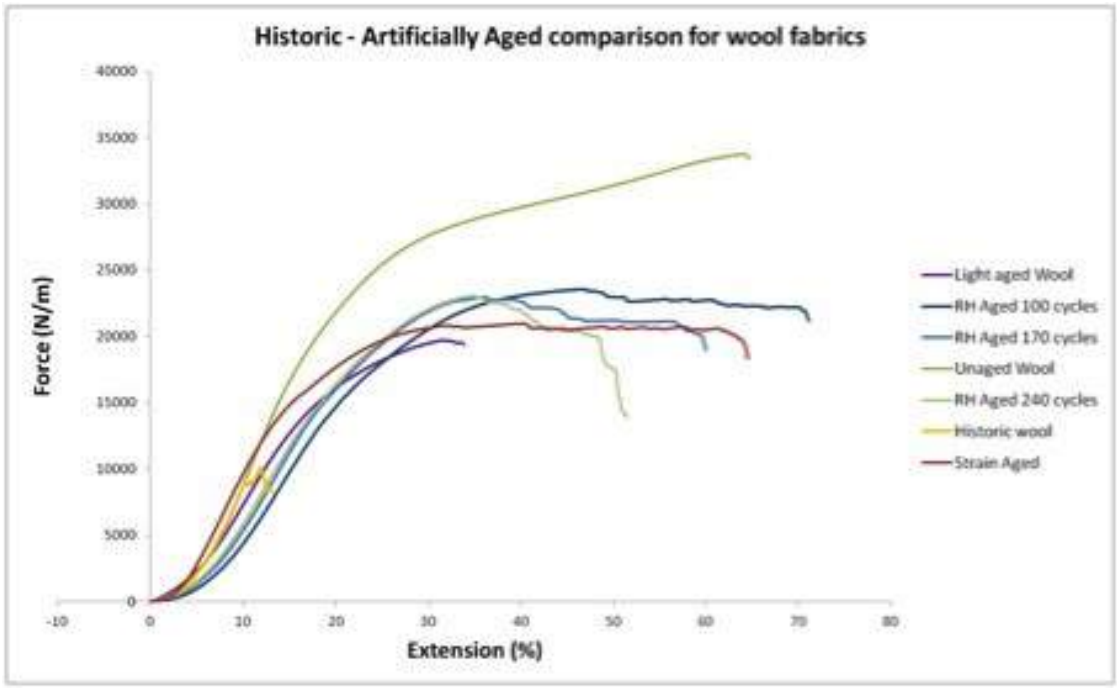

Figure 5
Variation of tensile behaviour of virgin, artificially aged and historic samples.

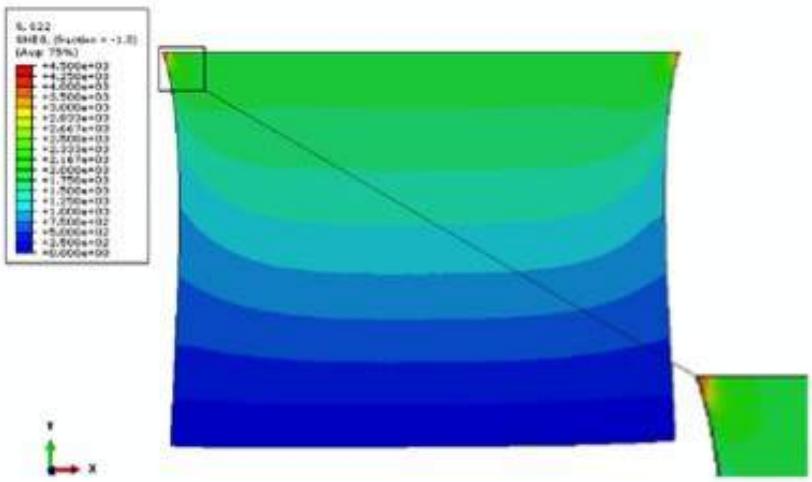

Figure 6
S22 stress distribution of a hanging tapestry with no slits.

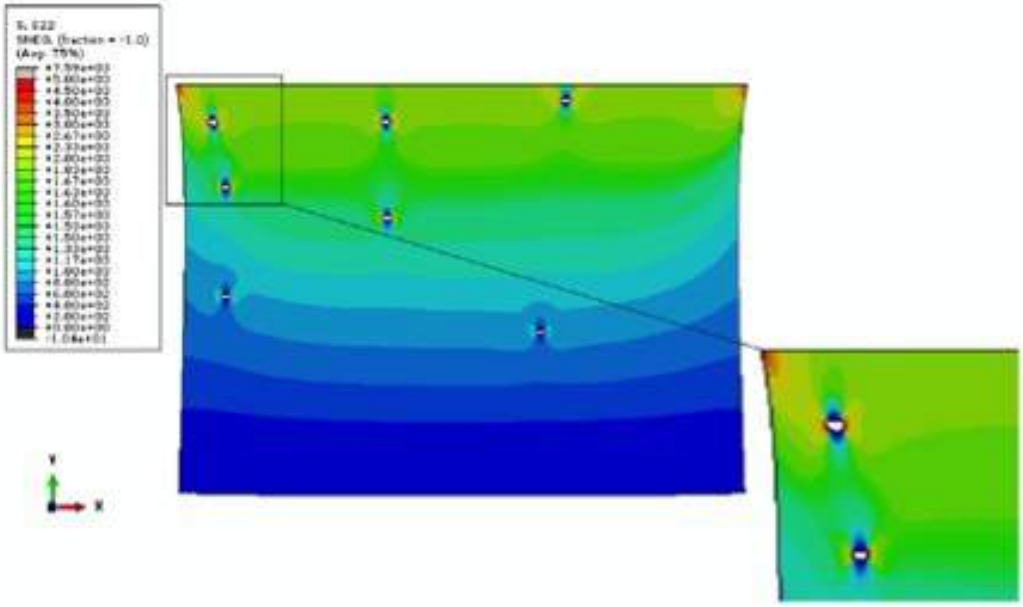

Figure 7
S22 stress distribution of a hanging tapestry with multiple slits.

Recreating the life of a tapestry: Fading dyes and the impact on the tapestry image

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Introduction

The commissioning of large-scale tapestries for palaces and castles was mainly confined to a small elite of monarchs and wealthy aristocrats in Europe before the eighteenth century. The subject matter ranged from classical myth to Biblical stories and from battles to commemorative triumphs. As magnificent and expensive objects, such tapestries often served as propaganda tools, speaking for the attributes of strength, mercy and moral virtue of their owners. The choice of narrative and its anticipated impact were therefore central to any commission.

Given the expense and symbolic value of tapestries, concern for their care and protection was, arguably, as crucial at the time of immediate acquisition as it remains today. That dyes fade has always been well known; what is less clear is the rate at which it occurs. The question is of particular interest where there has been a substantial change in colour across the tapestry. It was exactly this phenomenon which became apparent when conservation began on the tapestry *Alexander and Hephaestion Visiting the Tent of the Wife of Darius,*[1] from Charles Le Brun's famous set of the *Battles of Alexander* (1660-1) at Hampton Court Palace. The contrast between the obverse and the reverse faces was very marked, in particular in the colour of the tent and the central figure of Alexander.

The aim of this research was to reconstruct the life-cycle of this tapestry in order to identify when the fading occurred. By identifying the original dyes through chemical analysis, creating dyed wool samples and ageing them, the progress of the colour change could be established.

Historical background

This set of *The History of Alexander the Great* was woven in Brussels by Judocus de Vos, circa 1716 from cartoons by Charles Le Brun. Not only did the workshop take commissions from eminent clients such as William III of England and the Duke of Marlborough but it also produced numerous sets for the market (Brosens 2007:451). This set of *Alexander the Great* was probably amongst the latter as it was purchased in Flanders for George I by his agent, Colonel Cadogan. Seven of the set were intended to decorate the Queen's Gallery at Hampton Court Palace.

[1] The last tapestry in the *Alexander the Great* series at Hampton Court Palace to be conserved.

The history of Alexander the Great was a popular subject as many European monarchs, not least Louis XIV who commissioned Le Brun to paint the subject, wished to compare themselves to Alexander and claim his qualities of strength and command in military matters combined with generosity and honour. For George I, the new king of England, it was an equally compelling message which he wanted to convey to his new subjects.

When delivered to Hampton Court Palace the seven tapestries were found to be too large for the space. Rather than cutting them, the tapestries were pleated: horizontally, to accommodate the fireplace, and vertically to fit inside the panelling (Shepherd 2005). This work is likely to have been carried out on their arrival at the Palace. Once hung in the Gallery, they have remained *in situ* ever since.

Discovery

In preparing this tapestry for conservation, vertical pleats were found on both sides of the tapestry. The pleats were of a box construction, the viewing right pleat 215mm wide at the top and 370mm at the bottom and the viewing left pleat 520mm at the top and 440mm at the bottom. It appears that the pleats have never been opened since they were first stitched. The evidence for this is threefold; first of all, on the viewing left side, the pleat was stitched using a strong, deep yellow thread, matching the original colour of the border; secondly, that when spectrophotometer readings are taken for the obverse and reverse colours inside the pleats, they were found to be almost identical. Thirdly, the slit stitching has not been carried out inside the pleats as this area was not expected to carry any strain.

In opening the viewing right pleat, the most startling aspect is the change in the colour of Darius's tent (Figure 1). On the obverse face the tent beneath which Darius's wife and attendants are sheltering, appears grey or very light blue. In the pleat (and on the reverse) it is, by startling contrast, magenta. Between the tent and the central figure of Hephaestion, a substantial part of the tapestry is affected. It is astonishing on such high quality eighteenth century Brussels tapestry to find such an extensive loss of colour.

Dye analysis

Samples were taken across the tapestry: a total of 18 samples covering a wide range of colours. As this research was confined to the red palette, only the eight red samples will be reviewed (Figure 2). The dye analysis results are given in Table 1.[2] The analysis reveals the use of a wide range of dyes, some known to be light fast, such as Mexican cochineal, others to be especially fugitive such as orchil lichen, a dye substance banned by the

[2] Dye analysis undertaken by Ina Vanden Berghe, KIK-IRPA.

Dyers' Guilds in Brussels in 1580. In some of the samples, the orchil lichen had been over-dyed with indigo.
Unfortunately the analysis could not reveal the type of orchil lichen used but from dye literature it seems likely that it was varieties of Roccellae as they were extensively gathered in the Canary Islands and imported to Flanders (Sanchez Pinto 1995).

In light of the dye analysis results, it was decided to focus on the orchil lichen dye as these areas showed the most dramatic fading, not least in the central figure of Alexander.

Recreating the life of the tapestry: design parameters

Since this set of tapestries has always hung in the same gallery at Hampton Court Palace and lux data are collected from this gallery, it was felt that a research experiment could be designed to replicate the dosage of light the tapestries have received during their life time to establish when the loss of colour occurred and how, this in turn, may have affected the impact of the image. Once the light data had been calculated and the dye from the orchil
lichen made, wool was dyed and accelerated aged in a Xenotest® light ageing machine.[3]

Table 1 Dye analysis of samples taken from tapestry

Sample	HPLC-DAD	Micro Chemical Tests
Tent S2	Weld, madder + an indigoid dye	
Tent S3	Mexican cochineal + indigoid dye source	
Tent S4	Indigoid dye source	Indigoid dye source in combination with orchil lichen
Tent S5	Indigoid dye source	Indigoid dye source in combination with orchil lichen
Hephaestion	Mexican cochineal + Madder	
Alexander the Great	No dyes detected	Orchil lichen only
Woman	Mexican cochineal +	

[3] The Xenotest 150S® ages the fabric through the use of intense light. The Xenotest® incorporates a very powerful light source (approximately 150,000 lux) given through a xenon arc bulb which has the same spectral distribution as sunlight through window glass, a rotating drum, ten rotating sites for samples and a Relative Humidity gauge. In practice, most scientific investigations in this machine have adopted the British Standard (BSEN 20139:1992 and ISO 139:1973) of 65% RH. Although there is no temperature control available on the machine, the temperature remains ambient.

	Madder	
Prostrate Man	Madder	

1 Archival research

Hampton Court Palace was used as a summer residence by English monarchs during the eighteenth century. However research revealed that 1718 was the last summer George I used the Palace before his death in 1727 (Heath 1985). The tapestries are likely to have arrived and been altered to fit the space between 1718 and 1727. Sadly, no specific date has been found for their installation in the Queen's Gallery.

On the accession of George II, Hampton Court Palace resumed its place in the court calendar with the King and Queen and the court in residence during the summer of 1728. Between 1728 and 1737, the court came to Hampton Court Palace four times and it is reasonable to assume that the tapestries were hung for the first summer of George II's reign and the court's arrival for the summer of 1728. The Court was in residence for between 2 to 4 months in the years 1728, 1731, 1733 and 1737. Queen Caroline died in November 1737 and thereafter Hampton Court Palace was not to be used by a monarch and the court.

For the next 100 years, the Gallery would only be opened for occasional visitors to whom the Gallery was shown by appointment with the Housekeeper. In August 1838, following the death of the last housekeeper, Lady Emily Montague, Queen Victoria opened the Palace to the public, six days a week (Laws 1891:363). However in 1841 the display of the Gallery changed to allow part of the royal picture collection to be viewed. To do this the tapestries were covered with calico on battens and pictures hung over the top. It was not until 1885 that the tapestries were uncovered and the Gallery returned to its original display. As a result of these findings, it was decided to set the parameters of the experiment to the period 1728 to 1841.

The light levels experienced today in the Gallery are likely to be similar to those of the first part of the eighteenth century. The housekeeping practices for the Palace during the last years of the seventeenth century and in the early eighteenth century aimed to minimize damage to the lavish interior decorations. Dust and dirt were limited by a regular regime of cleaning. Light was controlled by the use of shutters, and a combination of cane sashes and umbrellos (Fryman 2011). Umbrellos were made up of a wooden frame covered with cloth or stuff to prevent the sun entering by a window. They could be fitted on the inside, or above the window, on the outside. According to Fryman, when the court was not in residence,

> 'the Wardrobe Keeper would have been able to close the shutters that were fitted on the inside of all the windows in the State Apartments and privy lodgings during the daytime, thereby shutting out the light entirely.' (Fryman 2011:233).

2 Calculating light exposure

Table 2 Light hours for the year the Court was resident at Hampton Court Palace and for the first three years the Palace was open to the public

	1728	**1731**	**1733**	**1737**	**1838-1841**
	2 July – 7 Sept	10 June-28 Oct	16 July – 27 Oct	14 July – 28 Oct	Open 313 days per year = 939 days
Jan					
Feb					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Total lux hours per period	112,027	204,586	143,670	149,117	1,024,415

Between 2006 and 2008 an average 394,929 lux hours was recorded per year in the Queen's Gallery, of which approximately 150,000 lux or 40% of the total lux hours for the year occurred during the summer months of June, July and August. Using this data and multiplying the figures by the number of days the court was in residence at the Palace, the lux hour dosage was calculated for the Xenotest® detailed in Table 2. [4]

The first four columns of Table 2 show the specific months in which Hampton Court Palace was occupied by the court between 1728 and 1737 with the total lux hours for each period. The final column shows that the Palace was open in every month of the year for the three years being included in the research experiment with the corresponding cumulative lux hours for the period.

3 Making the dye and dyeing samples

[4] Whilst acknowledging that the eighteenth century summers may have been sunnier or less sunny.

