ADHESIVES TREATMENTS REVISITED

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Edited by Jane Lewis

TEXTILE section

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FOREWORD

'Adhesives Treatments Revisited', was the third Adhesives Forum to be organised by the UKIC Textile Section. It was held in November 1997 at the Museum of London.

The aim of the Forum was to examine the issues relating to previous adhesive treatments of textiles. With more than four decades of experience of using adhesives, the textile conservation profession has much to gain from taking a positive look backwards. The papers ranged from the re-examination of past treatments, successful or otherwise, the complex issues surrounding the re-treatment of previously adhered textiles and current scientific research into the composites formed by object, adhesive and support fabric. Speakers came form as far afield as the U.S.A., Canada and Holland. The text from two of the posters presented at the Forum are published alongside the papers.

Particular thanks are due to Janet Farnsworth and the UKIC Textile Section Adhesives Group who helped organise the conference, and to Marion Kite who stepped in at short notice to chair the day. I would also like to thank Ann French who helped organise the postprints and to Zenzie Tinker and Barbara Heiberger for proof-reading them.

Jane Lewis

DEVELOPMENTS IN DECISION MAKING - THE CONSERVATION OF TWO COPTIC TUNICS

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The Medieval Treasury is one of the primary galleries of the Victoria and Albert Museum (V&A) and contains objects from the third century to the fifteenth century. It was redesigned in the mid 1980's and when it re-opened in 1986 the new display included a large number of Coptic textiles. One of the focal points of the gallery is a sixth century tunic from Akhmin in Upper Egypt, a site which is about 315 miles above Cairo and 140 miles below Thebes. Akhmin was one of the most important centres for linen manufacture in the ancient world and its burial grounds to the east of the city, discovered in 1884, have yielded large numbers of textiles. The museum's collection of Coptic textiles is based on the acquisition of around 300 pieces from the site in 1886[1]. Subsequent excavations from Akhmin and other sites in Egypt, notably Antinoë and Hawarah in the Fayum, have added to the collection which now contains 25 examples of complete or near complete Coptic tunics. In 1995, the British Museum requested the loan of a third century tunic for the exhibition "Ancient Faces" which opened in March 1997. This tunic, acquired from the Akhmin site in 1887, presented an ideal opportunity for rotation in the Medieval Treasury and in due course will replace the sixth tunic century which has now been on display for over ten years.

The conservation of these two tunics spans a period which has seen a significant number of changes in treatment proposals. The decision making processes which determined the conservation of each tunic give an interesting insight into developments within one studio as well as reflecting wider trends within the textile conservation profession. In both cases, the treatments were highly interventive and raised issues which constantly present difficulties for the textile conservator. These issues become more complex when dealing with textiles in advanced states of degradation. Both tunics are important examples of their type and need to be seen as primary objects in a major gallery. The conservation of each had to satisfy the demand for long term display and study as well as providing stability. Both tunics were supported using an adhesive technique. The choice of adhesive techniques for historic and important objects is often contentious and is necessarily the subject of continual discussion. The approach to the sixth century tunic is discussed and evaluated in the context of more recent developments in textile conservation. These developments are evident in the approach to the conservation of the third century tunic.

The sixth century tunic came into the studio early in 1986, 100 years after its acquisition. At some point in its history within the museum, it had been given a stitched support of cotton rep material which followed the original cut of the garment. The cotton lining was attached by numerous small close running stitches around all areas of loss using both a mercerised cotton thread and a loosely spun silk thread. It has always been assumed that work of this kind, of which there are a number of examples in the museum, was carried out in the 1930s, but there is no documentation to support this view. The tunic is a typical example of the main kind of garment worn in daily life in

Coptic Egypt. The simple T-shape is constructed from two lengths of linen. The sleeves and upper part of the garment are woven in one piece and the warps run horizontally. The two sections are joined together by a wide run and fell seam which appears like a stitched down tuck from the outside. The side seams are also joined with run and fell seams. The sleeve seams were open when the tunic came into the studio but stitch marks indicated that they had been joined at some time with stab stitches. Openings for ventilation slits below the armpits are finished with bound linen stitches. The tunic is decorated on both front and back with identical applied tapestry roundels and bands or clavi woven with linen warps and wool weft depicting stylised men and animals in bright and relatively unfaded colours of red, blue, yellow, green and black. The slit for the neck is finished with tapestry woven bands. Crease marks around the central tucked seam indicate that the tunic was probably worn belted. This would have brought its length to knee level which was the preferred fashion for men.

The survival of so many textiles from this area is entirely due to the preservative effect of the stable desert climate. The rapid spread of Christianity in the third century and fourth century AD meant that many bodies were simply buried in the clothes they would have worn in life. Embalming practices were carried out occasionally but in a perfunctory fashion. The condition of the sixth century tunic indicated that the body had been prepared for burial with preservative oils or resins. Cedarwood oils, acacia, dammar and pine as well as honey were all in use in the ancient world as embalming mediums[2]. Virtually the whole of the back of the sixth century tunic including the tapestry woven decorations was impregnated in waxy deposits which made it dark and inflexible and obscured the weave of the linen. The back had been slit from neck to hem in order to remove the remains of the body. It was not possible to discriminate between the remains of body fluids which more commonly stain the back of Coptic tunics and the saturation of the linen with embalming oils, a process which would have preceded any body deposits. The linen ground of the rest of the tunic varied in condition. On protected areas within the sleeves and seams it retained a creamy colour and was soft and flexible. A range of colours on the face of the garment typical of cellulose degradation indicated differing stages of deterioration. A central area between the two clavi where there were several areas of loss was noticeably more friable and the edges of all areas of loss where the linen had been exposed to greater oxidation were embrittled. In general, however, the front of the tunic was soft and pliable and the tunic as a whole was safe to handle.

The treatment of this tunic followed standard studio practice at the V&A in the mid-1980s. A series of adhesive techniques had been established a decade earlier. Approaches to conservation in general were more interventive ten years ago. One obvious example is in the washing of fragile material - Coptic textiles were routinely washed for a variety of reasons, a practice which would be viewed with far more caution today[3]. The sixth century tunic was washed, ostensibly to raise the pH of the linen (from 5 to 5.5) and to flush out the more soluble components of cellulose degradation. The back of the tunic was totally hydrophobic[4]. In line with studio practice a decision was made to support the tunic with nylon tulle treated with a thermoplastic adhesive. The adhesive chosen was the dispersion Mowilith DMC2 (co-polymer of vinyl acetate and dibutyl acetate). A very fragmentary eighth century sleeveless tunic had been conserved in 1978 using the

same techniques[5]. The initial support of the adhesive coated net had served to stabilise the fragments. A secondary support of dyed linen holland was then used to create a three dimensional garment from the evidence presented by the fragment[6]. At the V&A nylon tulle was a standard substrate for adhesive applications for more than 25 years as was the poly (vinyl acetate) dispersion Mowilith DMC2. The net was prepared under tension on a specially designed table. The adhesive solution was sponged onto the net using a 60:40 ratio of adhesive to water. Each coat of adhesive was dried using a cold air dryer before the next application. Two to three coats were usually necessary to make an effective bond. The net could be treated on both sides and used to create a 'sandwich' support. Object, adhesive-coated net and secondary fabric support were all mounted as one, usually using the uniform pressure of the vacuum hot table[7] to activate the adhesive.

There are two important functions of an adhesive support. It can give initial stability to a fragmented object enabling it to be handled safely before a fabric support is attached. Secondly, the amount of stitching needed to attach the fabric support is minimised by an adhesive support; this can be an important consideration in treatment decisions for types of embrittled deterioration.

One of the primary functions of the adhesive support on the sixth century tunic was to minimise the amount of stitching needed to join the slit which ran from the neck to the hem on the back of the tunic. Once the slit was joined the tunic would gain enough stability to be handled and the secondary support of linen could be placed. In line with studio practice and following the example of the treatment of the eighth century tunic, it was decided to give the sixth century tunic a preliminary overall support of adhesive coated net.