Natural dyes can be described as either ‘substantive’ or ‘adjective’; lichen is a substantive, or direct dye. These dyes become chemically fixed to the fibre without any mordant. Vat dyes also come into this category; indigo is a good example. Colour variations can be achieved by adding acid or alkaline to the dye bath.

As dyeing is an art as much as a science, this experiment acknowledges that the variables are many, including:

- the type of lichen: Rocellae or Lasalllia pustulata
- the making of the dye and the age at which the dye was used.
- the hardness of the water
- the potency of the ammonia or stale urine
- the addition of acids or alkaline to alter the colour

Lichen: Lichens are hyper-sensitive environmentally. They are slow-growing and cannot be cultivated (Whitworth, 2011:9). The tapestry wool was probably dyed with Rocellae species from the Canary Islands (Sanchez-Pinto 1995:546) but because no source was readily available, Lasallia pustulata was used for the experiment instead.

Dye: Extracting the dye from the orchil lichen is done by ammoniacal fermentation and consists of putting a sample of lichen in contact with aqueous ammonia for a period from between four days to six weeks depending on the colour required. The lichen is reduced to powder before being placed in a jar with the ammonia and closed. To facilitate the fermentation, the jar needs to be shaken and aerated. In this experiment, the samples were shaken and aerated four times a day for six weeks. At the end of this period, the orchil-type lichens develop a red-violet colour in the liquid[5] which can be used as a direct dye on unmordanted wool.[6]

Water: As it is impossible to know and therefore replicate the water used by the dyers in Flanders/Brussels, tap water was chosen for the dyeing. The pH was measured at 5.

Ammonia: Old recipes stipulate five-day old male urine (Cardon 2007:490) but for this experiment, household ammonia was used.[7]

Addition of acid: In order to achieve a colour as close as possible to Alexander’s cloak, acid was added in the form of Sarson®’s white vinegar. To replicate the colour of the tent, the colour achieved for the cloak was over-dyed with indigo.

Yarn: In Europe, the most commonly used fleece for tapestry weaving since the Middle Ages has been a hairy, medium fleece from white-faced horned sheep, from breeds such as the Cheviot and Welsh Mountain.

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[5] Showing the production of orcein colorant.
[6] Dye recipe from Isabella Whitworth, natural dyer.
[7] Kleen Off 570600 Household Ammonia.

Although, through breeding, sheep breeds have evolved over the centuries (Ryder 1984) it is most likely that the *Alexander* tapestry was woven with a hairy medium fleece. As sourcing the same yarn was not possible, white plied weft yarn was substituted[8] together with a tabby-weave wool fabric.

Method: With the orchil dye liquor made, dyeing was carried out using pre-wetted tabby wool (wetted with tap water and a drop of Orvus detergent). The dyeing took place over three days. A test dye was undertaken initially followed by the final dyeing with the chosen recipe.

The wool was placed in the dye bath and over the course of an hour the temperature was raised to no more than 60°C and maintained at that temperature for a further hour. After the second hour, the mixture was cooled overnight, with the material remaining in the dye bath. The next day, the dyeing was repeated in exactly the same way. When the bath had cooled overnight for the second time, the dyed material was rinsed until the water ran clear.[9] Following this initial dyeing, four variations were tested to establish the closest colour to the tapestry as given in Table 3.

Table 3 Test dyeing

	Dye	**Water Ratio**	**Additives**
Test 1:	100% orchil - 6.36 mls	100:1, 636 mls	
Test 2:	100% orchil (6.08 mls),	100:1, 608 mls	Weight of fabric x 2.5= 15mls white vinegar @ 5% acidity pH4
Test 3	100% orchil 6.73 mls	100:1, 673 mls	Weight of fabric x 6 = 40 mls white vinegar @ 5% acidity pH3 pH3
Test 4	100% orchil 6.8 mls	100:1 680mls	Pre-mordanted in white vinegar for 2 hours before dyeing

Test 2 was found to give the closest colour to the wool yarn samples taken from the *Alexander* tapestry. However, as the dye analysis had identified several variations in dyes, four sets of samples were prepared:

- Sample 1: Orchil with acid on tabby weave wool.
- Sample 2: Orchil with acid on wool weft.
- Sample 3: Orchil sample over dyed by dipping once into indigo on tabby weave wool.[10]

[8] Used by the studio in tapestry conservation for lost or degraded wool weft.
[9] Methodology from Isabella Whitworth, natural dyer.
[10] Placed in the indigo vat for 5 minutes and then oxidized for 5 minutes before being rinsed out.

- Sample 4: Orchil sample over dyed by dipping 3 times into indigo on tabby weave wool.[11]

One large piece of tabby wool was dyed and 15 grams of wool weft. Once dyed, the wool was divided into four pieces and two pieces were used for over dyeing with indigo.

4 Ageing

The wool samples were then prepared for real time ageing testing in the Gallery and for accelerated light ageing in the Xenotest®. As the test holders in the Xenotest® require a sample size of 130mm long x 55mm wide, all the wool samples were cut to this size and the plied wool weft was wound onto acid free card of the same dimensions.

Real time:
Given that in 1728 the court had been in residence at Hampton Court Palace between 2 July and 7 September, it was decided to put one set of samples on the wall where the tapestry hung in the Queen's Gallery for the same period, together with a lux meter, to give real-time data.

Accelerated ageing:
Using the following data from the Xenotest®, the amount of time needed to give an equivalent dosage of light was calculated using the formula:

$$\text{Number of minutes in Xenotest®} = \frac{\text{60 minutes x lux hours calculated for period}}{\text{Number of lux emitted from Xenon bulb}}$$

with the Xenon bulb emitting 145,000 lux per hour, the relative humidity set at 65% and the temperature between 19°C - 22°C.[12]

For example:

$$\text{Number of minutes in Xenotest for 1728} = \frac{60 \times 112027}{145000} = 46.35$$

The experiment entailed exposing 12 samples to the appropriate number of minutes for each year, taking spectrophotometer readings and photographing the samples after each dosage and then exposing these same samples to the next year's worth of light. [13] This built up the cumulative light exposure calculated for the tapestry over its life between 1728 and 1841.

Results

[11] Dipped into the indigo dye vat three times, each for 5 minutes and oxidized for 5 minutes in between each dipping.
[12] To ensure accuracy, the light level was tested and found to be emitting 145,000 lux hours.
[13] 3 pieces of fabric or yarn were tested from each of the Samples 1-4. Three readings were taken for each sample and readings averaged to give the results given in Tables 4-6.

The ‘real time’ spectrophotometer results showed a percentage rise in the value of L*, representing an increase in lightness, as did the samples artificially aged in the Xenotest®, seen in Table 4.[14] Unfortunately, no data was recorded on the lux meter in the Gallery so the number of lux hours to which the samples were exposed is not known. However it is clear that after a relatively small lux dosage, there was a significant loss of colour, with L* increasing by 12.9% for the accelerated aged samples and 12.01% for the real time samples respectively, in comparison with the control sample.[15] Given these findings, the accelerated ageing conducted by the Xenotest® was felt broadly to reflect real time dosages.

Table 4 Average Spectrophometer readings for L*

Tabby weave wool dyed in orchil	**Xenotest**	**Real time**
Control	34.46	34.46
112027 lux hours/ 1 summer	38.91	38.6
% change to control	12.9%	12.01%

Table 5 shows the results of accelerated ageing, with average spectrophometer readings for L* and % change in comparison with the control.

Visually, there was no perceptible change to any of the samples after the first summer of a 112, 027 lux hour dosage. As above, the spectrophotometer readings showed that 12.9% of the orchil dye was lost, indicated by a rise L*. Over the following summers, more colour was lost, indicating that by 1737, 28% of the dye would have been lost on 3 of the 4 samples tested, a level easily detectable by the naked eye (Figure 3).

Once the Palace was opened to the public in 1838, the tapestry received more light as the Gallery would have had its shutters open for six days a week throughout the year. In the period representing the next three years, the colour loss was dramatic. The tests show that by 1841 51.48% of the orchil dye would have been lost and between 47% and 41% of the orchil with indigo yarns would have faded (Figure 4). With this loss of colour, both Alexander’s cloak and the tent would have lost much of their impact, fading from magenta to light blue and grey.

Sample 2, the weft, behaved differently to the other woven samples as seen in Table 5 particularly at the beginning of the experiment; it faded at a slower rate. The wool weft was wound on to the card by hand and the

[14] L* represents the luminous intensity of colour i.e. its degree of *lightness* from Hunter 1948 *L*, *a*, *b* color space.
[15] The control samples were kept in a folder, out of the light.

uneven distribution this caused may account for the results from the Spectrophotometer.

Spectrophotometer data were also collected from the tapestry at the beginning of the conservation treatment. Readings were taken for the tent, inside and outside the pleat. Remarkably the two sets of data, those from the tapestry itself and those from the test samples, showed markedly similar readings. Table 6 shows that the reading for the magenta of the tent, where it had been protected, was almost identical to the control Sample 3, whilst the longest aged Sample 3 was only 7.89 % darker than the tapestry reading for the tent outside the pleat.

Table 5 Average Spectrophometer readings for L* for artificially aged samples

	Sample 1 Tabby weave wool dyed in orchil	**Sample 2 Wool weft dyed in orchil**	**Sample 3 Tabby weave wool dyed in orchil + indigo**	**Sample 4 Tabby weave wool dyed in orchil + 3 x indigo**
Control	34.46	34.77	30.68	28.52
112027 lux hrs/ 1 summer of 1728	38.91	37.02	33.54	31.61
% change to control	12.90%	6.47%	9.30%	10.80%
316,613 lux hrs/ 2 summers of 1728 & 1731	41.19	39.31	36.23	34.25
% change to control	19.53%	13.05%	18.09%	20.09%
460283 lux hrs/ 3 summers of 1728, 1731 & 1733	43.04	41.46	38.15	35.74
% change to control	24.9%	19.24%	24.35%	25.32%
609401 lux hrs/ 4 summers of 1728, 1731, 1733 & 1737	44.14	43.61	39.54	36.78
% change to control	28.09%	25.42%	28.88%	28.96%
609401 lux hrs/4	52.2	N/A	45.33	40.33

summers 1728 - 1737 + 1024415 lux hrs/ 3 yrs 1838-1841				
% change to control	51.48%	N/A	47.75%	41.41%

Table 6 Comparison of spectrophotometer readings from samples and the tapestry

Area on Tapestry	**Colour**	**Face**	**L* reading**	**L* for Sample 3**
Tent inside pleat	magenta	Obverse	30.25	30.68 for control
		Reverse	29.05	
Tent outside pleat	grey/pink	Obverse	48.91	45.33 after 1.63m lux hours
		Reverse	36.39	

From the experimental data, the loss of colour appears to have been extremely rapid at the beginning of the tapestry's life as there was approximately 47% loss of colour in the first 4 summers and 3 years. By contrasting this with the readings from the tapestry itself, it is clear that although some colour still remains, the loss of colour in the last years (1885-2012) has been minimal in comparison to the first period of its display history.[16]

Impact on the tapestry image

Startling as these results are, the question remains, does the loss of colour matter in terms of the reception of the tapestry? Is it a purely aesthetic issue or one which affects the interpretation of the work?

In viewing the obverse in comparison with the reverse, it is clear that the impact of the image changed greatly with the loss of colour, most notably the loss of magenta. Taken together, in the tent and the central figure of Alexander, a significant amount of the tapestry colour is lost. The impact of Hephaestion in his red cloak against the pale grey of Alexander feels oddly unbalanced on the obverse, especially as Alexander is the central figure. Viewed on the reverse, the balance of the image and its impact is very different, with the central figure of Alexander appearing much more dominant (Figure 5).

[16] The fading curve is typically very steep at the start of light exposure, reducing to a very shallow slope as the textile ages.

The scene depicts the moment when Alexander, accompanied by his lieutenant Hephaestion, visits the wife of Darius III, king of Persia, having defeated him in battle. Darius's mother pleads for clemency for her family and attendants but mistakes Hephaestion for Alexander because of his vibrant cloak (A-Al Zubi 2005). As both figures are cloaked, the question of the cloaks' colour is therefore vitally important.[17] With the original colouring, the question of the mother's choice would have been more nuanced and subtle, an error over the value brightness rather than colour symbolism. On the other hand, with the fading of the dyes, it appears that her error is one of fact rather than interpretation.[18]

Conclusion

Recreating the life-cycle of this tapestry has established the likely timing of the dramatic change in its appearance and impact. Despite good housing keeping regimes, over the four summers George II spent at Hampton Court, the king would have seen the tapestry fade. In the three years after the Palace was opened to the public in 1838, the loss of colour in both Alexander's cloak and the tent would have been almost to what we see today and the image interpretation would have been affected.

It is difficult to believe that the dyers and weavers of the prestigious Brussels tapestry centre would have knowingly used such fugitive colours as weavers and dyers were regulated by guilds whose specific purpose was to ensure high standards of practice were maintained. Could it be that the choice and impact of colour outweighed the need for best practice? Or could it be that the weavers were less fastidious in ensuring the highest standards of materials for this 'commercial set'? To unravel how or why this situation arose is beyond the scope of this paper but is undoubtedly a rich area of research for the better understanding of tapestry production in the eighteenth century.

Despite these unanswered questions, the information gleaned in these experiments can only help in interpreting these precious survivors of the eighteenth century tapestry weavers.

Acknowledgements

I would particularly like to acknowledge Chloe Hesketh (HRP) for all her work and expertise in dyeing the samples for testing and to Isabella Whitworth (natural dyer & independent scholar) for her generosity in giving her supply of orchil lichen for this work and for her time and knowledge of dyeing. I would also like to acknowledge the very helpful discussions and emails I have had with the following people: Pip Saunders (National Trust), Suzan Meijer (Rijksmuseum), Dr. Olivia Fryman (freelance curator), Prof Katie Scott (Courtauld Institute of Art), Penelope Walton

[17] Alexander is cloaked in magenta/purple for symbolising royalty and wealth, whilst Hephaestion is cloaked in red for power and prestige.

[18] Personal communication with Professor Katie Scott, Courtauld Institute of Art, August 2012.

Rogers (Anglo-Saxon Laboratory), Ina Vanden Berghe (KIK-IRPA, Belgium), Helen Wyld, Prof Koenraad Brosens (Univ. of Leuven, Belgium), and my colleagues Constantina Vlachou and Kate Orfeur.

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References

A-Al-Zubi, H. 2005. Conceptions of Alexander: The heroic and satirical in Le Brun's Alexander series and Dryden's "Alexander Feast". *Damascus University Journal* 21 (1+2) pp54-55.

Brosens, K. 2007. Flemish production 1660-1715. In: *Tapestry in the Baroque: Threads of Splendour*. The Metropolitan Museum of Art, New York. London: Yale University Press, pp441-453.

Cardon, D. 2007. *Natural Dyes: Sources, Tradition, Technology and Science*. London: Archetype.

Fryman, O. 2011. *Making the Bed: The Practice, Role and Significance of Housekeeping in The Royal Bedchambers at Hampton Court Palace 1689-1737*. Unpublished PhD thesis, Kingston University, pp226-233.

Heath, G. *Chronicles of Hampton Court*. Unpublished essay (part of the Heath Archive, held by Historic Royal Palaces, vols. 36 and 37, 1985), vol. 37.

Laws, E. 1891**.** *The History of Hampton Court Palace Volume 3*. London: George Bell and Sons. pp350-368.

Ryder, M. L. 1984. Medieval sheep and wool types. *The Agricultural History Review* pp15-28. British Agricultural History Society, http://www.bahs.org.uk/32n1a2.pdf

Sanchez-Pinto, L. 1995. A brief history of the canary weed, *Flecheten Follman. Contributions to Lichenology in Honour of Gerhard Follman*. Cologne: Botanical Institute, University of Cologne, pp544-551.

Shepherd, L. 2005. Changing approaches to tapestry conservation: the conservation of a set of seven eighteenth-century tapestries. In: F. Lennard and P. Ewer eds. *Tapestry Conservation: Principles and Practice.* Oxford: Elsevier, pp28-36.

Vanden Berghe, I. and Maquoi, M.C. 2011. Unpublished Dye Analysis Report. KIK-IRPA, pp6, 12-13.

Whitworth, I. 2011. An unsustainable demand: The trade in orchil lichens seen through a 19th century archive. *The Textile Society* 38: 2010-11, pp 4-9.

Suppliers

Kleen Off 570600 Household ammonia	Molesey D.I.Y. 75 Walton Road, Town Centre East Molesey, KT8 0DP
Tabby weave wool (Nun's Veiling)	Wolfin Textiles Ltd Cornwall Road Pinner HA5 4UH Tel: +44 (0)20 8427 7429 Fax: +44 (0)20 8428 4350 Email. cotton@wolfintextiles.co.uk
Wool weft	Hand Weavers Studio 0208 521 2281

Figure 1
The tent, on the fold of the pleat, showing the change from magenta to grey.

©Historic Royal Palaces

Figure 2
Tapestry, obverse, showing eight sample sites.
©Historic Royal Palaces

Figure 3
Test Samples after 600, 000 lux hours.
©Historic Royal Palaces

Figure 4
Test Samples after 1.02m lux hours.
©Historic Royal Palaces

Figure 5

Loss of colour: Comparison of obverse (left) and reverse (right) of central figures.

Project and innovation: Caring for a set of seventeenth century Verdure tapestries at Falkland Palace

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Sophie Younger, ACR
Proprietor, Younger Conservation

Introduction

The success of a conservation project is often about good team work. This paper discusses the context, history, 'emergency' treatment and two innovations relating to work by a conservation team on a series of six tapestries hanging along the processional gallery at Falkland Palace.

The project

1 Context

Falkland Palace in Fife (Figure 1) was initially built between 1501 and 1541 as a hunting retreat for King James IV of Scotland. It was also used by his son, James V, who died there in 1542. After ceasing to be a royal residence, the palace underwent a substantial period of revival and restoration following the purchase of the Keepership by John Patrick Crichton Stuart, the 3rd Marquess of Bute, in 1897 and his death in 1900.

The 3rd Marquess's son, Ninian, later became the 4th Marquess and was Keeper of the pbetween 1900 and his death in 1915. He was also the founder of the Dovecot Studios. Ninian continued his father's renovations and concentrated his efforts on the Chapel Royal at Falkland. The six Flemish Verdure tapestries discussed in this paper date from the seventeenth century but were bought by Lord Ninian in Holland in 1906 (Puttfarken et al. 1995) for £1537 18s (Drainey 2010). Originally they were hung in the Chapel Royal but subsequently were moved to the Tapestry Gallery (Figure 2), a space which had been restored by Lord Bute in the 1890s. Another set of four tapestries, depicting the story of Joseph and Benjamin, was later put on display in the Chapel Royal.

The Verdure tapestries depict rural, hunting scenes (Figure 3) in keeping with the former role of Falkland as a hunting retreat and, according to Ninian Crichton Stuart, the current Keeper of Falkland Palace, as 'a place of nature and culture' (Drainey 2010). The tapestries have no borders: it is not clear whether they were cut down to fit the Chapel Royal, or whether that had already been done prior to their purchase.

The tapestries formed an important part of the 'free and absolute gift' (NTS Central Archive files) from Michael Crichton Stuart to the National Trust for Scotland (NTS) in 1952. The Trust was appointed Deputy Keeper

of Falkland Palace by the family at this time in order to help with the care and maintenance of the property. The history of care of the tapestries, once they transferred to the NTS, is interesting. In 1965, Archie Brennan of The Edinburgh Tapestry Company Limited (Dovecot Road, Corstorphine) assessed their condition and prepared an estimate for 'cleaning and essential repairs' to all six panels at a cost of £300 (NTS Central Archive files). The Dovecot Studios, founded in 1912 by the 4th Marquess of Bute, were incorporated into The Edinburgh Tapestry Company in 1946.[1] The involvement of this company in the care of the tapestries shows a certain family continuity.

In 1981, the Conservation Bureau undertook a further condition assessment. This assessment gave a detailed description of the tapestries. It stated that they were all 'fairly dirty' and recommended 'cleaning; removal of some old repairs; support of weak areas onto patches; re-sewing of slits and re-lining' (NTS Central Archive files). Some of this work, including re-lining and altering the hanging system, was undertaken by Margaret Moran between 1991 and 1998. Moran worked on the four *Joseph and Benjamin* tapestries in the Chapel Royal and on only two of the six tapestries in the Tapestry Gallery.

Since the appointment of the first in-house conservator by the NTS in 1997, the overall approach to the care of the tapestries at Falkland has been to monitor their condition. Regional conservators were appointed in 2001 and the care of the Falkland tapestries was recognized as a priority. An in-depth condition survey was carried out on the largest tapestry by Sophie Younger in 2004. The view, at this point, was to focus on the largest tapestry and understand its condition in detail because it appeared the most vulnerable. A photographic record of damage was taken and then updated and reviewed annually while funds were sought to pay for conservation.

To this end, a collection fund for donations was set up at Falkland. Unfortunately, the way this money had been invested meant that the NTS could only spend the interest from the fund, which proved insufficient to cover the cost of in-depth conservation. This funding situation was re-examined in 2010 and enough money was made available to commission a programme of emergency conservation work.

It became apparent, when Younger updated her condition assessment of the largest tapestry in February 2010, that the antiquated press-stud hanging system had begun to fail and that the tapestries were at risk of falling off the wall. The urgent need to address this issue was recognized and a five-week project was programmed during the property's closed season in 2010.

2 Objectives

The main objective was to change the hanging system and, as a consequence of this, it was decided to view the six tapestries as a whole, rather than to treat them individually. Cleaning and stabilisation of the worst of the vulnerable weavings using linen and net patches was scheduled as required. To make best use of the limited space – one of the restricting factors of this project – the decision was taken to try Younger's innovative Velcro® strip (Sofstrip©) so that much of this work could be done with the tapestries hanging in situ.

A second project objective was to involve local NTS textile volunteers in the work on the tapestries. A textile volunteers group meets regularly at Hill of Tarvit, Fife, to undertake work on NTS collections and to make case covers and other protective items for objects. This group is supervised by Alison Docherty. Docherty also supervises similar groups of volunteers at Hopetoun House and the Black Watch Museum, some of whom were also persuaded to help with the Falkland project. The volunteers from Hopetoun House, who work regularly on the tapestries there, were particularly helpful given their experience. Volunteer involvement became one of the highlights of the project. The NTS is fortunate to have the support of over 3000 volunteers each year.[1] The Trust itself was formed by volunteers in the 1930s 'in order to protect and promote Scotland's natural and cultural heritage for present and future generations to enjoy'.[2] Since then volunteering has been at the heart of its work. Over the last decade the NTS has developed a more professional approach to organising volunteer forces and they are now managed by a designated Volunteering Department.

The Hill of Tarvit group has been meeting for over 25 years. Initially this group carried out a wide range of work on NTS collections, including upholstery. When conservators were appointed by the Trust at the end of the 1990s they were reluctant to allow volunteers to work on historic collection items unchecked. Whilst it takes many years of training and experience to become a conservator, most of the volunteers have very good needlework skills, skills that are now being recognised as something of a dying art because we are no longer learning needlework 'at our mother's knee' (Pearson 2006). Violet Dalton, Head of Volunteering for NTS, believes there has been a sea change in attitudes towards the volunteer's contribution because accredited conservators have become part of devising the framework within which volunteers can work so it is easier for everyone to feel more comfortable about their involvement.[3]

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1 http://www.nts.org.uk Accessed 10th July 2012.

2 http://www.nts.org.uk Accessed 10th July 2012.

3 Interview with Violet Dalton, NTS Head of Volunteering and Amy Drysdale, NTS Volunteer Coordinator, 10 July 2012.

NTS appointed Sophie Younger ACR, to devise the treatment framework and to manage its execution with Alison Docherty, supervisor of the Hill of Tarvit group, helping with delivery, co-ordinating the rotas and supporting the many volunteers she brought to the project. Within the NTS it is recognised that resources are not limitless. Volunteer involvement in projects is a pragmatic approach to achieving more with less, so long as defined tasks are delegated to volunteers with appropriate skills. These tasks must be clearly demonstrated and explained and further support provided as required. The Falkland Tapestry project was a good example of collaboration and of having the right mix of professionals and volunteers.

It should also be acknowledged that at critical points in the project, invaluable support was given by NTS property staff at Falkland, not least the gardeners and garden volunteers, who helped build the scaffolding towers and turn the tapestries at different stages during the emergency treatment.

A third project objective was to put preventive conservation measures in place. These included applying UV film to the windows in the Tapestry Gallery, adding light- reducing linings to the existing curtains, making these curtains easier to use by waxing the metal curtain rods and providing case covers for the tapestry chairs. Under instruction, the Hill of Tarvit volunteers helped enormously with their sewing machines, making the case covers and lining the curtains. The environmental monitoring data collected at Falkland Palace over the last two years shows that during the closed season improvements have been made to the control of light in this area. However, more work is required to reduce light levels when the palace is open to the public. To achieve the latter, Roman blinds, based on a prototype developed by Younger, will be installed in the Tapestry Gallery.

Innovations

1 The design of the temporary Velcro® strip (Sofstrip©)

Whilst the six tapestries were viewed as a complete set, two tapestries needed very little attention because they had been previously conserved by Margaret Maran. The two largest tapestries needed the greatest amount of attention due to shattered silk weavings and four out of the six tapestries still had the unsafe stud hanging system.[4] Both the large tapestries had a considerable repair history: there were numerous linen patches of all shapes, sizes, grain directions and textures and the random nature of the previous repair stitching was also an issue.

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4 Tapestry sizes: numbered from the Chapel: 1 – 7700 x 3345mm drop; 2 - 5800 x 3435mm; 3 – 2930 x 3435mm; 4 – 2920 x 3435mm; 5 – 940 x 3435mm; 6 – 1045 x 3435mm

A key consideration, to simplify procedures and reduce handling, was to undertake the treatment whilst the tapestries hung in situ. The work was carried out in the Long Processional Gallery, which was 2.5m wide. The Catholic Chapel adjacent to the tapestry gallery was initially considered as a possible work area but was ruled out because it was used each Sunday by the congregation of the Parish of St Paul's, St Mary's and Chapel Royal, Falkland.

In order to meet these needs Younger devised a Velcro® strip or Sofstrip© that could be sewn onto the front of a tapestry whilst it continued to hang from existing studs then, after the tapestry was taken down the Sofstrip© allowed for hanging the tapestry in reverse. She was careful to incorporate an isolating layer during its application so that subsequent stitching would not interfere with its removal.

The Sofstrip© consisted of soft or looped Velcro® and webbing (Figure 4 & Figure 5A). To allow for stitching just below the existing press studs the upper part of the double band of Velcro® was not fixed. The isolating layer was a Melinex® strip inserted during the application of the Sofstrip© (Figure 5B). The 'safety-net' Velcro® was there to prevent the movement from surface cleaning and stitching causing the studs to fail and the tapestry to fall; in the end it was partially engaged onto the 'hook' Velcro® whilst working on one of the largest tapestries. A key element in the project's success was the meticulous planning of the treatment, which included vacuum suction, cleaning and 'emergency' sewing work, carried out in a sequence according to the orientation of the tapestry.

To stabilise the vulnerable silk, most noticeably that between earlier repair work, linen patches were applied to the back whilst the tapestry was hanging with its front to the wall. After the tapestry had been turned the weak silk was strengthened with overlaid bespoke dyed mono-filament net. The stitching method securing the net and linen together was kept simple: regularly spaced lines of a staggered, long running stitch were worked perpendicular to the warps.

The treatment plan required two switch-overs from front to reverse and back again – these manoeuvres were done with the help of sewing and garden volunteers, as well as palace staff. Approximately ten people were available for each move, working in pairs at different levels using two tower scaffolds and a step ladder. Efficient team work was an essential part of these manoeuvres.

The Sofstrip© system successfully facilitated both the turning and careful workings of the treatment plan *in situ* (Figures 5C, 5D and 6), however communication with the volunteers could have been improved. Younger carried out most of the preparation work: measuring, cutting, marking grain and positioning support patches; dyeing mono-filament netting; cutting, pinning and shaping net overlays. Rather than photographs to illustrate the sewing technique there were 'worked-up' areas that the

volunteers could follow. However a series of annotated drawings or photos would have been a much easier guide rather than having to search for the mocked-up areas behind scaffolding, particularly when a few of the volunteers could not attend on a weekly basis.

2 The design of a simple cleaning tool (Sofvac©)

After the tapestry project a number of condition surveys were completed on the palace textiles early the following year. During this work there was concern about the levels of dirt on some of the more vulnerable floor coverings; cleaning was being avoided for fear of causing damage. Experience gained from the Tapestry Project cleaning trials and further investigation of the science of cleaning aided the design of a tool that would simplify and improve cleaning in the palace.

There is a rather complex relationship between the four factors governing vacuum cleaning systems: lift, airflow, velocity and friction loss. In simple terms, vacuum suction is effected by means of a motor turning a fan, causing differential air pressure between the front and back of the blades – air pressure is lower in front of the fan than behind. The air pressure difference creates a partial vacuum creating a flow of air through the material to be cleaned, drawing particles out (of an object) through a filter into a bag in the appliance. The blades are shaped to impel the draught out via the exhaust vent. Air flow rate (litres per second) has a linear relationship with velocity (metres per second) and they are therefore equally reduced by friction; lift/suction (millibars or inches of water / mercury lift) and airflow conversely have an inverse relationship (Monkhouse 1978: 396-398).[5]

Vacuum cleaners manufactured for the consumer market have an efficient design based on a balance between power consumption, airflow and suction. Conservators, however, require the ability to fine tune the suction level to suit the job in hand: delicate textiles require decreased suction. This can be achieved by selecting a vacuum cleaner with less powerful suction, regulating suction power on a variable dial, adding more hose length, opening an aperture to increase airflow, adding net coverings or changing the nozzle shape. Technical specification for the machine should be consulted before use, because less airflow does not necessarily equate to less suction.

During cleaning of the Falkland tapestries a balance had to be reached between ‘cleaning’ and ‘over cleaning’ and to address the fact that the reverse was much dirtier than the front. Too much suction when cleaning from the front might have drawn and lodged dirt from the back to the

5 http://www.hydramaster.com/inside/article/article2.asp , accessed: March 2011.Emails with the manufacturers’ technical staff: Nilfisk, Preservation Equipment and Conservation By Design Ltd.

front of the tapestry. The results of cleaning trials, that were carried out to facilitate optimum performance and help illustrate procedures to the volunteers, were very informative.