Access to the inside of the garment was simplified by the slit in the back and the fact that the sleeves were open at this stage. The net was worked in sections starting with the face of the tunic. The adhesive was activated using an ordinary hand held iron set to 100^{0}C. The direction of the treated net followed the direction of the warp which ran horizontally in the upper part of the garment. Supporting the back of the tunic was much more difficult. The stiff waxy impregnation of the linen made it resistant to adhesion. The surface wax on the inside of the tunic was marginally reduced by treating with 1,1,1 - Trichloroethane and the net was given four coats of adhesive to ensure an effective bond. Hard ridges caused by the weight of the tapestry woven roundels were individually backed by separate patches of treated net before the main support was inserted. This was placed in two sections to follow the warp direction of the upper and lower back. The net was not cut away in areas of loss but left as it was felt this would give more uniform support to the tunic. Exposed adhesive on these areas was treated with Industrial Methylated Spirits to minimise sheen.

Finally, a dyed linen support was inserted and areas of loss were couched to this secondary backing using both Skala polyester thread and double threads pulled from Stabiltex™. A cotton lining marginally smaller than the tunic was made for the final display and the tunic has hung on a basic T-bar display stand for the last ten years.

During this period many aspects of interventive conservation have been re-evaluated. In the V&A, for example, the use of adhesives now only accounts for 2-3% of conservation treatments. Despite the

infrequency of these treatments there is a greater choice of support materials and adhesives and a more refined approach to method. The profession in general has benefited from increased collaboration between studios and from the influences of related disciplines such as paintings and paper conservation. At the V&A a determined effort has been made to become familiar with a much wider range of adhesives and their individual qualities to enable the conservator to make a more appropriate choice to the object condition and type. A group of ten thermoplastic adhesives widely used in textile conservation have been examined both in studio practice (to determine and evaluate working qualities) and by the Science Section of the museum to evaluate the factors which can be measured objectively[8]. The studio work resulted in a workshop manual which has proved a useful preliminary tool in the initial stages of selection of an adhesive. The development of this work by Boris Pretzel in the Science Section has resulted in the creation of a flexible matrix which ranks qualities of the adhesives against each other and provides a guide to selection depending on the individual need of the object[9]. The matrix incorporates key elements from the studio work including the recognition of the experience of the conservator as a significant factor in the choice of adhesive. Additional factors included from the studio work were ease of use - reflecting properties of the adhesive solutions and their behaviour during the casting of a film and ease of handling reflecting the properties of cast and dry adhesive films. The objective factors were bond strength; ease of removal; reversibility; acidity; flexibility; corrosiveness and staining; toxicity and the necessity for fume extraction; heat sealing temperature; glass transition temperature (Tg) and toughness of the film. The ten thermoplastic adhesives chosen for this project were Mowilith DMC2; Mowilith DMC2 + DM5; Vinamul 3252; Vinamul 3254; Lascaux 360HV + Lascaux 498HV; Texicryl 13-001; Vinnapas EP1; Paraloid F10; Beva 371 and Lascaux P550-40TB.

Other notable developments within the profession as a whole include a renewed and more informed interest in the use of starch adhesives and the use of paper as a support substrate. A recent survey undertaken by the Adhesive Group of the UKIC Textile Section indicates that 35% of textile conservators have had some experience of the use of starch adhesives and 20% use wheat starch in regular studio practice[10]. The approach to the conservation of the sixth century tunic and the choice of materials might be very different today. Many conservators, for example, have discontinued the use of nylon tulle as a support substrate preferring Stabiltex™, silk crepeline or non-woven substrates such as paper[11] or spun polyester materials. The problem of the split back may not have directed the whole treatment proposal and the front and back of the tunic may have been treated differently. The back of the tunic, for example, might well have benefited from a more local treatment using Japanese paper and wheat starch. It is likely that a fabric support may have been cotton, rather than linen which can move too readily in a situation where stitching is minimised. The importance of a well designed mount is now recognised as a vital part of the support system for many highly degraded objects[12]. More effective support of the tunic could have been achieved using a well designed mount and the degree of intervention may have been reduced.

Treatment proposals for the third century tunic, which was conserved ten years later in 1996, were inevitably influenced by the developments which have taken place both within the textile conservation studio of

the V&A and within the profession as a whole. This tunic, acquired from the Akhmin site in 1887, is one of the finest and earliest examples to have emerged from the burial sites of Roman Egypt. It is important not only as a central object in a primary gallery but also as a reference for study. Like the sixth century tunic it is woven from undyed linen from sleeve edge to sleeve edge. The clavi are tapestry woven in purple wool with flying thread brocading in undyed linen[13]. A short narrow band of wool, incorporating gold thread in the weave, towards the lower front of the tunic indicates that the garment had special significance. All seams of the tunic were open but there was evidence of stitch holes at the sleeve seams. Three rows of stitch holes across the width of the tunic indicated that originally there had been a waist tuck for adjusting its length. The length suggests that the tunic was probably worn by a woman [14].

An initial assessment of the condition of the object revealed substantial areas of loss mainly around the waist and across the shoulders and neckline; there were contemporary repairs in these areas of very thin linen patches. The linen surrounding the areas of loss was fragmented, brittle and stained. Throughout the rest of the tunic, the linen, although yellowed and degraded, was surprisingly supple and robust. There was no evidence of embalming fluids or body deposits and in general the tunic was remarkably clean. There were numerous creases associated with burial and other creases acquired from storage. At some point in its history it had been stitched to a heavy ill-fitting linen backing with numerous silk stitches (in a similar manner to the preliminary support given to the sixth century tunic). The stitching had caused the linen to break up around the areas of loss resulting in further damage. A Melinex map of the object was created to record stitchmarks, creases and areas of contemporary repair.

A number of treatment options were considered. Encapsulating the object in silk or polyester crepeline could have achieved a satisfactory result but would have obscured the surface texture of the object; in addition the object exhibited a wide range of tonal values which would have been minimised by a facing material. The importance of the garment for both display and study had to be taken into account. All original evidence had to be accessible. A stitched support could also have achieved a good result but could not have supported the most vulnerable and brittle areas of the linen. It was the condition of these areas which eventually determined the choice of an overall adhesive support.

Thermoplastic adhesives were chosen in preference to other classes of adhesives for several reasons. The tunic is a large object. The application of the adhesive presented potential problems over such a large surface area. It was important that the adhesive and the substrate on which it was applied retained enough flexibility to accommodate tensions between the object and the support. The flexibility of the adhesive film had to be combined with good bond strength. Bond strength had to be achieved without penetration of the fibre by the adhesive. Reversibility had to be achievable without leaving residues of adhesive in the fibres. The film had to be easy to manipulate; a thermoplastic adhesive with a low Tg which would enable the conservator to operate some degree of handtacking was considered ideal. Extensive experience of the use of thermoplastic adhesives in the section indicated that this combination of qualities could be found in the range of adhesives which had formed the basis of the testing programme undertaken by the Science Section of the museum.

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The scale of the object meant that large surface areas of film needed to be made. This practical fact eliminated the solvent based adhesives - Lascaux P550-40TB, Beva 371 and Paraloid F10. Fume extraction facilities were not adequate enough. The size of the object also meant that the adhesive film had to be easy to apply and handle. Referring to the experiences of the conservators who had developed the workshop manual, this further eliminated Vinnapas EP1, Vinamul 3254, Texicryl 13-002 and the combination of Lascaux 360HV and 498HV. The three remaining adhesives (Mowilith DMC2, Mowilith DMC2 plus DM5 and Vinamul 3252) scored equally well on hot peel tests (an indication of reversibility). Only Vinamul 3252 passed completely on staining tests and this fact plus the lower Tg of this adhesive which gives it excellent handtacking properties clarified the choice. The acid value of Vinamul 3252 is low [15], and independent testing of Vinamul 3252 indicates that its pH tends towards neutral on ageing[16]. The film was made five weeks in advance of the application. For strength and weave compatibility, Stabiltex 4™ was chosen as the substrate for the adhesive which was applied in a 20% solution.