Trials were carried out over an area of 1m², during which the suction was varied, and dirt caught on a muslin square placed over the top of the hose below the nozzle (Figure 7). Brushes were not used but two different nozzle shapes and coverings were trialed. Figure 8 illustrates dirt removal from the first vacuum clean on the front using MuseumVac® backpack; the machine had a variable airflow of between 18-40 litres per second. The suction dial was set at its lowest, a 120cm hose extension was applied and a dual nozzle with no net covering was used. Dirt removal was found to be too effective. There was particular concern about the quantity of longer fibrous material in the sample - finer dirt was lodged under the fibrous dirt. Figure 9 illustrates dirt removal from the first vacuum clean on the front using the small red MuseumVac®. The machine has a variable airflow from very low to 12 litres per second; the suction dial was set to a quarter of its range, and a broad nozzle with a smooth net covering was used. The dirt particle size was much smaller and less fibrous; this methodology (with further regulation of power when required) was adopted because the result was considered appropriate for these tapestries. In the end two complete cleans were carried out on the front and four on the back.

If the speed of the vacuum fan is constant then the amount of air passing through the vacuum cleaner, per unit of time, is also constant. For a more slender nozzle the individual air particles move more quickly (due to greater pressure differential between the front and back of the fan) which results in greater suction per unit area: narrower vacuum attachments can therefore pick up heavier dirt particles than wider attachments. In the end, it was not the widest nozzle that was selected but the one that facilitated the greatest volume of moving air particles through the nozzle. The stocky shape of the broad nozzle was preferred because it not only created a good working interface for suction cleaning but it also enhanced a reduction in suction and collected dirt more evenly across its aperture.

The cleaning tool developed, and now called Sofvac© combined the broad nozzle shape favoured during the tapestry cleaning project with a robust and detachable nylon net covering to reduce fabric losses.[6] The design works particularly well over the fringes and ends of carpets. It not only makes cleaning safer but also helps to reduce the risk of pest activity through improved housekeeping regimes. The prototype has been used at the palace by Mary McBain (Head House Keeper for 19 years) on both a Henry and a Nilfisk machine (GD910) but it would be suitable on any 30mm hose. McBain carries it around, in her pocket, during her cleaning round and attaches it to the hose as and when it's needed - she takes it

6 Sofvac© available from website www.youngerconservation.com , search icon *Sofcreations.*

home to wash regularly with no detrimental effect to the netting, giving consistently good results (Figure10).

Project and innovation: Conclusion

The tapestry project successfully realized its main conservation objective of substituting a defective hanging system with Velcro®. The innovative approach, using Sofstrip©, to carry out this work with the tapestries hanging in situ solved the problem caused by lack of space.

Volunteer participation in the project was very successful. This was mainly due to their objectives, work schedules and treatment having been well defined, allied to the willingness of the volunteers, their experience of working on historic objects and regular close supervision and guidance. Nevertheless the involvement of volunteers on a project of this scale did present some challenges. Supervision of up to six volunteers at one time can be tricky. Jobs were matched to ability and a head for heights. Working at height is not possible for all volunteers, so tasks had to be assigned depending on their ability and willingness to safely climb the tower scaffolds. In fact only three of the ten volunteers were willing to do so. Low level assigned tasks were carried out by the volunteers working from either floor level or from the low scaffolding platform, about 0.4 m above floor level.

Publicity gained both during and after the project was an unanticipated bonus. Several newspaper and magazine articles highlighting the work that was undertaken were published during the project. Following the completion of the project the NTS produced a leaflet and a photo banner explaining the work carried out, both of which are now on display in the Tapestry Gallery. It is clear that the role of conservation needs to be better recognized and that raising awareness through interpretation helps visitors to understand the complex nature of the objects and demonstrates how they are conserved. Further in-house publicity has resulted in increased fundraising for future phases of this project. However, there is a long way to go and the conservation and care of such large and complex objects is an on-going task. In the medium term the temporary support treatment will stabilize the tapestries but fuller conservation will eventually be needed and this will require additional funding.

This project combined a balance of skills, willingness, good judgement and experience (Figure 11).[7]

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7 In addition to Bon's and Younger's time the team included: NTS sewing and garden volunteers who contributed 96 hours to the project (this also included Alison Docherty's time marshalling, focusing and encouraging the volunteers); Falkland Palace staff who helped out with the project work when required. Younger's time off-site (doing preparatory work such as bespoke dyeing, colour matching and ordering materials) and on site totalled 9 weeks.

References

Bouwmeester W. 2012. *Falkland Palace Environmental Monitoring Report 2012.* Wilma Bouwmeester Collection Care.

Drainey N. 2010. *Priceless tapestry treasures hang on with help from vacuum and Velcro. The Scotsman,* 6 December 2010.

Horrocks H. 2009. *Falkland Palace and Garden Guidebook.* Edinburgh: The National Trust for Scotland.

Monkhouse F. J. 1978. *Principles of Physical Geography*. London: Hodder and Stoughton.

Pearson B. ed. 2006. *The Volunteer: The Newsletter for Volunteers with the National Trust for Scotland*. Edinburgh: The National Trust for Scotland, Winter 2006.

Puttfarken T., Hartley C., Grant R. and Robson E. 1995. *Falkland Palace and Royal Burgh Guidebook.* Edinburgh: The National Trust for Scotland.

Younger S. 2010. *Estimate for Conservation of a Large Verdure Tapestry at Falkland Palace.* Sophie Younger Textile Conservation.

The National Trust for Scotland Central Archive Files: 01/0048/04/03/FAP.

The National Trust for Scotland *Volunteer Management Handbook* 2011.

The National Trust for Scotland *Volunteer Policy* 2004.

Suppliers

Nilfisk

Nilfisk-Advance Ltd
Nilfisk House, 24 Hillside Road
Bury St Edmunds
Suffolk 1P32 7EA

Vacuum cleaner MuseumVac®
Product No. 561-1997 (shown in Figure 8)
Backpack cleaner MuseumVac®
Product No. 561-1997 (shown in Figure 9)

Preservation Equipment
Vinces Road
Diss
Norfolk IP22 4HQ

Conservac CV555 MUE (Shown in Figure 7 though not used in trials)
Conservation By Design Ltd
Timecare Works
Sinerway
Bedford MK42 7AW

Velcro® and webbings
William & AM Robb Ltd
247 Govan Road
Glasgow G51 1HJ

Figure 1
Exterior of Falkland Palace.
1995. © National Trust for Scotland/ Douglas MacGregor.

Figure 2
The Tapestry Gallery in Falkland Palace.
1995. © National Trust for Scotland/ Douglas MacGregor.

Figure 3
Detail of huntsman from tapestry in the Tapestry Gallery, Falkland Palace.
1995 © National Trust for Scotland/ Douglas MacGregor

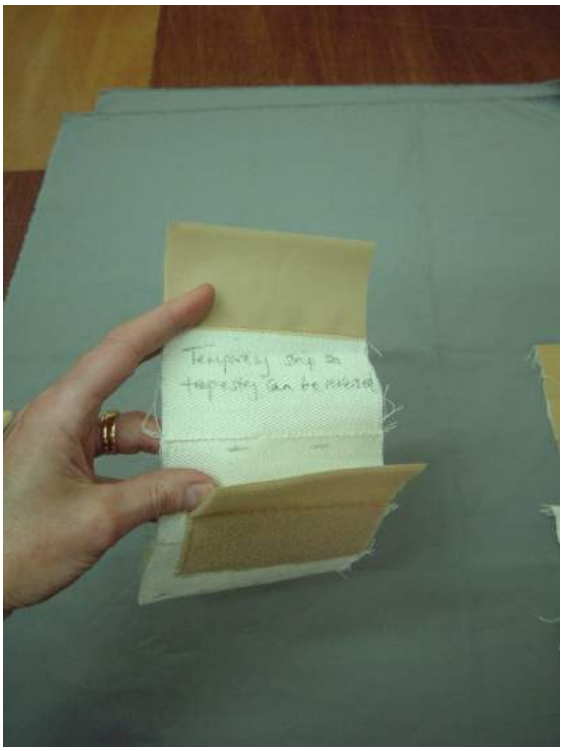

Figure 4
Temporary Velcro® strip

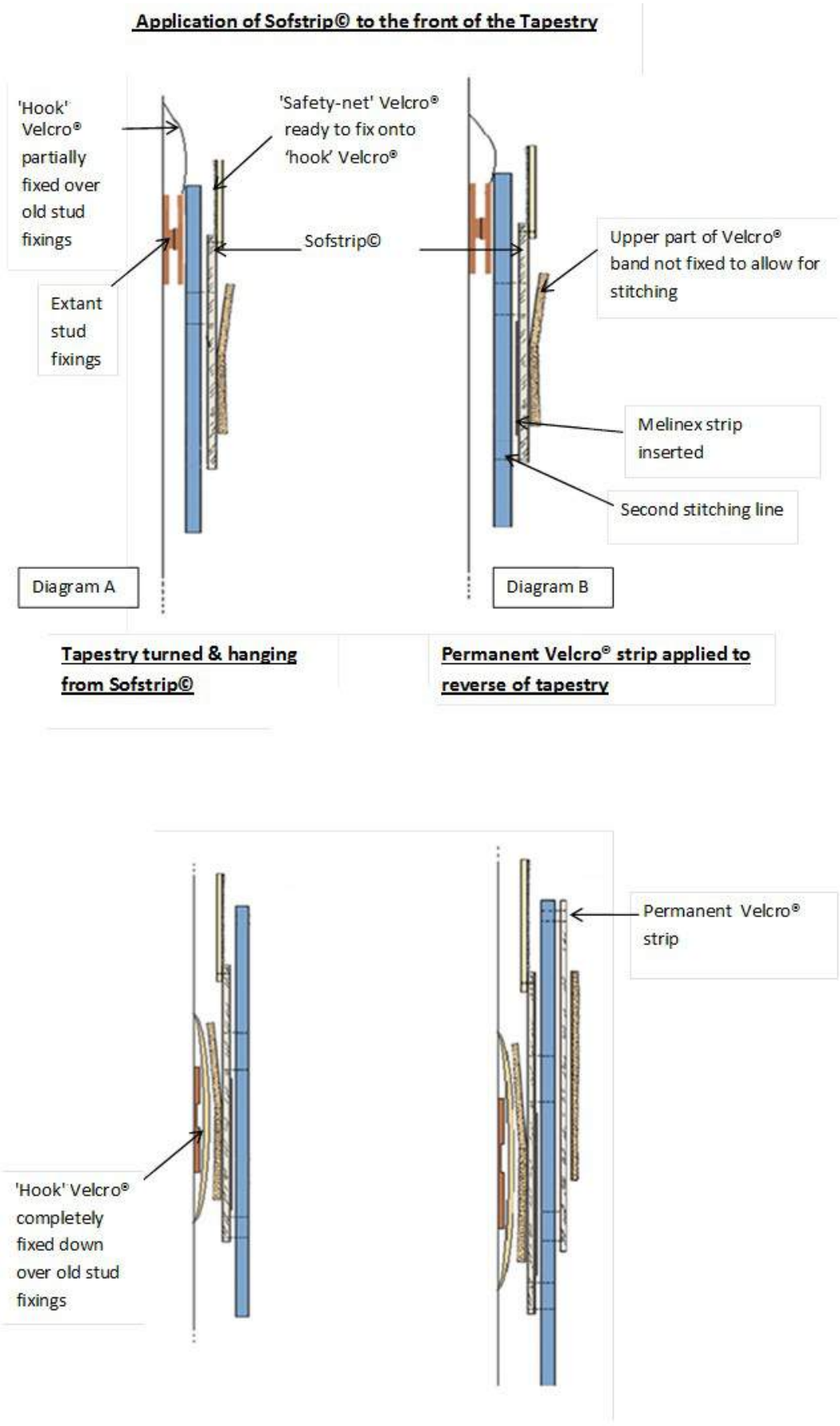

Figure 5
Application of Sofstrip© to the front of the tapestry.

Figure 6
Sofstrip© in use to hang the tapestry. Permanent Velcro® strip in place.

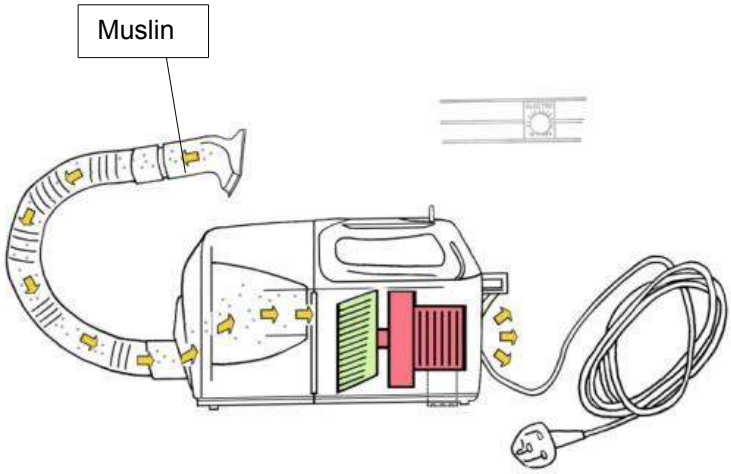

Figure 7
Muslin positioned over hose head and under nozzle.

Figure 8
Dirt sample from cleaning trial & image of MuseumVac® backpack used.

Figure 9
Dirt sample from cleaning trial & image of small red MuseumVac® used.

Figure 10
Sofvac© tool in use

Figure 11
The team which included: sewing & garden volunteers, Palace staff, Sophie Younger,
Julie Bon and Alison Docherty.

Developing skills through partnership: the Doddington Hall tapestry project

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Elaine Owers
Assistant Textile Conservator, National Trust Textile Conservation Studio

Introduction

In 2010 a joint project was set up involving four partners: Doddington Hall in Lincolnshire, Lincoln University, Bishop Grosseteste College and the National Trust Textile Conservation Studio. The project was funded by the Doddington Hall Conservation Charitable Trust, via a successful Heritage Lottery Fund (HLF) grant application made by the owner, Claire Birch. Six MA Conservation students from Lincoln University and one student from Bishop Grosseteste College Heritage Studies programme worked as volunteers on the project at Doddington Hall. Ksynia Marko acted as consultant and supervisor, and Elaine Owers was able to put into practice experience gained during her tapestry internship at the studio. Together they were able to give guidance to both the owner of the tapestries and the students. This paper describes the project.

Background to the project

Doddington Hall, built for Thomas Tailor, Registrar to the Bishop of Lincoln, was completed in 1600 and is a grade 1 listed building (Doddington Hall and Gardens 2007). The estate has passed down to the present family through inheritance and gift. In the 1950s the house, as with so many of our country houses at that time, was in a very poor state of repair. Substantial government grants allowed for a new roof and other crucial structural repairs on condition that the house was opened to the public; this began in 1954. Sympathetic restoration of the house and estate has been ongoing since the early 1970s and in 2006 a small private charity was founded. Its remit is ‘to preserve and enhance the natural and historical environment of Doddington Hall, its contents, surrounding gardens and estate for the greater enjoyment and education of the thousands of visitors to the Hall each year’. The charity’s first project was to raise funds for the cleaning and conservation of two sets of seventeenth century Flemish tapestry and to maximise the associated opportunities for learning.

Phase 1 of the project focused on a rare set of eight pieces of Flemish tapestry dating back to the 1620s which depict scenes of rural life. The set had been repaired, cut up to fit and nailed to the walls of the Holly Bedroom in 1762. Their survival is of great interest as, by that date, tapestry lined rooms were completely out of fashion. It would seem that

this was a deliberate act of antiquarianism by the then owner, John Delaval, undoubtedly designed to reinforce a message of a long family lineage. In fact John Delaval installed two such rooms, the Holly Bedroom which is open to the public, and the Yellow Bedroom which is on the private side of the house. Neither set of tapestry had been touched since their installation and centuries of dirt from wood and coal fires and exposure to light had left them extremely dirty, damaged and faded.

In March 2007 Marko was asked to review conservation estimates and to write specifications for treatment for tender purposes. At that time there were no funds available and discussions continued over the next two years to ascertain the best course of action and what the options might be, ranging from tendering the work, to directly employing a conservator, to using volunteers. An application for funds was made to the Heritage Lottery Fund (HLF) in late 2009. Simply to raise funds for a freelance conservator to do the work was not a viable option. The success of the application depended on the project's potential for learning and wider public involvement and access.

Having secured funds the owner was keen to get on with the work planned to start in spring 2010, but agreement had to be sought from participating colleges, students recruited, everyone involved properly briefed, equipment organised, dates and working hours agreed and the work programme planned. Adequate lead in time for such projects ensures that everyone knows what to expect, and that everything is in place right at the start (Marko and Golbourn 2010). In this case preparation took about 6 months and work started in October 2010.

Phase 1 - De-installation

Phase 1 of the project was to allow the removal of the tapestries, their documentation and wet cleaning, with the production of appropriate interpretation material to inspire visitors to engage with the work and to learn more about the tapestries' historic significance, how they were made and how they would be repaired.

The project proposal was put to tutors and students at Lincoln University and Bishop Grosseteste College. It was recognised from the outset that, apart from the need for getting the job done, the students had also to benefit from the experience. Those interested signed up, recognising that it would give them valuable experience of working on site and evidence for university assignments. The group volunteered to undertake the work to fit in around their other commitments. This allowed only two days per week (Thursdays and Fridays) over four to five weeks, including a two day contingency ending with a transport run to Belgium, for the tapestries to be wet cleaned, organised for 15 November.

The initial meeting with the students at Doddington allowed for an introduction to the house and the context in which the work would be carried out. The better informed the students were, the more involved they would be with the project. They had to form themselves into a

cohesive team, with a clear leadership and point of communication. With guidance, and using formats familiar to them, they undertook risk assessments, time management planning, detailed documentation including photography and drawings to allow re-installation in the future and wrote up methodology statements for all processes (Figure1). The work was completely new to them and they approached it with rigour and enthusiasm.

House staff assisted by removing skirting boards and electrical points, revealing dirt, releasing falling debris from the walls and leaving one useable socket for a light source. These areas were vacuumed and debris removed. The tapestries were secured to the wall by numerous tacks, both around the perimeter and through the body of the weaving. The latter had to be located and removed first and some of these were difficult to see or were deeply embedded. For each tapestry in turn tacks were then removed from the vertical edges with every other tack removed from the top edge. Long open slits were sewn to prevent complete failure during handling and weak areas were supported with a net overlay, especially over the door and areas on the north wall. Seams between tapestries were opened so that each tapestry could be removed individually.

A roller was first prepared by attaching sticky back hook Velcro® along its length. Soft loop Velcro® was then pinned to the edge of the tapestry on the reverse by which means it was attached to the roller. The roller rested on a supportive wooden block on a sheet at floor level which enabled it to be manoeuvred slowly across the floor, rolling the tapestry at the same time. Finally it was secured with Velcro® ties and lowered to floor level. Each member of the team had a specific job to do (Figure 2).

In order to complete the work effectively and in the time available, tests were made to establish the appropriate vacuuming procedure. An area 580 mm x 330 mm required four minutes of slow methodical vacuuming at 100mbar suction, using a soft brush attachment to remove the worst of the sooty deposits without removing too much fibre. This equated to 42 minutes per square metre for dealing with both the front and back, requiring 46.5 man hours overall for the whole set (Figure 3). Before final rolling and packing weak areas were further supported and unravelling raw edges over-sewn (Figure 4). All the tapestries were completed on time and ready for the transport run to Belgium.

One student from each college accompanied Marko to Belgium to observe and record the wet cleaning process and, again, to gather information for interpretation. A trial wash had been undertaken beforehand in the studio on one of the tapestry repair patches so the team was reasonably confident of success, given some slight modifications to the cleaning process. Soft brushes had to be used to help lift away the dirt and time was needed between detergent applications to allow the fibres to release ingrained soiling. The first water sample collected was filtered to reveal a slurry-like deposit like wet charcoal! The preparation for each tapestry started at 8.30am each morning with the first wetting out at 9.30am, with the tapestry dry by 7.30pm.

Phase 2 - Mounting tapestries for display

Having emptied the Holly Bedroom of its contents the resulting blank canvas provided an opportunity to fill the room with interpretive material, raising public awareness of the project. Three students returned to Doddington in May 2011 to assist Owers in mounting two pieces of tapestry for display. One piece had returned from wet cleaning and a smaller, still dirty, piece was removed from the wall in the Yellow Bedroom to act as a comparison. One of the students took responsibility for removing the dirty piece of tapestry from the wall in the Yellow Bedroom and mounting this onto a padded board which worked well as an individual project.

The cleaned piece of tapestry measured 3.5m x 1.5m requiring a giant padded board in the form of a wooden stretcher frame. Sheets of Correx® were stapled to a frame made by the estate carpenter. For strength the joins in the Correx® were matched up with the supporting bars of the frame. The students assisted with all aspects of the mounting, from stretching the domette and linen scrim used as the finishing fabric (Figure 5), to undertaking holding repairs and fixing to the board using a supporting grid of stitches. A Melinex® template set the pattern for regular grid lines of stitching (Figure6). Work took place in the Long Gallery which allowed for public engagement when the house was open (Figure 7). Once mounted the two pieces of tapestry demonstrated just how successful the wet cleaning had been (Figure 8).

As a former Lincoln student, and someone who has benefited from a two year HLF/Icon internship in tapestry conservation, Owers was able to test her own ability in leading this phase of the project and, once again, the commitment of the students and their ability to learn new skills and put them into practice was essential to completing the task.

Interpretation

A student from Bishop Grosseteste College had the task of working up interpretation and engagement material ready for the 2011 season and worked with the media company. Five information panels provide details of the history of the Holly Bedroom, information about the project, how the tapestries were removed and cleaned and what happens next. A touch screen provides more information with short videos showing the students and conservators at work.

The nailing of the tapestries to the walls is documented in the family’s archive, with a letter written to Sir John Hussey Delaval by his steward, John Portes, on 25 July 1762. This letter has been painted onto a cream sun blind, replicating the original handwriting. It reads:

> ‘Honourable and most worthy sir I am hanging the tapestry in the bed chambers according of Lady Hussey Delaval’s orders. I have had a taylor all of this week mending the tapestry before we hang it up.’[1]

A sample of the wash water brought back from De Wit, together with bags of dirt and tacks are displayed on a table (Figure 9). Amongst them are the remains of a bat found behind one of the tapestries during de-installation – a favourite with young visitors! Also present in the room is a comments wall inviting visitors to have their say on plans for the tapestries and a children’s activity table. There is an activity leaflet for children, with a quiz and a tapestry picture to colour.

As part of a continuing development and refreshment of the interpretation, a small piece of partially conserved tapestry has been added, prepared by Owers at the National Trust studio. It is mounted on a frame allowing both the front and reverse to be visible as it is rotated. A small sample of warp yarns was inserted and brick couching was worked on one edge of the linen to make it easier to identify the stitching in the piece itself. One of the holes was also left unfinished with a few warps laid to better tell the story of the conservation stitching, showing how a tapestry is given both structural and aesthetic support (Figure 10).

Interpretive material was also written to accompany the piece. Presenting tapestry as part of the interpretation has at times involved thinking outside the box, particularly as tapestry conservators are unused to presenting their work until it is completed and ready to be re-hung. We have found that this makes our work much more accessible to the public. Public feedback has been very positive with many visitors staying in this room the longest during their visit to the property.

‘Hands on Tapestries’ launch

In July 2011 the ‘Hands on Tapestries’ project was launched with an evening reception. This was a great opportunity to meet everyone involved in the project. Guests included the trustees of the conservation charity, a representative from HLF, the company who produced the digital media, the students, staff and volunteers from Doddington Hall. Members of the press were invited, providing more valuable publicity.

The following is an extract from a speech that Leah Warriner-Wood, one of the Lincoln University students, made at the launch:

> ‘During October and November last year a group of six of us got absolutely filthy, worked until our bones ached and – I think everyone will agree – had an absolutely wonderful time! We lifted nearly 2000 tacks, broke 5 tack removers, found one mummified bat and vacuumed nearly 70 square metres of tapestry……and thanks to Claire’s somewhat idiosyncratic predecessors we were able to experience conservation as we would never be able to experience it

[1] Letter in family archive dated July 1762.

in the University labs, as well as work alongside two of the country's top textile conservators'.

The future

We were interested to know how the students involved in the project used the experience as evidence to get jobs and further training. Two of the students have undertaken internships, one with the National Trust at Powis Castle as a Conservation Assistant, another in preventive conservation with the National Trust for Scotland. Another took a short term contract as a project curator at Kings Lynn Museum. All have been doing voluntary work to further their career prospects. They valued the experience as a chance to work on-site in a heritage environment with conservation professionals, to work as a team and contribute to a local project.

The next stage for the project is a second HLF bid to secure £295,000 to remove the second set of tapestries in the Yellow Bedroom and conserve and reinstate both sets. It is intended to set up a conservation workshop at Doddington in the Holly Bedroom, enabling staff, volunteers and visitors to learn more about the tapestries and their conservation. Internships, placements and work experience will provide further opportunities for conservation students.

Conclusion

The success of the project so far has been the result of a number of factors, not least the energy and enthusiasm of Claire Birch, owner of Doddington Hall, which drove the project forward inspiring people to become involved, and the willingness of the students to commit to the project. Timely and careful organisation and close communication between all parties was essential. Its success was also based on the identification of a distinct task to be carried out in a defined timescale, with clear objectives. It gave the students invaluable experience of textile conservation, of on-site work in difficult conditions and the benefits of team working. It allowed them to turn the theoretical into the practical, working outside the lab in a real life situation.

It has been a project that has also tested the consultancy and supervisory skills of the more experienced conservators involved and their ability to communicate, 'What is tapestry conservation?' to a wider audience.

Acknowledgements

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References

Marko, K and Golbourn, C. 2010. Project planning and management. In F. Lennard and P. Ewer, eds. *Textile Conservation: Advances in Practice.* Oxford: Elsevier, pp43-52.

No author. 2007. *Doddington Hall & Gardens*. Lincoln: In Sync Design.

Suppliers

Tapestry cleaning	De Wit Royal Manufacturers of Tapestries Refuge Tongerlo Abbey Schoutetstraat 7 2800 Mechelen Belgium Tel: 00 32 15 20 29 05 info@dewit.be www.dewit.be
Corrugated plastic sheeting (Correx®) & Melinex®)	Preservation Equipment Vinces Road Diss Norfolk IP22 4HQ Tel: 01379 647400 www.preservationequipment.com
Velcro®	Mac Culloch and Wallis 25-26 Dering Street London W1S 1AT Tel: 020 7629 0311 www.macculloch-wallis.co.uk

Figure 1
Initial photography and documentation.
© NT Textile Conservation Studio

Figure 2
Removing the tapestries from display.
© NT Textile Conservation Studio

Figure 3
Surface cleaning.
© NT Textile Conservation Studio

Figure 4
Securing weak areas prior to rolling and packing.
© NT Textile Conservation Studio

Figure 5
Preparing the stretcher frame.
© NT Textile Conservation Studio

Figure 6
Fixing the tapestry to the covered frame using a supporting grid of stitches.
© NT Textile Conservation Studio

Figure 7
Engaging with visitors during an open afternoon.
© NT Textile Conservation Studio

Figure 8
Comparing a dirty and cleaned piece of tapestry.

© NT Textile Conservation Studio

Figure 9
Some of the interpretive materials available to visitors, including a sample of wash water and bags of dirt and tacks.
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Figure 10
A handling piece of partly conserved tapestry.
© NT Textile Conservation Studio

The public programme and conservation aspects of the Burrell Tapestry Project

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The Burrell Tapestry Project

The Burrell Tapestry Project is one of the first major collections-based projects led by Glasgow Museums' Research Section. The aim of the project is to produce a catalogue of the tapestries in the Burrell Collection. Sir William Burrell gave his collection to the city of Glasgow in 1944. The collection consists of 9000 objects of which 200 are tapestries of international importance. In the 1983 catalogue of the Burrell Collection Richard Marks, Keeper, said 'Sir William, with justification regarded his tapestries as the most valuable part of his Collection'. They include examples from all the major weaving centres ranging in date from the early fourteenth century to the eighteenth century, though most date from the late fifteenth and early sixteenth centuries. Sir William also gave money to Provands Lordship, Glasgow's oldest existing house and a former Bishop's residence. The money was used to purchase six tapestries that are included in the project.

The conservation aim for the project is the assessment of each tapestry. Work has also included preparing them for photography and facilitating access. The photography was an essential part of the project with photographs being taken of the fronts and backs in normal and ultra violet (UV) light and a raking shot of the front. After photography conservation reports were written on each tapestry. At the start of the process the plan had been to write straightforward condition assessments but these quickly developed into more extensive reports recording what was seen and how it was interpreted by a textile conservator. The size of many of the tapestries meant that the only place large enough to carry out the photography and assessments was the Burrell Collection's temporary exhibition gallery. A long hoist was installed on the back wall of the gallery and the tapestries were hung on it with hook and loop tape. The work started with the tapestries from store but later progressed to those on display.

The project required great commitment by Glasgow Museums in terms of the scale of resources and in managing the disruption of displays in

the Burrell. Key to the delivery was finding ways to maximise available resources and to turn disruptions into opportunities. With the loss of the temporary gallery for exhibitions and with tapestries coming off display it was decided to undertake the photography and conservation assessments in public view (Figure 1). Once a tapestry was put on to the hoist for photography it was left there for a time so that it could be seen by more people. Information was provided on the tapestries as they were photographed and assessed. The final stages when tapestries were removed from display were the most difficult for the museum and required considerable work to manage visitors' expectations. A major part of this process was the public engagement programme, funded by Museums and Galleries Scotland and set up and run by the Burrell's Learning and Access team.

The Learning and Access brief for the Burrell tapestry project was to create a comprehensive learning programme to complement the conservation work. The aim was to engage and inform the target audiences of non-expert adults and families as well as to attract new visitors to the museum. One of the largest challenges the Learning Team faced was communicating exactly what a tapestry is and how it is made. It was found that many visitors struggled to understand the woven concept and older visitors would draw comparisons to 'tapestry' kits that are in fact embroidery. Visual displays using weaving looms proved to be the most effective way to demonstrate the techniques behind the tapestries and a set of interpretation boards was created with a loom as the integral interactive element. These were positioned in the galleries adjacent to the temporary conservation studio and were available continuously for public use.
As well as permanent interactive displays the Learning Team felt the most positive way to engage visitors would be through facilitated workshops and events. The programme that developed was as wide ranging as possible and included many different approaches.

The public programme

1 Dance Ecosse

To bring the tapestries to life and provide a context for them, a dance group, Danse Ecosse, performed medieval dances within the main tapestry gallery (Figure 2). Up to six ladies dressed in replica period costume performed authentic dances dating from the fifteenth to the seventeenth centuries, the period of the Burrell Collection tapestries. Audience participation was encouraged and adults and children joined the fun, learning a variety of dance steps that seemed very reserved in comparison to today's dance styles. On each of the four performance days Danse Ecosse was present in the galleries for up to four hours and

attracted audiences of up to three hundred visitors. Small children were particularly attracted to the costumes due to the fairytale princess nature of the garments. Demonstrations have always been popular in the museum and the visual display created was particularly pleasing to visitors.