The tunic was given a full support and the film was applied in the weft or hanging direction. The linen was too vulnerable to consider a patched support but retained enough tensile strength and flexibility to make the adhesive support a viable option. The fact that all the seams of the tunic were open meant that the garment could be opened flat which facilitated application. The adhesive was activated using a spatula iron after placement of the fragments by hand. This ensured controllable application, although even pressure cannot be guaranteed when mounting by hand. The tapestry woven bands were treated separately and couched to untreated Stabiltex supports. One of the most important considerations of the adhesive support was that it should support and retain all evidence of creasing from burial conditions. The softness and flexibility of this film ensured that this was achievable. Another important practical and aesthetic factor was that the adhesive could be easily removed from the substrate where it was exposed in areas of loss. This was considered essential because of the surface sheen and low Tg of Vinamul 3252. A method was devised using long fibre, machine rolled acid free paper. Small sections of paper (no larger than $5cm^2$) were laid rough side down on the exposed film and dampened with acetone using a cotton wool swab. The damp paper activated the exposed film and removed it when the paper was peeled away. This method proved highly successful and could be adapted to accommodate areas containing frayed edges or single threads which needed to remain adhered to the adhesive film. The adhesive also proved relatively easy to remove from the supported linen. Microscopic examination of the linen after a section of film was removed to create a 'viewing' window on the reverse of the tunic, revealed that there was no visible penetration of the fibres by the adhesive.

When complete, the tunic was given a secondary support of dyed cotton lawn which enabled supplementary stitching to be carried out. A mount which followed the outlines of the conserved tunic and gave additional overall support was constructed for display.

The decision making process which preceded the treatment of the third century tunic has evolved from the experience of many conservators and many conservation treatments. The testing programme formed the base which facilitated the decision but the testing programme itself results from

the collective experience of many years of adhesive use in the section. A greater range of adhesives and support materials has made it necessary to identify with far more clarity the criteria necessary for a particular application. Greater knowledge of the physical and working qualities of a number of adhesives combined with experience of treatments which have succeeded or failed in the past have made it easier to make a choice which is more appropriate to a particular condition. Application techniques and anticipated results are notably more refined and sophisticated. The ten years between the treatment of these two tunics has seen enormous developments in the profession resulting primarily from open exchange of experience and information and collaboration between conservators from different training schools and approaches. It will be interesting to look back in ten years time and re-assess again.

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STICKY DRESSES - THE RE-CONSERVATION OF THREE EARLY 19th CENTURY DRESSES

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Introduction

A major costume exhibition, In Royal Fashion, held at the Museum of London in 1997 gave the textile conservation section the opportunity to work on a substantial number of clothes and accessories associated with Princess Charlotte of Wales (1796 - 1817) and Queen Victoria (1819 - 1901). Amongst these were three dresses of similar construction and with similar conservation problems. Each dress had been conserved in the past with an adhesive treatment and each required considerable re-treatment before display was possible. These previous treatments obviously influenced the decision making processes involved in the re-conservation of the dresses. The re-conservation illustrates where reversal of previous adhesive treatments of fragile costume is possible and warns of situations when it is not. Whilst the dresses form an interesting focus for discussion they were not approached as a group at the time but rather their treatments evolved on from one another as their specific conditions required.

The order in which the dresses were treated was dictated by outside demands such as the photography schedule for the accompanying publication to the exhibition and the current focus of the curatorial research. It was useful however that the first dress to be treated was the smallest and least degraded. Conservation issues could be worked out on a smaller scale and then went on to influence the approach taken with the other larger and more complex dresses.

The paper is divided into three parts; Part I describes each of the three dresses. Part II examines the previous adhesive treatments and the thinking behind the re-conservation undertaken. Part III discusses particular aspects of the re-conservation treatment and examines how the approach differed as the treatments progressed.

Part I

Description of the three dresses

The Blonde Lace dress

Dating from 1831-2, the dress was worn by the young Princess Victoria. It is believed to be her earliest surviving dress and is therefore of great importance. The double layered dress is constructed of blonde lace over cream satin. It has a full skirt which is gathered tightly at the back into a bodice with a deep 'v' neckline giving the characteristic low shouldered look of the period. The dress has very full, puffed sleeves decorated with satin ribbons and lace frills. The blonde lace is thought to be of French manufacture [1]. The ground of the lace net is covered with a single flower motif embroidered in silk floss. The lace net is made in narrow 6cm. strips which are joined together in an almost undetectable way. The deep scalloped, floral hem border was worked in a separate horizontal band and just as skilfully attached.

The Bellflower dress

The second dress to be treated was an elaborate three part ensemble associated

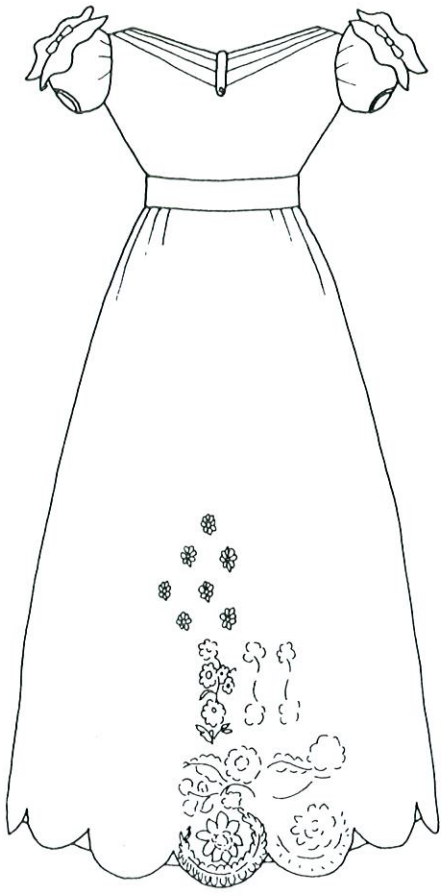

Diagram of the Blonde Lace dress

with Princess Charlotte of Wales. Thought to date from 1814-16, the bodice, skirt and train of silk net embellished with applied bell flower motifs has been described as, "an exquisite example of the Regency dressmaker's art." [2]. Made from cream, single pressed point silk net, the Bellflower dress is also believed to be of French origin[3].

The high waisted dress has a separate bodice with a low gathered neckline and short puffed sleeves. The full skirt gathers on to a ribbon, at the waist. The long train, almost three metres in length, is thought to have been attached at the waist. The main ground of the net is scattered with applied bell motifs of stamped card wrapped in cream silk floss. On the train, each bell enclosed a silvered glass bead. The skirt has two magnificent stems of three-dimensional bellflowers running down the centre front and around the hem. This is repeated as a single stem around the edge of the train.

Silk wrapped wires hold out the shape of each bellflower. They are covered with embroidered silk net decorated with silvered glass beads threaded along wire. The bells drop down from twisted stems of cord and strings of the glass beads

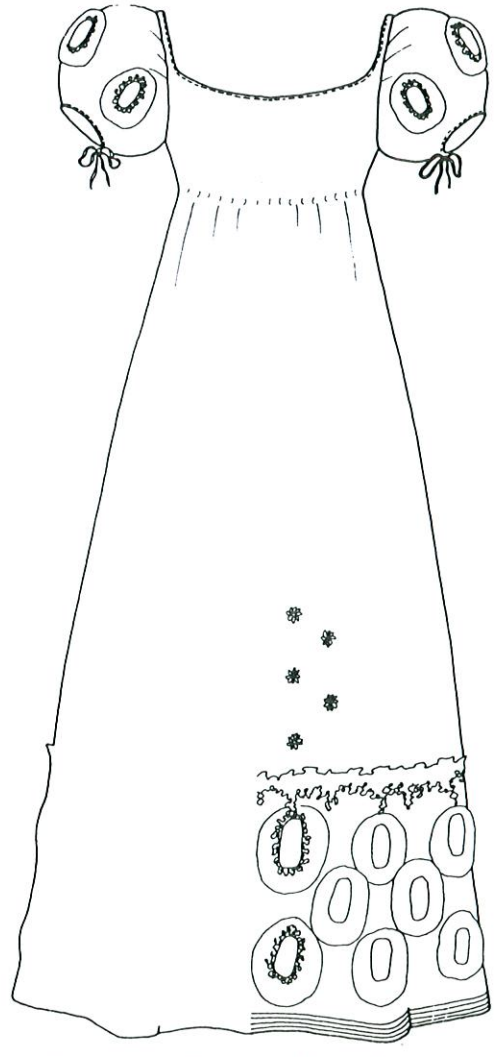

Diagram of Net and Floss dress

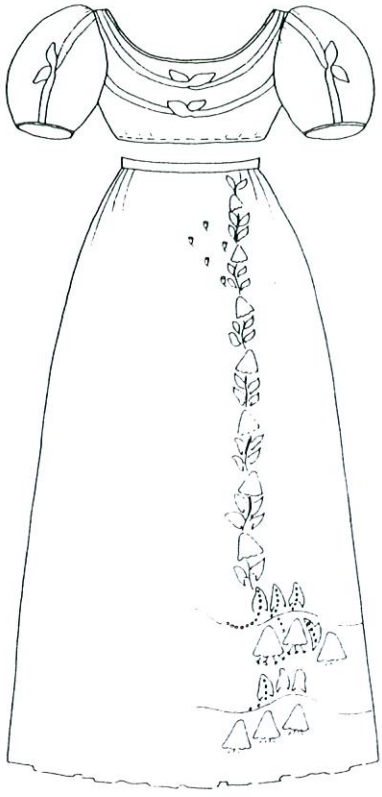

Diagram of the Bellflower bodice, skirt and train

intermingled with leaf motifs. The bellflowers even have dangling "stamens" of glass beads hanging from wire stiffened, chenille threads.

The Net and Floss dress

Also dating from 1814 - 1816 and associated with Princess Charlotte, this was the final dress to be treated. The dress is high waisted with puffed sleeves and wide oval neckline, which gather up on drawstrings. Like the Bellflower dress it is cream silk tulle but more simply decorated with a repeating eight petalled, embroidered flower. The single point, machine made, silk net is also thought to be of French origin [4]. The long, straight skirt is tightly gathered at the back with a deep ornamented hem. This takes the form of three rows of net puffs decorated with loops of tightly coiled, twisted silk thread surrounding strips of satin ribbon. The bottom of the dress is finished with a simple, pleated satin border.

Part II

Previous treatments

The Museum of London does not have comprehensive records of the three dresses but it has been possible to piece together some of their recent history. Interestingly there is reference in the main object files relating to the treatment of both the Princess Charlotte dresses, dating from the late 1960's. (Proper textile conservation records really only started in 1971.) The earliest of the accompanying photographs show that both dresses, already very fragile and splitting, appear to have been lined at some time with a fine muslin or cheese cloth. This was presumably removed during the previous treatment; the muslin from the Bellflower dress has been retained in the object file. The notes, rough diagrams and photographs relate mainly to the treatment of the Bellflower dress and show various stages of the treatment being undertaken. Included is an interesting list of instructions:

"1. Put it in the largest possible plastic bag with bicarbonate of soda - lots. After about a week take it out on a sheet.
2. Photograph the pleating at the top.
3. Undo the pleating at the top. Lay the train flat on the largest table in the library which must be covered by two blankets and a sheet.
4. Very carefully pin the tattered net into place, putting the pins into the blanket etc slantwise.
5. Cover the net on to it (sic) and iron with the light hand iron at 120°.
As many people as possible need to help as large pieces of net have to be used."

It would be interesting to know if these instructions were dictated by a more knowledgeable restorer/conservator. Notes relating to the conservation of a different dress in the Museum of London collection mention that the museum purchased ready-made adhesive impregnated net from another workroom. These notes also mention Mowilith as being the adhesive used, although unfortunately not which type[5]. It is probably fair to assume that it was either Mowilith DMC2 or the combination of Mowilith DMC2 and DM5 – both were being used elsewhere at this date, in textile conservation.

There are also photographs of the Net and Floss dress, labelled, "July 1968, before restoration, after cleaning", but unfortunately no written notes about the treatment. The cleaning in question appears to be lashings of bicarbonate of soda, like that used with the Bellflower dress - the photos show it being brushed in/off with a large paint brush. One can also see a tantalising glimpse of one sleeve which at that stage appears to still retain a lining or sleeve from the under dress. The original double ribbon drawstring system at the waist is also visible in the photograph but which now no longer exists.

Other notes describe the treatment actually given to the Bellflower dress, presumably following the list of instructions, "Received in a very fragile and rather soiled condition. Cleaned by immersion in dry bicarbonate of soda. Mounted with nylon net impregnated with adhesive. This involved unpicking the garment - a careful record was made of all seams, gathering etc., with photographs, drawings and measurements. A new under dress was made of cream twilled silk."

Like the 1990's re-conservation, we assume that the other dresses were treated at around the same time, in the same way - for a specific display in 1968. Notes dated January 1969, relating to the conservation of the dress associated with Princess Charlotte's wedding, mention the treatment of the Bellflower dress too. They say that reference should be made to, "the

waist of the skirt of the dress from Princess Charlotte's trousseau, recently mended and now on show and made of similar net." The notes on the wedding dress mention a problem with the adhesion of the net caused by the, " weight and slipperiness of the silver strip embroidery", and interestingly go on to state that the net was therefore, "secured with stitching through the embroidery". This is the only reference to any supplementary stitching being thought necessary with the previous adhesive supports.

The past treatment documentation, though not nearly as detailed as current day conservation records at The Museum of London, did prove useful. It gave us some quite clear indications of what was done in the late 1960's and what was done before. The diagrams with all their measurements turned out to be imprecise when compared with the objects. Either the measurements were taken inaccurately in the first place or they do show the exact measurements of the dresses before they were taken apart and treated – and indicate poor re-construction techniques. The pre-treatment photographs of the Net and Floss bodice provided help in correcting wrongly set sleeves. The photographs also show the extent of the bi-carbonate of soda treatment and indicate the condition of the dresses in 1968.

The 1990's conservation treatment records are far more extensive and probably amount to many hundreds of words of assessment of previous treatment and current condition, justification of re-treatment decisions, documentation of re-treatment, diagrams and before, during and after conservation photographs. Due to a change in staff, the conservation records for the Blonde Lace dress and the bodice and skirt of the Bellflower dress were invaluable. However, despite the improvement in documentation, it proved to be what was not said that caused an inconsistency in the treatment of the train. This is discussed further in Part III; the point worth making here is that the conservator needs to be aware of the future interpretation of our records. This particular error happily resulted in an improvement in the treatment but it is an inconsistency in the treatment of the three part dress and could perhaps be questioned ethically.

Decision to re-conserve the dresses

The condition of each dress and each past treatment was carefully assessed. The dresses had to be treated and minimal treatment was not appropriate for a number of reasons:

- despite some of the dresses selected for the exhibition showing signs of extreme weakness, the option of displaying in a less stressful way than being mounted on a body was not permitted.
- the dresses had to be made strong enough for staff other than conservators to handle during the numerous body fittings, which were under curatorial control.
- the dresses had to be strong enough to withstand being mounted for a period far longer than the actual exhibition; the photography commenced more than two years before the exhibition opened and during the intervening period many of the costumes had to be stored mounted.
- it is not known whether the bi-carbonate of soda treatment given to both the Bellflower and the Net and Floss dresses, has had a detrimental effect on their condition. A cleaning element in the re-conservation treatment would perhaps help remove any remaining residue and leave the fibres with a more neutral pH.

General assessment of the previous adhesive treatments

In all three cases the previous choice of an adhesive support had worked very well; over all the adhesive bond was still holding

including in the weak fragmented areas. The problems now apparent mostly related to the application technique. These included:
- the inappropriate use of patches when a full support would have been less damaging;
- the haphazard application of the support regardless of the structure and seams;
- the bunching and folding of both the original fabric and applied patches;
- the over heavily, "impregnated" adhesive net often resulted in a stiff, sticky and shiny surface;
- the lack of any supplementary stitching;
- the lack of attention given to realigning damaged areas accurately subsequently causing distortion and damage to the original fabric.