2 Glasgow School of Art

In an attempt to present tapestries to a new audience and to encourage visitors to view them in a new light, students from the Glasgow School of Art were invited to submit proposals for 'Tapestry: A New Interpretation', an initiative designed to create artistic responses to the tapestries and the project. Five students from the Master of Fine Arts course participated in the initiative and all spent time in the galleries viewing the tapestries and the conservation work before submitting their ideas for approval.
Once approved the students then set about delivering their work.

Rosemary Scalon's proposal was initially based around photography and large-scale wallpaper of images 'found' on the internet. An idea to cover a large wall space with images of flower and plants was put forward, however the difficulty in producing this and the cost implications meant that an alternative idea was eventually used. This took the form of a gallery display of smaller pieces of Rosemary's work inspired by the tapestries' composition and their subject matter, as in the tapestry *Peasants Hunting Rabbits with Ferrets.* Rosemary also delivered an adult art class related to the Curator's Favourite talk on the Divine Wisdom tapestry. The class was titled Creative Collages and 12 people took part. It began with a talk on the background to her work and took participants through the process of using images from the internet to create a watercolour painting before encouraging them to create their own pieces.

Shelton Walker provided two separate proposals, the first being a large-scale sculptural installation based upon the fibres woven into a tapestry. The second, preferred proposal, was installed on the windows of the North Gallery: *Three days five hundred years hence* was a 'performance drawing' based on the amount of time it took the weavers to create a tapestry, Shelton wanted to focus on the time spent creating tapestry compared to the time taken by visitors to view tapestry. She timed visitors and translated the times into binary code, related to weaving by the technological advancements of the loom which led to the development of computers but also left many weavers without employment. The resulting code was then transferred to the windows in washable marker pen (Figure 3). In addition to creating the installation Shelton took visitors on a guided walk of the tapestries

while explaining her art installation on the windows. Later she ran a session *Drawing as Leading,* a ‘drawing’ walk outside in the park using lengths of wool in bright, contrasting colours. The workshop explored the ideas of drawing as a form of communication with participants winding yarn around interesting features in the environment to create a narrative that was then relayed to the rest of the group.

Suzie Smith’s work explored ideas of art and interaction and the relationship between fine art and craft. A large percentage of her work is based upon interacting with the public in new ways. Taking her inspiration from the largest of the tapestries, Suzie proposed a comic brochure that invited the public to interact with the tapestry and fill out speech and thought bubbles to interpret it for themselves. Suzie also led the Burrell for Families workshop *Comic Art* where families worked together to create their own comic strips inspired by the tapestries on display.

Oliver Braid’s interpretation was a series of soft sculptures displayed in the galleries. The installation was described by the artist:

> ‘Similarly to many of the tapestries, in my work there is often an implied narrative – usually a very convoluted one. In this narrative there is usually a protagonist who is experiencing a joyful situation. To them, this joy comes from a pureness which they feel is essential to their being. It is this enjoyment which, from the perspective of others, becomes grating or annoying. The others see this joy as frivolous and its presence becomes a source of antagonism.’ (Oliver Braid 2009.)

Peter Schoeffer’s work was a translation of a visual narrative from medieval times into the present context. By transferring this image onto a forgotten space in the museum, an attempt was made to bridge the gap between past and future, in this case the *Peasants Hunting Rabbits with Ferrets* tapestry translated into painted form on an unusual angle on the underside of a staircase within the public galleries (Figure 4). Peter and Oliver both ran demonstration workshops for the general public which were well attended and engaging.

3 Tapestry study days

To give visitors the opportunity to further investigate the intricacies of tapestry weaving and the history behind it, two tapestry study days were created in conjunction with the curatorial and conservation departments. Each day was advertised as a stand-alone session but together they gave participants a comprehensive view of tapestry weaving.

Study Day 1 was designed to ‘investigate the ancient tradition of tapestry weaving and how it has evolved through time.’ The 26 participants were given an introduction to the Burrell tapestries and the tapestry project by Patricia Collins, Curator of Medieval and Renaissance Art. Jonathan Cleaver, a contemporary weaver from the Dovecot Studios in Edinburgh provided an overview of weaving techniques and the history behind the craft. The participants were then given a short tour of the galleries and the opportunity to explore the temporary conservation and photography studio created for the project.
Helen Hughes and Sarah Foskett, the textile conservators working on the tapestries, explained how the photography was conducted and what they were looking for when working with each tapestry. Participants were able to see both the front and back of the pieces and allowed to examine intricate details at close quarters, something that visitors do not normally have access to (Figure 5). The afternoon consisted of a practical session with contemporary weaving artist Jo MacDonald. Jo introduced her modern take on weaving – the art of ‘tufting’ – and participants created a small piece using recycled materials.

The second of the two tapestry study days delved deeper into the crafts behind the tapestries. Eighteen participants investigated the fibres used in both historical and contemporary tapestry weaving and learned the processes of turning natural products into functional yarn. Wool, flax, and silk were discussed along with ‘new’ fibres such as alpaca, soyabean and milk protein. The workshop then examined natural dyes and how plant dyes can be manipulated to produce a wide range of colours. The afternoon practical session was spent learning the art of spinning and how to set up a loom for weaving. The spun wool was then used to create a small practice piece.

4 Tapestry demonstrations and classes

Throughout the public programme a number of tapestry demonstrations were held in the galleries. Delivered by Jonathan Cleaver of the Dovecot Studios, the sessions provided an opportunity for visitors to experience the craft of tapestry weaving first hand. As well as demonstrating, Jonathan also allowed visitors to take part by weaving on the loom and on small pieces of card. The sessions were well received by all ages and helped to further engage visitors with the tapestries and the project.

For those wanting to build on their weaving skills, a number of weaving classes were held for both beginner and intermediate weavers. For the

beginner workshops Learning and Access staff were able to purchase small hand looms that gave a sense of realism to tapestry weaving that cardboard looms could not (Figure 6). Intermediate weavers were encouraged to bring along pieces currently being worked and Jonathan provided a ‘clinic’ to help and advise on problem areas.

5 Family & holiday programme

The tapestry project provided a fantastic opportunity to integrate tapestry weaving with the regular Burrell family programme. Burrell for Families is series of workshops that run twice a month and focus on adults and children learning together. Aimed at families with children aged five to twelve the sessions use objects in the museum to develop knowledge and skills in a fun environment. Sessions during the tapestry project included weaving with unusual materials, creating giant tapestry images using fabric and designing individual tapestries. In addition, many of the school holidays programmes during the project contained weaving or tapestry-inspired workshops. These sessions helped to bring the project and the craft to a younger audience in an accessible and engaging way.

The Burrell tapestry project aimed to engage as wide an audience as possible and to ensure the youngest audience, pre-5 children, were involved. Learning & Access Curator Lyndsey McLean worked with professional storyteller Jean Edmiston to create Mini Mondays. Taking the form of eight sessions held on a Monday afternoon, Mini Mondays consisted of storytelling, music and movement inspired by the tapestries and the stories they depict. All those attending the sessions were encouraged to participate in the activities and the workshops proved to be very popular with every one fully booked.

To provide a varied and interesting programme for visitors it was decided that a number of films, loosely linked to the tapestries, would be screened during the project.
Films such as *Elizabeth*, *Girl with a Pearl Earring* and *The Other Boleyn Girl* were shown in the Burrell Lecture Theatre. Although the original screenings enjoyed only limited success, the film programme has grown into a successful monthly event, attracting audiences of up to 120 people. This has been one of the lasting legacies of the tapestry project public programme and one that is being continually built upon with the introduction of holiday and special occasion screenings.

To complement the informal public programme, a formal schools workshop was developed for primary and secondary levels. The workshop uses tapestry and textile weaving to meet various learning outcomes as part of the Curriculum for Excellence. Pupils view and

learn the basics of tapestry weaving and then try weaving small pieces on handlooms. The session proved very popular and the workshop has become a lasting legacy of the tapestry project with increasing numbers of school bookings each year.

Conclusion

There have been a number of benefits and legacies for the textile conservators from the public programme, such as the chance to talk directly with members of the public, with tapestry weavers and being able to work with the Learning and Access team as well as other members of staff and volunteers. The big surprise from talking with the public and museums staff was just how difficult it was for many people to conceive of tapestries being woven. This was highlighted by the reactions to Shelton Walker's work where few people recognised the connection between weaving, binary code and the development of computers. While this may have implications for conservators in presenting a case for treatment or display requirements it did show that there can be a great deal of appreciation and support for the care of the tapestries even without an innate understanding of their nature. The chance to look at some of the tapestries with the weavers, Jonathan Cleaver of the Dovecot Studios and Louise Martin, Head Weaver from the West Dean Tapestry Studio team at Stirling Castle, showed that there was so much more to discover about their construction and gave an appreciation of the skills of the weavers, the importance of the techniques used, their intended effect and the long-term effects on the condition of the tapestries. One outcome from the public programme was discovering that people want to engage with the tapestries and particularly welcome a chance to do so when there is an element of personal interaction.

Figure 1
The Temporary Exhibition Gallery becomes a photography studio.
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Figure 2
Danse Ecosse encouraging public participation in medieval dancing.
© CSG CIC Glasgow Museums Collection

Figure 3
Shelton Walker creates performance art using binary code.
© CSG CIC Glasgow Museums Collection

Figure 4

Peter Schoeffer creates a new response to the Burrell tapestries.

Figure 5
Examining the ‘past’ during *Tapestry Study Day 1: Past, Present and Future*.

Figure 6
Jonathan Cleaver of Dovecot Studios delivers a beginners course in tapestry weaving.

Colouring the past for the future: retouching of old restorations in a tapestry

Mieke Albers
Senior Conservator,
Rijksmuseum, Amsterdam, The Netherlands

Introduction

After a major rebuilding and renovation project the ‘New Rijksmuseum’ in Amsterdam re-opened in April 2013. From this date on a selection of tapestries in the collection will be exhibited bi-annually. The textile conservation department, with its experts Suzan Meijer, Carola Holz and Mieke Albers, has been actively engaged in the restoration of a number of tapestries which were the first to be exhibited.

Amongst these are four tapestries from a series of landscapes with scenes from Ovid’s Metamorphoses. They were woven in the Manufacture des Gobelins in Paris round 1680 and inspired by paintings by Charles de la Fosse. In the past various parts of one of the four tapestries, *Acis & Galatea Listening to Polyphemus’ Song,* have undergone considerable restoration work (Figure 1). This restoration work was done mainly in the sky and rock formations where parts were rewoven. Unfortunately non-colourfast thread was used, resulting in bad fading. These old and very obvious repairs had a disconcerting effect on the composition and showed up very much next to the other tapestries from this series on display which had suffered far less from this type of damage.

The importance of exchange of knowledge with other disciplines

The initial plan was to give the afore-mentioned tapestry a standard treatment and accept the old restoration for what it was because, technically speaking, it had been done well. It was felt that removing the repairs would cause too much damage and would moreover be unethical. However while working on the tapestry doubts arose over the chosen method of treatment. On completion of the work the tapestry was hung in the textile workshop and doubts increased because the faded old repairs remained too noticeable and disconcerting. Possible further treatment of the affected parts was discussed at length within the textile conservation department and various options were considered:

A. The faded parts could be camouflaged with nylon net in the right colour.
B. Light projection as done in 2010 on the tapestry *The Oath and Departure of Eliezer* (Perkins *et al.* 2011) might be possible. [1]
C. The possibility of 'retouching' the faded parts was contemplated but because in textile conservation 'retouching' is 'not done' this was not really considered an option.

1 Henry VIII's tapestries revealed, Hampton Court Palace, April 2009- January 2010 http://www.hrp.org.uk/Resources/HenryVIIIsTapestriesRevealed

Two factors worth mentioning played a role in the deliberations that continued within the department. Both broadened our minds as well as encouraging movement in the direction of the third option. The first factor was a coincidental one. At the time two painting conservators, normally based in the Frans Hals museum in Haarlem, were temporarily housed in the textile department of the Rijksmuseum. We developed an interest in each other's expertise and work, and were able to exchange thoughts and ideas relating to our two disciplines. It was enlightening to witness each other's work processes on a day to day basis. It soon became obvious that each conservation discipline has its own strategy and that each restorer is inclined to follow his own particular thought and work patterns. The presence of the painting restorers took us out of our comfort zone. We realised that textile conservators generally accept faded restorations for what they are. In painting conservation, however, the removing and/or retouching of old restorations is hardly a point of discussion. Within this discipline many of the research methods will determine how the painter originally depicted the painting in order to conserve it thus. It is fascinating to see that retouching lacunae and distressed areas will make a painting easier on the eye and above all do it justice. This different approach to conservation gave rise to the idea of retouching the old restorations on the tapestry. The painting conservators helped the textile conservators to view the tapestry in a different light and to regard it, for once and by way of an experiment, as a painting.

The second factor is a more structural one. All of the Rijksmuseum's conservators, staff and students of the bachelor/master conservation course[2] and De Rijksdienst voor het Cultureel Erfgoed[3] have now been housed together in a new building. Thus a great deal of expertise has been brought together. It is of great benefit that fast and efficient exchange of knowledge between the disciplines is now possible.

Retouching of faded old restorations

2 http://www.uva.nl/en/disciplines/conservation-and-restoration
3 http://www.cultureelerfgoed.nl/en

Experience has taught us the importance of interchange with members of different disciplines in case of doubts and/or differing viewpoints about a project (Figure 2). Meetings to discuss the best way to approach conservation methods have become standard and so it was decided to join ‘eyes and minds’ as to what to do about the faded parts of the tapestry. Not quite unanimously the retouching method was favoured. The deciding factors were:

- Was there any reason not to use this technique in textile conservation considering that it is used in other conservation disciplines?
- As relevant parts of the tapestry are not original one could compare retouching in a way with a supporting camouflaging material, a technique commonly used in textile conservation.
- After completion the total effect would be more harmonious.

A decision was made that only the most affected parts would be treated in this way and these were marked on the tapestry. The retouching was subject to a number of conditions:

- The dye/paint had to be water-based.
- The dye/paint had to be colourfast.
- The treatment had to be reversible.
- Samples of all colour shades had to be repeatable. Experimenting on old tapestry was not an option since the fibres would absorb the dye or paint immediately.
- The dye or paint should not ‘bleed’ on to original parts of the tapestry.

Which dye or paint to use became the next question. Camouflaging techniques are frequently used so ‘Deka silk’ textile dye that is used in the Netherlands was the first to consider.[4] It is water- and acrylic based and has a good colourfastness. However for the following reasons this dye turned out to be unsuitable:

- It dries irregularly and leaves a kind of film on the fibre.
- It is very difficult to make exact copies of the colours.
- The dye bleeds into the surrounding areas. This is not a problem on a supporting material but it is when retouching is applied.
- For fixation, ironing is needed.