These kinds of observations about a previous treatment are relatively easy to make thirty years later with the benefit of major developments in the use of adhesives in textile conservation. They are certainly not meant as criticisms. Two very basic facts emerged from the assessment and they are:
- that the decision to use an adhesive support was the right one;
- that if the dresses had not been treated in this way or if they had been given poorly executed stitched supports they would probably have not survived at all.

Decision to re-conserve using an adhesive technique

The above factors set the parameters for the choice of treatment and contributed to the decision to continue using an adhesive technique in the re-conservation of the dresses. Other factors included:
- the simple fact that the previous adhesive treatment had worked.
- if a stitched support was undertaken instead, the amount of stitching required would be so huge that it would be very visually disturbing.
- it is debatable whether a stitched support could have held down the fragmented lace and tulle adequately.
- in any case, with the time scale available, a stitched support would have been too time consuming.
- each of the dresses had the potential to take many hundreds of hours to re-conserve and formed only part of a very extensive conservation programme. The needs of the individual object had to be balanced against the staff available, the needs of the other 200 or so other textiles in the exhibition and the textile conservation section's other museum duties.
- a sandwich of a transparent fabric with stitching was discounted as it would have been aesthetically unacceptable and would have adversely affect the drape of the dresses.
- the decision of whether to re-conserve with a new adhesive support became even more complex with the second dress to be treated, the Bellflower ensemble. The decision was reviewed after the treatment of the bodice and will be discussed fully in Part III.
- consequently the re-conserved parts needed to be compatible with the previously treated areas, when total reversal was not possible.

Part III

Reversal technique and wet cleaning

The previous adhesive net was found to peel away easily from both the silk lace and the net using a 50:50 solution of Industrial Methylated Spirit (IMS) and deionised water. The solvent was applied using swabs of cotton wool, left for a moment and then the net was gently peeled away from the object. Fresh swabs of solvent were then applied to flush out the excess adhesive. Black paper sandwiched in Melinex was placed behind the areas to be treated, to aid visibility, particularly when

overlapping patches of adhesive net had been used.

During the removal of the patched support from the Bellflower bodice it became clear that the silk net was in worse condition than originally surmised. In large areas the net had split along the lines of holes in the weave, leaving narrow zig zag shreds. The shreds had a tendency to curl up when the support was removed. When all of the support had been removed, the bodice was left extremely fragmented, fragile and tacky, due to the excessive amount of adhesive that had been used.

When the dress being treated was also to be wet cleaned, the reversal procedure moved straight into wet cleaning, with the second swabbing through of fresh solvent being quite liberally applied in the wash bath[6]. The use of very dilute washing solution was found to improve the final stages of adhesive removal. This was not done however, with the Bellflower bodice due to its fragmentary condition. It was the first of the tulle pieces to be wet cleaned and there was very great concern that it was too weak to withstand the wet cleaning process. With hindsight, this was probably the wrong decision as the bodice survived intact and still seemed grey and slightly soiled after wet cleaning. This may indicate that not quite all the adhesive was removed and what remains may be holding on to some dirt. Whilst it is difficult to directly compare two different objects, the adhesive on the Net and Floss dress seemed to reverse very well and the dress emerged from the wash bath very clean and lustrous. During the wet cleaning of both the Bellflower bodice and the Net and Floss dress, large silk screen printing screens that had been used first to aid air circulation in the drying of the Blonde Lace dress, proved extremely useful. They enabled the solvent carrying the reversed adhesive to pass freely through the object, reducing the risk of it being re-deposited elsewhere. This was one example of the treatment techniques evolving from one dress to the next.

The wet cleaning of the dresses followed the normal procedure used for the washing of very fragile costume and layers of Reemay were used for protection and support. When cleaning the Net and Floss dress, a lower percentage washing solution than usual was used (0.05% Synperonic N and sodium carboxy methyl cellulose in deionised water). Because of the extreme fragility of the Bellflower bodice, the water level was raised to just above the object held on the screen, without causing disturbance to the weak fibres. The water level was then adjusted up and down to encourage slight suction between the base of the screen and the main body of the water, to help release the soiling.

Realigning weave structure

The blonde lace was intact enough to not require realignment but with the Bellflower bodice and the Net and Floss dress it proved safer and easier to realign the structure of the net by working over small areas, after the object was dry. Black paper sandwiched in Melinex was placed behind the net to be realigned and small areas were re-moistened using an ultrasonic humidifier. The threads could then be gently straightened and the weave gradually re-established. This was a painstakingly slow process. Very great care had to be taken to avoid further splitting the net; often the slightest shift of the damp net in one area could pull apart another. Very degraded, split net is impossible to completely realign. Whilst one can straighten the vertical strips, they have stretched and the flexibility of the net has gone. It is therefore not possible to line up the vertical strips without leaving gaps in between. Great improvements could be made however, as this was an

aspect of the previous treatment which seemed to have been ignored.

The presence of the net puff decorations on the net and floss dress caused a problem with realignment after wet cleaning; it was first noticed when the sleeves were wet cleaned. The layers of net involved in the puffs and the net beneath, tended to dry in one mass. When the skirt was wet cleaned individual collars of Reemay were placed beneath each puff and this, combined with manual re-puffing as the skirt dried, proved very successful.

When re-aligning the sleeves from the net and floss dress, the decision was belatedly taken to snip the split net along side each seam, to enable the sleeves to be laid flat. At the time, this seemed the lesser of two evils and meant that the original seams could be left intact. As costume conservators, we are so aware of not wanting to disturb original construction and stitching that we sometimes fail to see the whole costume and get way-laid in the fine detail. With hindsight, if these few centimetres of the net had been cut prior to adhesive removal and wet cleaning, some damage to the sleeves could have been avoided. It illustrates that we perhaps need a greater flexibility of thought and approach when dealing with very tricky costume conservation problems.

Choice of support

It seemed obvious that where old adhesive patches had been removed, the application of full supports would be more appropriate. Aspects of the previous treatment had worked well; the choice of net was one of them. Shying away at first from using net, other semi-transparent support fabrics were considered, such as silk and polyester crepeline. However these proved too opaque behind the lace and the net where the transparency of their structure was integral to the appearance of the dresses. The sheen of the satin under layer of the blonde lace dress was obscured by the crepeline; this was equally problematic with the net dresses, where the missing under-dresses would have been revealed glinting through the net.

Textile conservators appear to have made a definite shift away from using net in conjunction with adhesives in the last decade for a number of reasons[7]. The pressure used in the heat sealing process can cause an impression of the net on the textile being supported. This can be permanent even after reversal of the adhesive. Some conservators have also experienced old adhesive net treatments peeling away by themselves and so question the suitability of net as a support. However this seems to have usually been when net was used to support compound weave structures and when no supplementary stitching had been worked.

Nylon has also been found to degrade more quickly than other fibres. However, it was interesting to note that where untreated silk crepeline had been used as a covering for the waist drawstring on the Bellflower bodice in the 1960's conservation, it had degraded completely and crumbled to the touch. Evidence from the dresses showed that the nylon net had not degraded noticeably. It was still strong and supporting the areas as intended. It may be that the thermoplastic adhesive and the nylon net form a composite material with different characteristics to the individual parts. This is an area of research which has been neglected in adhesive testing programmes. However, Irene Karsten is currently studying the interactions between adhesives, supports and supplementary stitching threads in degradation scenarios[8]. It will be interesting to hear if her findings indicate that new composite materials are in fact being created.

Choice of adhesive

Vinamul 3252[9] was chosen as the most appropriate thermoplastic adhesive to use. One of the main reasons for this choice was that the conservators involved had considerable experience of its use and were familiar with all its characteristics. The adhesive had performed well in the Victoria & Albert Museum's evaluation programme of adhesives for use in textile conservation[10] and also in the earlier Courtauld Institute assessment of thermoplastic adhesives[11]. A soft, more fluid adhesive is necessary in the conservation of costume because it is important to retain the drape of the textile. Experience of using Vinamul 3252 indicates that the low Tg of 3°C does not adversely affect the performance of the adhesive in stable conditions. In fact, it feels noticeably less sticky than Vinnepas EP1 which has a slightly higher Tg of 4°C and has a very similar tackiness to Mowilith DMC2 which has a Tg of 10°C.

A far lighter adhesive film than had been used previously on the dresses was needed. The Blonde Lace dress did not require structural support as it had a sound under-dress. The adhesive net was required to give cohesion to the damaged areas and was to be strengthened with supplementary stitching. The two tulle dresses required a lighter adhesive support than had been used before, to avoid the previous problems of stiffening and shiny surfaces. The seams and the weakest areas would be strengthened with supplementary stitching.

Application of adhesive

The adhesive film was to be made by stretching the dyed net over smooth, tightly pulled polythene. The tension of the net is crucial to the success of the film because the net loosens considerably when wet with adhesive. Old fold and crease lines in the net will re-form and lift, resulting in these areas being adhesive-free. The tension required to hold large areas of net taut enough causes distortion of the edges. Therefore a little extra net must be allowed for so that the edges can be discarded. The first time bulk adhesive net was made, for the Blonde Lace dress, adhesive tape was used to secure the edges of the net to the polythene. This did not hold well and care had to be taken to keep it dry. It was also very time consuming to apply whilst achieving the even tension. When the adhesive net for the Bellflower bodice was prepared, the much better solution of self-adhesive contact fastener (Velcro™) was hit upon. The hooked side of the fastener was stuck to the table on top of the polythene. The net holds well to the hooks and it can be laid out and then quickly and easily re-adjusted to achieve a tight, even effect. The soft side of the fastener can then be pressed in place, once the final positioning is achieved. The addition of a tacking thread running along the grain of the net and which relates to measured points on the table, also improves accuracy and prevents distortion.

As with all adhesive application, accurate preparation of the support is essential. As well as the weave being exactly aligned, it is important that the adhesive is evenly applied. The conservators involved usually make adhesive films by applying the adhesive with a small synthetic, decorating roller. A fine film drops through to the reverse of the support against the polythene. With a net film, the excess adhesive needs to be removed from the surface of the net with the wrung out roller to prevent it from settling in the voids of the weave. A second application of adhesive is not necessary or advisable as this simply collects thickly in the voids and results in the adhesive carrying the fabric rather than the fabric carrying the adhesive. Being able to see the adhesive as the film is cast is another way of achieving

even distribution, to this end a length of dark coloured paper was laid under the polythene.

For the Blonde Lace dress, test samples were made to ensure that the minimum amount of adhesive was used. Concentrations of 10%, 15% and 20% adhesive in deionised water were made up on net and each was heat sealed to black poplin and to net. The black fabric was used to help show if the adhesive was in-filling the weave of the net whilst the net heat sealed to net would indicate the strength of the adhesive bond. Silk crepeline samples were used as controls. A 10% adhesive film on crepeline gave quite adequate support when adhered to net but to achieve the same degree of adhesion with net supporting net, a 20% film was required. This is obviously due to there being fewer points of contact between the two layers.

Separate tests for the support of the Bellflower bodice were carried out. The adhesive net in this case needed to act as more of a structural support. It was necessary to establish if a higher concentration of adhesive would offer better adhesion without complications. Concentrations of 20%, 30% and 40% were tested. The results showed that a 40% film meant that exposed areas of adhesive under the holes were left extremely tacky and the supported net felt stiff. Similar, lesser problems with the exposed areas were experienced with a 30% film, however there was good adhesion to the supported net and no stiffening. It was difficult to assess whether the 30% film was better than the 20% film, which was not quite as tacky in the exposed areas and held well. A compromise was reached by deciding to use a 25% film.

Pattern taking

It is necessary to draw up exacting patterns of the parts to be supported so that the adhesive net can be correctly cut to shape, before it is applied. The over skirt of the Blonde Lace dress was found to be not cylindrical but A line. Cutting the support was further complicated by the fact that the skirt is gathered into the waistband and that the gathers are particularly tight at the back. It was decided to apply the net in four separate pieces following the pattern of the under skirt. Guide-lines were basted through the joins in the lace above the seams in the under skirt. Measurements were taken at various points between these lines so that patterns for each of the four sections could be drawn. The guide lines were left in place, to be used during the adhesion process. Patterns were also made of the bodice.

For the Bellflower dress, patterns were drawn up after wet cleaning and alignment of the weave had taken place. Reference was also made to the rough patterns taken from the misshapen bodice and sleeves before cleaning. By comparing the shapes of each sleeve against the other, patterns were drawn which took into account the areas of loss. A similar process was followed for the bodice. To ensure the patterns were correct, a toile was made up of the complete bodice and after checking it on a body, no alterations were found necessary.

A similar process was followed for the Net and Floss dress. Patterns taken of the bodice before cleaning and realignment showed up the distortions of the original net. This was particularly visible in the back and side pieces which had been originally shaped using the natural elasticity of the net. The degraded and aged net was no longer able to stretch. A more regular pattern was worked out by comparing the two sides and taking into

account the ribbon at the waist. Like most of the Princess Charlotte dresses, the bodice showed signs of having been deliberately cut larger on the right side.

The direction of the grain of the original fabric was marked on the patterns to ensure that when the adhesive support was cut out, it would match. The care taken in the pattern taking stage was worth while as an immediate improvement in the shape and hang of the dresses was apparent.

Adhering the adhesive net support using a heated spatula

To successfully apply the adhesive treated support to the object, it is imperative that proper access can be gained. This may, in very extreme cases, mean opening up original seams - as was the case with the shoulder seams on the Bellflower dress. This had not been done during the previous treatment and the result was a misshapen muddle. Being able to see the section to be adhered clearly is also advantageous and to this end black paper sandwiched in Melinex was placed under the area to be adhered. For the bodice of the Blonde Lace dress, where access was difficult, narrow spoon like probes of the black paper sandwiched in Melinex were made and used.

When applying the adhesive net to the underside of the skirt of the Blonde Lace dress, the support had to be worked up into the highly gathered waist line. The guide lines from the pattern taking had been left in the lace and the adhesive net was aligned with these and adhered from the flat hem area up towards the waist. Only a small section of polythene backing was rolled away from the adhesive net at a time.

The bodice of the Net and Floss dress created different problems due to the intentional stretching of the original silk net by the dressmaker when the dress was made. Adhesive treated net will not stretch in the same way and so it was not possible to align the grain of the original net with the support net. The support net was aligned with the centre front of the bodice, which was on the straight of the grain. But when one attempted to follow the construction and put in the darts, the shoulder corners of both the new and the original net became distorted. To avoid setting in these distortions, the support net was allowed to run off grain over the darts and the rest of the bodice. In this case, it was felt better to support the original net as smoothly and evenly as possible than to rigidly follow the original construction of the bodice.

The temperature set on the heated spatula was 90°C but the actual temperature of the base of the attached foot was between 65-71°C. To ensure that one uses the optimum temperature for a particular thermoplastic adhesive, it is advisable to test the spatula iron as there often seem to be quite big differences between the temperature setting on the dial and the actual temperature of the foot.

Adhering the adhesive net support using a vacuum hot table

Whilst treating the Net and Floss dress, it was decided that it would be appropriate to use a vacuum hot table to adhere the net support to the skirt. There were worries that because of its large size, it would be difficult to achieve an even application of the adhesive support with a spatula iron. To this end arrangements were made to hire the facilities at the textile conservation studio at the V&A.

After the previous adhesive net support was removed, the skirt was wet cleaned using the large wash table at the V&A and the original net was realigned. The appropriate pieces of adhesive treated net were tacked in place over the back of each

skirt panel using a spatula iron. The support net was overlapped at the seams and the excess was trimmed away. The net puff decorations around the bottom edge had to be protected from the vacuum suction or they would have been flattened and partially adhered to the support. After some deliberation, this was done by positioning the decorated area of the skirt off the vacuum table. The surface of the vacuum table was covered in thin Melinex and the skirt was placed on top, face up on the adhesive net support. It was covered in fine Melinex and the heat retaining blanket. The vacuum hot table was set at 60°C with a vacuum pressure of 40 millibars for 1 minute. After treatment, the adhesion seemed very good and even. The area of net behind the decorations was supported onto the adhesive treated net later, using a spatula iron.