Testing

4 Deka Silk DEKA-Textilfarben GmbH, Kapellenstr. 18, 82008 Unterhaching Germany.

After consultation with the Rijksmuseum's painting conservation department we experimented with Lascaux gouache paint.[5] It was soon apparent that it became too opaque at it dried, especially when put on a textile base. However our interest was awakened by their 'drop by drop' system and so the decision was made to test Lascaux Sirius Primary Watercolour System of which a water as well as an acrylic based variety is available.[6] We decided on the water-based variety for a number of reasons:

- It seemed easier to dissolve and according to known data would dry less mat and more transparent.
- The 'drop by drop' dosage system makes it possible to make exact shades of colour and to record the components for later reproductions.
- It is not based on the three primary colours but instead on five colours: magenta, red, cyan-blue, ultramarine, yellow plus black and white.
- The pigments used for this paint are pure and so very little is needed.
- Supposedly a total of 7800 shades of colour are possible.
- The paint dries semi-mat and according to the instructions would to some extent remain soluble.
- It is possible to layer the paint without an underlying layer dissolving provided each layer is left to dry properly. Layers applied too thickly however will dissolve.
- Colourfastness values are 7 to 7/8 on the ISO blue wool standard, excellent as stated by Lascaux. The binding agent of the paint is an acrylic copolymer.

By means of a colour theory developed for this series, samples were made to a strict pattern on a wool rep and a Bourette silk.[7] A colour wheel and a number of shades of the spectrum were made. Also tested was the amount of water that needed to be added to the mix to avoid bleeding into surrounding areas and the underlying warp. Different types of paintbrushes were tested as well as the way to apply the paint. Different techniques e.g. pointillism (stippling paint in different colours on the weft) were tried and tested for bleeding and fading.

5 Lacaux Colours & Restauro, Zurichstrasse 42, CH-8306 Brüttisellen, Swiss
http://lascaux.ch/pdf/en/produkte/kuenstleracryl/Gouache_englisch.pdf

6 http://lascaux.ch/pdf/en/produkte/kuenstleracryl/Sirius_Prospekt_englisch.pdf

7 Whaleys (Bradford) LTD, Harris Court, Great Horton, Bradford, West Yorkshire, BD7 4EQ.

The above tests and colour shades were carefully documented. Finally comparable tests were done on old tapestry fragments that were photographed before and after. To test the reversibility the samples of all shades of the colour wheel were tested by Royal Manufacturers de Wit in Mechelen, Belgium. Samples of all shades of the colour wheel were tested for bleeding onto nearby parts and the warp. All samples were cleaned with the 4.5 pH aerosol cleaning method, it being the standard pH for cleaning tapestries with old painted restorations. To test for bleeding to the warp and/or possibly to restrict it, the samples were put on the vacuum table face up as well as down. During rinsing the 4.5 pH was maintained except for the last rinse in demineralised water. A slight fluctuation of the pH could not be prevented. The same test was repeated but this time with a 7-8 pH, one that de Wit Manufacturers normally use for cleaning tapestries.

The 4.5 pH cleaning showed no trace of colour on the foam that had been put underneath the samples during the cleaning process, nor were traces of colour visible on the sponges and soft paper during and after drying. The colour difference between treated sample and reference sample was negligible. For the aerosol cleaning with the more alkaline pH the results were almost the same with the difference that the intensity of the colours of the samples which were cleaned face down was reduced.

Another way to test the samples was to put them in a solution of a universal textile cleaning product in demineralised water, using a gentle up and down movement. [8] No signs of bleeding could be seen with the naked eye. After drying no residue was left on the underlying tissue. However the paint had become thinner and lighter in colour.

Conclusion

We can therefore conclude that:

- The applied paint is not reversible and does not bleed to nearby parts or the warp if applied very dry.
- The colours remain unchanged after cleaning. The desired colours can easily be reproduced and only minute quantities are needed.
- As the sheen of the wool and silk disappears after application of the paint the pointillism technique appears preferable.

8 Universal textile cleaner developed by ‘the Central Laboratory, Amsterdam, the Netherlands; Solution of Methylcellulose; Triton X100, Ammonium citrate, in demineralised water.

- Infilling of large areas in one colour results in a rather lifeless mat effect.
- To restrict and control the absorption of liquid the use of fine pointed synthetic paintbrushes is advisable.
- The conservators and curators involved in this project discussed their findings after completion of all tests. They concluded that the Sirius paint scores well on all points except reversibility. However as we are dealing with parts of a tapestry that are not original in the first place, there was sufficient justification to use the retouching technique and appropriate paint.

Treatment necessitated putting the tapestry in a vertical position. So a construction of corrugated cardboard and PVC tubing was made to hang the tapestry. The overhanging part of the tapestry was put over a roll in front of this construction. It was necessary to use an Optivisor binocular magnifier, and pointillism was selected as the preferred application technique. The paint was only applied on the weft. By applying various shades of colour next to each other - if necessary by applying several coats - or by leaving small areas of the weft untouched, a light and lively effect was achieved (Figures 3 and 4; Figures 5 and 6). Furthermore the sheen of the old restoration has been kept and where necessary a single line made by a brushstroke imitated a hachure. Sometimes it was quite difficult to get the result we aimed for because different types of material - wool, cotton and silk - were used. As a result of this the paint absorption and final colouring were not constant. A critical eye was called for.

The conservation project as described above has been enlightening. The usual ways of looking at, thinking about and researching textile conservation have been broken wide open. The cooperation and critical discussions with members of other disciplines have been of great value. And so the tapestry has benefited, it is now more pleasing, restful to the eye and harmonized with the other tapestries of this series.

Acknowledgements

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References

Perkins R., Owens H., Carr C., Hallett K., Gibb I. and Frame K. 2011. *Henry VIII's Tapestries Revealed*. In J. Bridgland ed. ICOM- CC 16th Triennial Conference Lisbon, Preprints. Cd rom format.

Figure 1
Detail, tapestry before ‘retouching’.

Figure 2
Interchange with members of different disciplines.
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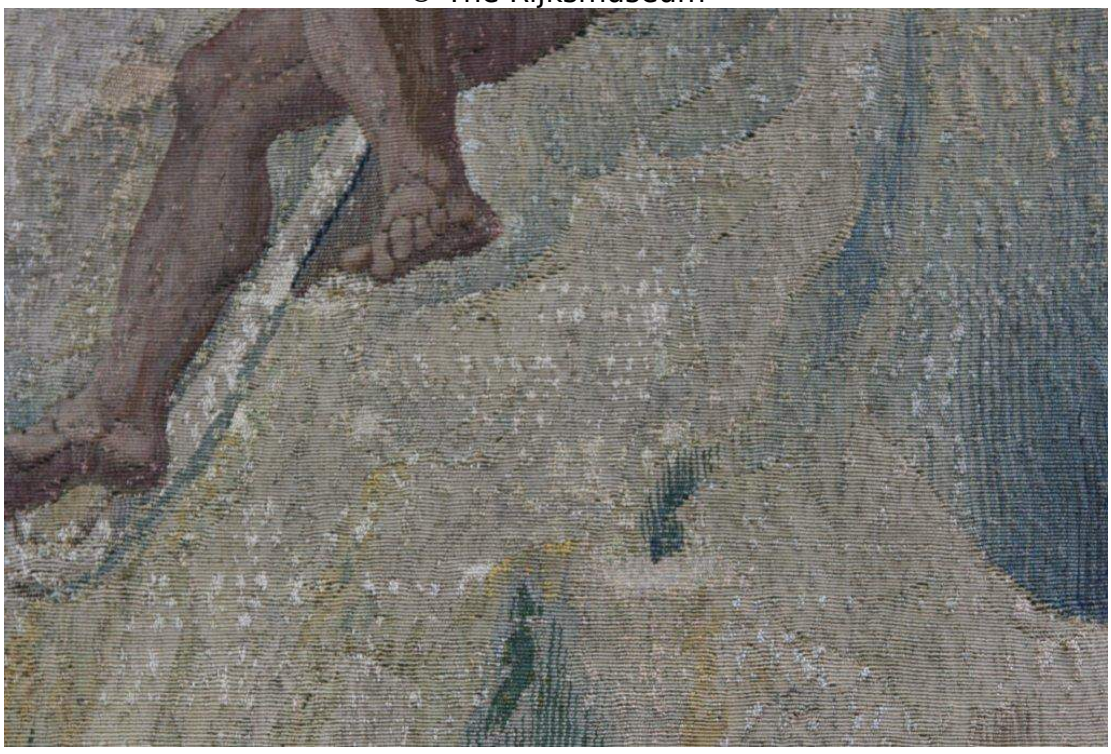

Figure 3
Detail, tapestry before ‘retouching’.
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Figure 4
Detail, tapestry after ‘retouching’.
© The Rijksmuseum

Figure 5
Detail, tapestry before ‘retouching’.
© The Rijksmuseum

Figure 6
Detail, tapestry after ‘retouching’.

The conservation treatment of the *Decius Mus* suite at Kilkenny Castle: An international and interdisciplinary project

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Introduction

In 2010, The Office of Public Works Of Ireland (OPW) made contact with the Fundación Real Fábrica de Tapices in Madrid (FRFT), to investigate a suite of tapestries belonging to the *Decius Mus* series, based on cartoons of P.P. Rubens, preserved in Kilkenny Castle (Figure 1). The objective was to evaluate the state of conservation of the textiles and write an intervention proposal in order to clean and stabilise the suite and, if possible, prepare them for exhibition.

A process of multidisciplinary cooperation was organized to undertake the complex task, as it was necessary to take account of the multiple factors influencing the treatment of the tapestries. Mary Heffernan, Assistant Principle Officer, National Historic Properties, OPW, described the general criteria of the OPW for the preservation and future display of the suite of tapestries; Jane Fenlon, Advisor on the *Decius Mus* Tapestry Project to the OPW, documented the origins of this collection and provided valuable information on the history and historical conservation of the suite; Antonio Sama, curator at Fundación Real Fábrica de Tapices studied the aesthetic principles of the suite designed by Rubens within the 'critical context' of the relationship between painting and tapestry-making during the period that the suite was woven; Isabel Fernández as Head of Department of tapestry conservation developed the intervention methodology taking account of the very fragile condition of the tapestries, the enviromental context where they will be displayed and the conclusions achieved after historical study of the suite.

History

The Butler family, Dukes of Ormonde in both Ireland and England, had a large collection of tapestries in the mid to late seventeenth centuries. Some 25 suites are listed in an inventory taken in 1675 (Fenlon 2003: 41-2). There are other earlier references to tapestries in inventories taken in the late 1620s and 1630s, although no suites are named until a later inventory of 1653 when the then Marchioness of Ormonde returned from exile (Fenlon 2003: 37).

The Ormonde Collection had many famous suites of tapestries, including the Lambeth set of *The Horses* and *The History of Decius Mus*, woven to designs by Sir Peter Paul Rubens about 1618. They certainly owned the earliest known suite of tapestries on the subject of Don Quixote (Fenlon 2003: 118). The first reference to the *Decius Mus* tapestries in the Ormonde Collection occurs in an inventory of the Duke and Duchess of Ormonde's goods taken in 1675, when the tapestries were listed with 25 other suites of tapestries as 'Antwerp hangings containing seven pieces of the Story of *Decius Mus* 13 foot deep', location not given. It should be noted that these were the only tapestries in the entire collection that measured thirteen feet in height (Fenlon 2003: 41-2). In 1682 the *Decius Mus* suite was referred to in a letter between Ormonde's agent and their housekeeper.[1]

In 1684 the *Decius Mus* suite was listed in an inventory as 'seven pieces of Antwerp hangings of the Story of Decius 13 foot drop lined with canvas', hanging in the Dining Room of Dunmore House, the Duchess of Ormonde's house outside Kilkenny (Fenlon 2003: 124). In 1717 in an inventory taken by the Forfeited Estates Commissioners at Kilkenny Castle (Figure 1) there is a reference to seven pieces of tapestry (no name) but of thirteen foot drop, valued at £90 for the seven pieces in the suite. This was the most expensive suite listed, some others were valued as low as £20. Three pieces of the tapestries also described as being 'thirteen foot drop' were in the house of Mr Hoskins, the 'upholders' in Kilkenny, where they were described as being 'fresh lined with canvas'.[2] Was this the first repair? After this last reference from the inventories we have to rely on reports from visitors to Kilkenny castle for further information to establish a sound provenance for the tapestries and their condition.

In 1715, after a Bill of Attainder was passed on the 2nd Duke of Ormonde for treason following his abortive Scottish adventure, Kilkenny Castle was left empty except for a gardener and some very few staff. The Duke had departed for exile in Europe, first to Madrid and then to Avignon where he retired to live in great magnificence. Meanwhile, during the Duke's exile, Kilkenny Castle was described as a once beautiful palace and now [it is] like 'a weather beaten ship in a storm, after a long voyage with all her cargo thrown overboard' (Chetwood 1748: 179).

The earliest reference pertaining to the tapestries by visitors to Kilkenny is from *Diary of a Tour in 1732 throughout parts of England, Wales, Ireland and Scotland made by John Loveday of Caversham 1711 – 1789*. Loveday notes that in some rooms there was 'Incomparable tapestry', and 'Ye figures in it expressive and colours lively', although he does not actually name the *Decius Mus* suite (Loveday 1890: 30).

A junior branch of the Butler family inherited the estates on the death of the second Duke's brother in 1758, moving into the castle shortly

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[1] HMC Ormonde Papers VI 1895-1920: 538.
[2] NA Ms FEC/876 1717:f.36.

afterwards when they began to repair and refurbish the interiors. In 1778 another visitor to the castle, Philip Luckombe, remarked on the suite of hangings representing the story of Decius, describing the condition as:

> ‘though not so glowing in their colours as the seasons [another set of tapestries that survived] are nevertheless admirable in other respects. Pity that they should be exhibited to so little advantage’,

and he goes on to criticise the shape of the room, which was situated in one of the round towers, adding:

> ‘One of the largest pieces is folded round the mixed angle at the windows, so that the part of it on the concave surface has a glaring light while that on the plain is almost in darkness’ (Luckombe 1778: 74).

Before 1790 there is another description of the tapestries where they are said to be admirably executed, and contain ‘the history of Decius… the colours fresh and lively’. (Ledwich 1804: 480-82) Was this when the paint was first applied? In 1824, according to the Rev. James Graves who published a paper on the tapestry of Kilkenny Castle, the tapestries were taken down and stored before the rebuilding of the castle in the *Gothick* style (Graves 1852: 3-9). He also tells us that in 1851 they were taken out again and the six remaining pieces ‘have been repaired and relined’. Another example of repair that needs to be noted!

In the early twentieth century, due to changing times and after a period of ruinous extravagance that included two royal visits to Kilkenny, the Ormonde family was unable to maintain the castle and sold the contents in 1935 in a sale that took three weeks. The tapestries then languished in storage for another 40 years or so, when in 1976 they were again repaired – and an invoice for ‘59 hours work costing £129.5.0s was paid’.[3] The tapestries were then on display hanging in the picture gallery at Kilkenny Castle for a number of years (Figure 2). In the early 1990s The Office of Public Works purchased the tapestries from the Ormonde Settled Estates along with a collection of portraits and some few remaining pieces of furniture.

From this brief history of the suite of *Decius Mus* tapestries it may be understood that they went through periods when they were valued and cared for interspersed with periods of neglect and then repair.

Conservation treatment

The *Decius Mus* suite at Kilkenny Castle is an example of woven hangings using linen warps with wefts of silk and wool. This peculiarity and centuries of intensive usage resulted in very serious damage to the suite, bringing their condition close to ruin. When FRFT first approached this commission to prepare a project to clean and provide support to the tapestries, the OPW expressed a desire to put them back on display. However, at that time it was not possible to assess the full extent of the damage to these

[3] OPW files.

textiles due to the very heavy layer of dust that was covering them, and it was only after starting to work on the set that the actual extent of the damage could be recorded.