Supplementary stitching

With each dress, supplementary stitching was worked down all the seams, through both the original fabric and the adhesive support, using silk threads. The degree and type of other supplementary stitching varied according to the individual requirements of the dress.

The very damaged lace around the waist of the Blonde Lace dress was brick stitched to the support, as was the lace around the holes. The sleeves were covered with dyed, untreated net. They were in relatively good condition and there was not enough access to allow any net to be inserted under the lace. Each embroidered flower was stitched to the covering net and this close contact avoided the lace being clouded by the net. The deep frills of lace on top of the sleeves were supported onto adhesive net and stitched. All the flowers on the bodice were also stitched down and the scalloped hem was over sewn to the support before it was trimmed to shape. The stitching is visible on close inspection but it is not considered disturbing from the viewing distance, when the dress is on display.

The bodice of the Net and Floss dress was not in quite such a shredded condition as that of the Bellflower. The weak areas were stitched to the adhesive support, using a couching technique. The skirt will also be couched after the dress comes off display; there was insufficient time to do so before the exhibition opened.

Support of the Bellflower skirt and train

As already touched upon, the three parts of the Bellflower dress did not receive the same re-conservation treatment. The bodice was in the worst condition; being very fragile, misshapen and having incorrectly re-set sleeves. It also had a very grey appearance, unlike the rest of the dress. If it had been left untreated, the bodice could not be mounted on a body and the curator saw the dress, displayed as originally worn, as being pivotal to the exhibition. The bodice was therefore re-treated. However mention should be made of the dilemma faced by the conservators in coming to this decision. If the same treatment could not be repeated on the skirt and train, would it be more ethical to leave the old adhesive treatment in place on the bodice? Unlike the skirt and train, the bodice was structurally very weak. After much soul-searching and discussion it was decided to tackle the bodice and then assess the treatment before proceeding with the skirt and train. It was fully realised at this stage that there was a strong possibility that the skirt and train would not undergo such drastic work.

After re-mounting the bodice on new adhesive net, it was decided that no more supplementary stitching other than stitching all the seams would be undertaken at this stage. The original net was in shreds and to double secure all

these shreds with stitching would have meant covering the entire surface of the bodice. This would have been unsightly and extremely time consuming. However, the bodice could be encased in net or in fact stitched, in the future, if felt necessary.

The experience of conserving the bodice which had been extremely difficult and time consuming - but rewarding all the same, made it obvious that the same treatment would not be suitable or viable for the other parts of the dress. Trying to reverse such large areas of fragile and very heavily adhered silk net would be extremely problematic and would inevitably cause damage. Taking this and the presence of the glass bead decorations into account, it was thought unlikely that a vast improvement could be made by a repeat treatment, however well executed.

As the existing adhesive support was still holding relatively well, time was concentrated on the worst areas. The unnecessary over-patches of net were removed. Where the net had been broken into detaching strips, it was stitched back on to the support using a brick-stitch technique. Larger areas of net which had come away from the adhesive net were re-heat sealed to the support which still carried a heavy coating of adhesive. This appeared to work but may well prove to be a temporary measure[12]. In some areas, where the silk net was folded and bunched onto the support, it was possible to gently ease it off and realigned it before re-heat sealing. A considerable number of the floss-covered bell decorations were also stitched to the support.

The edge of the train had been treated with several layers of adhesive net and was uneven and unsightly. It was decided to establish a new and more regular line for the folded edge which was very obviously the result of the previous treatment. Excess old repair net was cut off to reduce the number of layers in the turning. Extra, new adhesive net was added in, where the original net did not reach the new edge line. It was obvious in some places, that the original net had been cut in the past, probably during the previous treatment.

The three-dimensional bellflowers were badly distorted and flattened. Many were partially detached and had splitting silk net and broken wires. The silvered glass beads were extremely fragile; many were crushed and they were prone to shattering at the slightest movement. The bells had not been supported during the previous treatment but it was decided to support those on the skirt individually with nylon net and supplementary stitching. Purely by accident, a slightly different and better approach was taken with the support of the bellflowers on the train. The conservator in charge assumed that adhesive net had been used to support the bells on the skirt and therefore automatically used adhesive net for those on the train. In fact, a plain dyed net had been used as a stitched support. The adhesive net proved more effective.

Firstly, each bell was re-shaped by hand; the wires having remained pliable. A piece of triangular shaped adhesive net was inserted into the bell and heat-sealed in place. The new net was brought around the bell and extended down onto the net ground beneath the bell, for extra strength. Each bell was also re-secured to both layers of net with stitching along its lower perimeter. Further support stitching was then worked through the adhesive net along the lines of beads and the outer edges of the bell. Areas of split silk and weak embroidery were couched down to the repair net. The stamens were re-shaped by hand and re-attached as necessary. On the train alone, there were 96 bells.

The decision to focus the treatment on the three dimensional bellflowers and the worst areas of the skirt and train worked well. The over all appearance of the dress was greatly improved and the decision to leave the previous adhesive support in place, with a few subtle improvements, has proved very satisfactory.

Conclusion

After the re-conservation of the three dresses, each was able to be mounted on figures for the exhibition and appreciated once more, much as they were worn. The longevity and relative success of the previous adhesive treatments, prove that this type of treatment can work with very fragile costume and that the right treatment decision was made at the time. It is our collective experience, as textile conservators, thirty years later, that has enabled us to improve on the application technique rather than the choice of treatment. The re-conservation of the Blonde Lace dress and the Net and Floss dress prove that it is possible to reverse old thermoplastic adhesive treatments, even when the original fabric is weak and degraded. However the life of the original fabric should not be thought of as infinite and the condition of the textile will eventually reach a stage where reversal is not practical or in fact possible. The approach taken with the re-conservation of the Bellflower dress perhaps illustrates where the limits to reversal and re-treatment of an elaborately decorated and very fragile piece of costume lie. The compromise approach taken with the re-treatment of this dress has proved successful, at least in the short term. Given the particular problems of the dress and the given circumstances, this was seen as the best treatment option available and has enabled the public coming to the exhibition, to appreciate some of the former splendour of the ensemble.

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A DECADE AND A HALF OF HINDSIGHT: TWO ADHESIVE TREATMENTS RECONSIDERED

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Introduction

Two past conservation treatments involving an adhesive technique for textiles recently required further attention. This afforded an opportunity to observe the successful aspects of the treatment, as well as to assess how and why certain elements of the technique had failed.

In 1979 two late nineteenth century regimental banners of embroidered silk were supported on silk crepeline cast with a film of Mowilith DMC2 (vinyl acetate - dibutyl maleate co-polymer dispersion). They were also faced with a stitched covering of nylon tulle. Since that time they have hung in the open environment of a chapel on St Michael's Mount, an island off the coast of Cornwall.

In 1982 an early nineteenth century Turkish robe of fine figured silk was supported on nylon tulle coated with Mowilith DMC2. The costume has been on display since then in a showcase at Arlington Court, Devon.

Both treatments employed the same adhesive but other factors vary: the character and condition of the original textiles, the choice of substrate materials, the means of application, the mounting and the environment of display. In both cases the adhesive bond of Mowilith DMC2 has proved lasting, while other factors have ultimately failed to maintain the preservation of the textiles.

These treatments are characteristic of their time: after a decade and a half of evolution, the adhesive technique had become an accepted means of supporting textiles and was most often used in these two 'standard' methods of application. An appraisal of past treatments provides a chance to evaluate how adhesive techniques and conservation thinking have further evolved another decade and a half later.

Two nineteenth century regimental banners

The two regimental banners from St Michael's Mount date from the late nineteenth century. One is in the form of the Union flag with the crosses of red, white and blue seamed together as single layers of silk. The central red cross contains embroidered motifs which are worked so that they can be viewed from either side, and inscriptions - embroidered onto a yellow silk - which are applied to both face and reverse.