The tapestries showed signs of extensive usage with areas of faded colours that confirmed exposure to direct sunlight. Also present were obvious signs that they had suffered several former restorations over the centuries. Given the overall damaged condition of the tapestries, it is not surprising that the poor condition and nature of the linen warps had not been noticed until a close examination was carried out, prior to the cleaning process. During this examination the extreme fragility of the general structure of the textiles became more obvious and the idea that the first approach to the treatment had to be reviewed gained importance. The initial proposal relied on the assumption that the suite had been woven employing woollen warps, and that the structural condition was not as poor as it finally turned out to be.

1 Condition

Under the hessian lining it was found that a series of patches made from fragments of other tapestries and different textiles had been sewn onto the reverse. Sometimes up to four layers of fabric were used in an attempt to maintain the cohesion of the textiles (Figure 3).

As a consequence of exposure to direct light the silk wefts had been practically destroyed, and in attempting to mend this damage large areas of repair had been rewoven directly into the tapestries. The quality of this reweaving varied in both quality and skill and the silk repair threads had suffered the same damage as the original ones after years of intense exposure to deteriorating agents, resulting in extensive areas of wefts practically reduced to dust (Figures 4 and 5). A microscopic examination of samples of loose fibres to evaluate the general condition of the fibres found that the silk wefts were extremely damaged; the depolymerisation of the fibre was very intense resulting in a partial loss of twist and tensile strength. This explained the presence of such big gaps and patches and the large areas of reweaving that had been used to infill the missing silk.

The linen warps were brittle and dehydrated, and there were large areas where warps were broken and in some cases missing (Figures 6 and 7). Only the areas of wool weaving have maintained some structure and strength but even these, when examined under a microscope, showed that due to loss of torsion, the fibre had lost tensile strength. The general structure of the tapestries was seriously compromised.

2 Treatment approach

On the basis of these findings, the OPW and FRFT had to revaluate the initial assessment of the tapestries and they entered into discussions about the best possible way to achieve the aim of preserving and if possible displaying some of the tapestries. A careful examination of each

tapestry was carried out in order to determine the actual extent of damage. Detailed photographs of the whole surface were taken, dividing it into squares measuring 800mm x 600mm. These images were used to locate all the actions undertaken to test, clean and stabilise the tapestries and will, become part of the documentation included in the final report. Appendix 1 contains technical details of the first two tapestries, which were recorded once they were fully restored.

After testing the colour stability of the fibres wet cleaning of five of the six tapestries was carried out. Throughout this process, different levels of intervention and damage were recorded that required subtle changes to the stabilisation treatment. Constraints include a limited budget and the time required to complete the task. Such constraints contributed to weight the balance in favour of the minimal intervention criterion, already assumed as the best possible approach to preserve the suite. It was therefore decided to respect all the reweaving, removal of which would have caused possible further damage to the tapestry. It was also decided not to remove those repairs that were not creating tensions or creases, including those areas where the hessian supports had been painted (during one of the several interventions recorded) with a water stable paint to visually integrate the infilling, as they were not visually distracting and were reasonably functional and integrated in the ensemble.

Prior to wet cleaning the suite it was necessary to ensure the dimensional and colour stability of the painted hessian restorations, so a sample of this support was taken, in order to measure it before and after washing. As the test was successfully accomplished, the wet cleaning procedure was undertaken after removal of the hessian lining, except in areas where this material was found essential to give a minimal structural cohesion to the ensemble. Further protection was provided by gently sewing a temporary protection mesh on the areas where bare warps were present (Figure 8).

Following the detailed study the need to review the previous stabilisation treatment was identified. The initial proposal had entailed the use of a conventional stitching and reweaving process with supports employing demi-duit embroidery stitch (brick couching) with a 3mm gap between stitches in order to stabilise and infill areas of loss. The extreme fragility of the linen warps and their brittle nature would not withstand such intensive sewing, and the big areas of gaps required a general stabilisation. It was decided during discussions about the new approach that there was a need to develop a method to recover the structural stability as an early stage and that this might, with minimal intervention, avoid intensive sewing over the very fragile linen warps.

3 Tapestry design

Once the technical and structural issues were defined it was also necessary to focus on the visual qualities of the tapestry in order to try to find a compromise between the stabilisation and the challenge involved in restoring the visual qualities of the tapestries as they were conceived. The

discussion on the visual exigencies of the treatment was based on research into the tapestries' history; when Rubens accepted the commission to design cartoons for a *History of Decius Mus*, the art of tapestry was struggling with its own aesthetic principles and its social value. The first reference to this commission dates to around the end of 1616, between the Genovese merchant Franco Cataneo and two master weavers from Antwerp, Jan Raes and Frans Sweerts. In the terms of this contract it is noted that the Flemish master was responsible for the model's composition and the final appearance of the textiles.

The lack of great designers, or cartoonists, was at that time partly responsible for the decline in Flemish tapestry production, which was reduced to mannerist repetition of late Renaissance models. On the other hand, painting was starting its rise as a hegemonic art, monopolizing the collector's preference and reducing interest in other artistic disciplines. In such a context, the critical standing of tapestry seemed to be declining towards what
would later be catalogued as Decorative Arts, secondary to the Fine or Major Arts. Rubens was aware of this situation, as he had personal connections with the tapestry weaving community. Hendrick Pypelinkx, his maternal grandfather, and his Uncle Dionysus were merchants specializing in the tapestry and textiles trade, and his second wife, Helena Fourment, was the daughter of a prominent silk and tapestry merchant, Daniel Fourment.

It is interesting to quote a phrase from the artist which illustrates his knowledge of the subject:

> "One evaluates pictures differently from tapestries. The latter are purchased by measure, while the former are valued according to their excellence, their subject, and number of figures" (Vergara 1999: 187)

It is quite possible that the artist decided in this, his first approach to tapestry design, to contribute to the revaluation of the art of tapestry weaving. In fact this may be the explanation for the revolutionary changes he introduced in using oil painting for his designs and discarding the traditional employment of tempera and water based paints on paper supports when preparing the designs for transfer to weaving. The substitution of water based drawing, sometimes mere sketches, in favour of perfectly finished and detailed oil paintings was an attempt to introduce the weavers to the art of painting. Rubens' purpose was therefore to give the weavers the best means of translating the brightness and delicate nuances of oil painting into the language of wool and silk. This new aesthetic approach imposed technical challenges, which the weavers used to explore the possibilities of their discipline and its limits. Their feelings of accomplishment turned into a proud vindication of their art, in the form of woven mottoes claiming that tapestries were the equal of paintings (Sama 2006). For example:

DIVINA PALLADIS ARTE PICTVRAM SUPERÁVIT ACVS
(By means of the divine art of Pallas, the needle has conquered the art of painting)
(Figure 9).

It was assumed therefore, that for painters as cartoonists as well as for weavers themselves, Flemish baroque tapestry was understood following the concept of ‘woven paintings’ and so the aesthetic essence of tapestry weaving was consequently equal to the principles of painting. Both were committed fundamentally to represent ‘truthfully’ stories with a moral background. It was as important to capture the sensuous plasticity of baroque style as to develop the iconographical programme that would provide and facilitate a moral significance and it was according to this principle that the *Decius Mus* suite was woven.

4 Structural support and visual infilling

All these factors were kept in mind when developing the conservation methodology to be applied to the *Decius Mus* suite of Kilkenny Castle. The general condition of the tapestries required a visual reintegration of large areas as much as stabilisation of the whole. Therefore it was a fundamental task to develop a method of sewing that would help to visually approach the essence of this suite while at the same time respecting the inevitable fragility of these tapestries.

From the technical point of view, it was clear that it was necessary to provide structural support to the tapestries. This support might also help to recover the tonal variation of different areas, in order to help minimal intervention when sewing. Therefore Belgian linen support fabric was dyed in several different colours and the pieces were stitched together using herringbone stitch, in the same way as when adding a general support to a tapestry. Fixing, or support, lines were used to hold the tapestry to the supports in order to give some stability to the ensemble, assuming this action was partial and unable by itself to reinforce the damaged structure.

Once the general supports were fixed, the tapestries were mounted on the loom in order to gradually reinforce partial areas of loss and fragile warps by sewing a series of fixing lines employing running stitch through the perimeter of the area to be treated prior to the visual infilling of missing areas. Where the tapestries appeared strong enough a series of fixing lines was worked around the weakened areas. On those parts where linen warps were damaged or broken, laid thread couching stitch was employed to provide further protection and structure to the tapestry.

Once areas were stabilised the procedure of infilling the areas of loss was undertaken as follows: the loose linen warps were gently fixed to the support using demi duit needle work (brick couching) in either silk or wool threads, with a separation between points of 10mm. Once the warps were secured, a visual infilling of missing areas was made, covering the bare warps by introducing lines of coloured wool or silk threads attached to the

backing support. These were slipped underneath the couching stitches, running parallel to and on top of the bare warps. This achieved some re-introduction of colour in the areas of lost wefts (Figure 10). This action worked very successfully to recover areas where the massive loss of wefts had interrupted the integrity of the scene, by fixing the bare warps in the first instance and then colouring them through the insertion of selected coloured threads (Figures 10, 11 and 12). In areas of total loss it was decided to add double strands of thread to create reproduction warps that were attached to the backing support. This provided extra volume to the areas where the difference in thickness of the layers was visually very disturbing.

At the time of writing the project was close to completion. As work on the tapestries progressed and the condition of each was more fully assessed it was necessary to adapt the approach to suit the different types of damage encountered. In two cases the linen warps were far too fragile to employ this visual infilling method and only laid thread couching stitch was employed to stabilise areas of bare warp. Work on four of the tapestries has now been completed. Additional backing support and stabilisation will be provided to tapestries so that they may be displayed on tilted panels in order to minimize the stress due to weight. Light and environmental control will have to be considered as part of the global project. Our common objective throughout this project has been to allow the public to see some of the original splendour of this very remarkable suite of tapestries.

Appendix 1

Technical information: *The Interpretation of Victim*
Density warp: 70-80/dm.
Material: linen
Colour: none
Yarns: 3 Spun: 3Z/S

Density weft: 140-150/dm.
Material: wool
Colour: several
Yarns: 2 Spun: 2Z/S.

Density weft 180-190/dm.
Material: silk
Colour: several
Yarns: x Spun Z/S

Technical information: *The Dismissal of the Lictors*
Density warp: 70-80 threads/dm.
Material: linen
Colour: none
Yarns: 3 Spun: 3Z/S

Density weft: 140-150 wefts/dm.
Material: wool
Colour: several
Yarns: 2 Spun: 2Z/S.

Density weft: 180-190 wefts/dm.
Material: silk
Colour: several
Yarns: x Spun: Z/S

References

Chetwood, W. R. 1748. *A Tour Through Ireland by Two English Gentlemen.* London.

Fenlon, J. 2003**.** *Goods and Chattels.* Kilkenny: The Heritage Council.

Graves, J. 1852. Ancient Tapestry of Kilkenny Castle. In *Transactions of Kilkenny Archaeological Society* II, Kilkenny.

Historic Manuscripts Commission, *Ormonde Papers* 11 vols., London 1895-1920, VI, 538.

Ledwich, E. 1804. *Antiquities of Ireland.* Dublin.

Loveday, J. 1890. *Diary of a Tour in 1732 Throughout Parts of England, Wales Ireland and Scotland made by John Loveday of Caversham 1711-1789.* Edinburgh.

Luckombe, P. 1778. *A Tour Through Ireland.* London: National Archives Ms. FEC/876, 1717.

Sama, A. 2006. Entre la pintura y el textil: la restauración de tapices. In *Aportaciones Teóricas y Experimentales sobre Problemas de Conservación. Actas del II Seminario sobre restauración de Bienes Culturales*, Aguilar de Campoo (Palencia): Fundación Santa María la Real, pp153-184.

Vergara, A. 1999. *Rubens and his Spanish Patrons*. Cambridge: Cambridge University Press.

Figure 1
A general view of Kilkenny Castle, home to the Butler family, Dukes of Ormond, in the seventeenth century. The castle dates from the thirteenth century, although what is visible here is mostly nineteenth century rebuilding in the Gothic style.
Reproduced courtesy Office of Public Works, Dublin.

Figure 2
Kilkenny Castle: the picture gallery showing the tapestries

hanging in the early 1990s.
Reproduced courtesy Office of Public Works, Dublin.

Figure 3
Different layers of patches superposed during previous restorations in an attempt
to maintain the cohesion of the ensemble of the tapestry.
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Figure 4
Large areas of silk were lost and then repaired in former restoration processes.
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Figure 5
The silk used in the reweaving itself became completely degraded, resulting in the massive loss of silk shown here.
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Figure 6
The very fragile linen warps have been completely lost as a consequence of
the intensive use and repair.
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Figure 7
Comparative images of linen yarns showing the poor condition of the linen warps: top and second from top, samples of linen warps from *The Interpretation of the Victim;* third from top, a sample from the *The Dismissal of the Lictors;* bottom, a sample of a new uncoloured linen yarn (10x magnification).
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Figure 8
Cleaning process of a tapestry from the suite in our washing installation designed to clean large format textiles.
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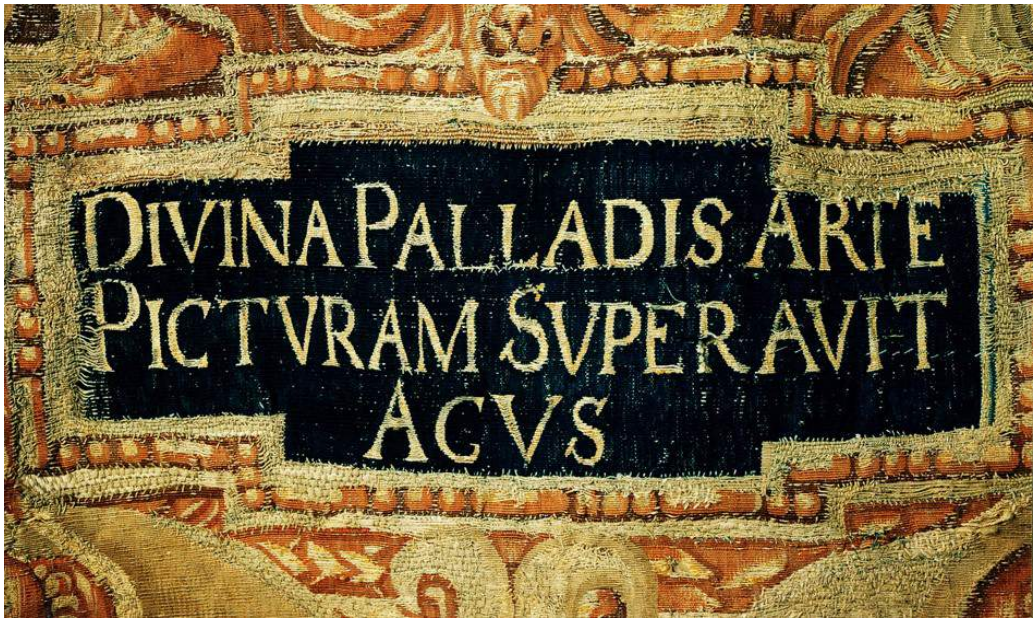

Figure 9
Motto from the tapestry *Alexander Worshipped as a God,* from *The History of Alexander* series, woven by Jacques II Geubels in Brussels, 1628-1630.
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Figure 10
Visual infilling in areas of loss.
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Figure 11
Visual infilling in areas of loss.
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Figure 12

Visual infilling in areas of loss and laid couching stitching used to stabilise
the weakened areas.