The second banner has a similarly seamed union cross in the top corner. Its main ground is of a single layer of red silk decorated again with double-sided embroidery motifs and applied inscriptions. The central area, however, has a second layer of silk to take the weight of a Crest worked densely in metal thread on both sides.

Each banner has fringing around three edges and a sleeve for hanging on the fourth. Photographs taken prior to the 1979 conservation show the traditional manner of hanging such banners at a very steep angle. The diagonal folds of drape and the additional tensions created by the diverse embroidered motifs had inevitably caused tendering and splitting in the ground silks.

The conservation treatment given to the banners in 1979 used well-established materials and methods. Silk crepeline was cast with a film of Mowilith DMC2,

applied with a brush over a release surface (a sheet of polythene or Teflon-coated glass cloth). The crepeline-film was then heat-sealed to the reverse side of the banner. Within the union crosses, the colour and direction of weave of the different silks has been followed. Prior to the heat-sealing, it seems that the applied inscriptions had been covered with nylon tulle held by stitching. Also, the second layer of silk in the centre of the Crest banner had been supported on an adhesive-coated tulle.

The face side of each banner had been then totally covered with untreated nylon tulle held in place by stitching along seamlines and around the edges when the fringing and sleeve were reattached.

In 1996 - 17 years later - additional conservation was considered necessary, and it was most interesting to observe how this first treatment had served the banners in their particular conditions of display. The durability of nylon tulle and silk crepeline on 'open' display has often been questioned, and it has been doubted that Mowilith DMC2 could maintain a lasting bond in environments of high and fluctuating humidity.

Firstly, the covering of nylon tulle, although it was creased and seemed to have acquired a white deposit (perhaps sea salt?), still appeared and felt relatively strong and supple; it was continuing to perform its intended function of protection.

Moreover, the bond of the adhesive Mowilith DMC2 was certainly continuing to consolidate the two types of deterioration present in the silks: the soft degradation within the white silk and the more brittle condition in the red. It was noted, however, that adhesion had been rejected by some of the embroidered motifs and here the crepeline had a tendency to crack away around the outline.

Indeed, the one significant failure of the treatment overall was in the silk crepeline. Throughout, the crepeline was seen to be breaking-up along the foldlines of drape which had reformed when the banners had been hung again.

It was agreed that the new conservation should retain the bond which was already established with the Mowilith DMC2. The silk needed this type of consolidation: to reverse the adhesive treatment and replace it with another would have subjected the fragile textiles to an unnecessary stress.

The banners now required additional support with a layer of Stabiltex™ (polyester crepeline), stitched to cover the reverse side. Although the nylon tulle on the face side seemed still to be strong, it was decided that this should also now be replaced by Stabiltex™. Thus both sides of the banners would be given a consistency not only in visual appearance, but also in long term stability and drape.

The fringing was temporarily removed while the banners were now supported between two layers of a ready-dyed Stabiltex™. This time, more extensive stitching was made, not only along the seamlines but also through the splits in the silk, using fine polyester thread (Skala). A thicker thread (Mara) was used to support the heavy metal thread Crest and also to finish the edges before the fringes were reapplied.

When the banners were returned to display in the Chapel, the flagpoles were altered to a horizontal position so that the textiles can now hang under less stress of drape and, indeed, so that the embroidery and inscriptions can be better appreciated.

Anteri, a Turkish robe

The young girl's anteri - a Turkish robe - is displayed at Arlington Court alongside a portrait of Caroline Chichester as a child, wearing this very costume in 1849. The robe is of a silk, woven with alternate stripes of pink figured satin and green taffeta. It is edged with pink and green cord trimming and lined with soft loose-weave cotton.

Past records note its condition and its conservation treatment in 1982. At that date, the back panel of silk was supported by heat-sealing onto nylon tulle which had been coated with Mowilith DMC2. In another 'standard' practice of the time, the adhesive was most likely to have been applied while the net was suspended so that it did not touch the work surface. A specially designed 'net-table', such as the one at the former Osterley Workshop, employed two sets of beams which could be bolted together to hold either end of a section of net. (The beams were padded and covered with a release material.) A small sponge was used to spread the adhesive evenly over the yarns without filling-in the spaces. Once one coating of adhesive was dry, another could be applied until the required 'strength' was achieved.

Problems of tension could be encountered with this method. To maintain the natural state of the knitted structure was difficult: the net needed to be fairly taut for the application but it tended to sag after each coating, whether because of the presence of the adhesive or the action of sponging - perhaps both. It often required re-tensioning after each application and thus the adhesive would have set the knitted structure in an overstretched state.

It has been observed elsewhere with textiles supported on such net, that, over a period of time, the net appears to have a tendency to revert towards its former dimensions. The support then becomes too tight, stressing and intermittently breaking the adhesive bond, consequently creating wrinkling in the textile. This is what seems to have happened with the Turkish robe.

In 1996 - 14 years on - the conservation and mounting of the costume were reconsidered. Now, the condition of all the silk was re-assessed. Across the waist area covered by the sash, the original colour, 'body' and integrity of weave are well preserved; in contrast on the sleeves, tendering by light and wear has caused fading of colour and loss of strength.

One lower section of the back panel is disfigured by pale orange-coloured blotches and within this staining the silk is embrittled and has split. Here the adhesive treatment remained essential and the net was still giving it appropriate and sympathetic support. Elsewhere, in the stronger, more supple areas of the back panel - perhaps where the silk had needed more freedom to drape and drop - the net was causing problems. The back panel certainly required support, particularly across the shoulders, but with hindsight it was considered that a more accommodating result could now be achieved by a stitching technique. The sleeves and front panels, previously untreated, would also benefit from support by stitching.

The lining and trimming of the back panel, restitched after the previous treatment, were unpicked. It was agreed that the net should be removed from all but the brittle area. The bond of adhesion proved still very strong. Trials were made to soften the Mowilith by a warm air current - a method known to be easily successful with more fibrous cotton textiles - but it was found that the silk required too much potentially distorting manipulation. A preferable method was to use damp poultices to swell

the adhesive and gently release the bond.

With this method, it was possible to remove most of the net section by section but to retain it selectively within the brittle area, trimming away from each stripe individually to avoid creating one sharp edge across the weave which could cause a line of weakness.

It was decided that all the silk should now be given a total support of Stabiltex™ (polyester crepeline) held by staggered stitching down each stripe using fine polyester threads (Skala and pulled Stabiltex™, as appropriate). The weakest, softest and most vulnerable areas across the shoulders first required a visually and physically more solid backing of habutai couched. The brittle area retained its consolidation of Mowilith DMC2.

The back panel was worked first. The original stitching of lining and trimming - lost in the previous conservation - could now be imitated by copying that on the front panels. Later, when this stitching on the fronts and sleeves was released to facilitate their conservation, it was found that the original threads could be carefully pulled out and preserved, then subsequently replaced, as far as possible following the original stitch-holes, once the silk had been supported.

It is interesting to note how much more documentation of conservation is respected and required, a decade and a half on. The complete new mounting of the robe tries to reflect more closely the original wearing of the costume as portrayed in 1849.

Conclusion

Observations made during the reconsideration of the two treatments were purely practical, although it would still be possible to make a more scientific analysis of the performance of each of the materials.

There is certainly no criticism of the conservators involved in the first treatments: these were accepted materials and methods of their time. It is through observation - and with hindsight - that new treatments can be refined.

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I am grateful to Jane Lewis for encouraging me to write this paper and for reading it at the Forum.

RE-EVALUATING THE APPLICATION OF ETHYLENE VINYL RESIN-BASED ADHESIVE (BEVA 371) FOR TREATING TEXTILES AND COSTUMES.

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This paper will review the application, advantages and history of using ethylene vinyl resin-based adhesive, commercially known as Beva 371, to stabilizing textiles and costumes. This paper will discuss the success of using this adhesive in the stabilization of shattered silk. In particular, the paper will focus on the treatment of an 1890 silk costume, treated in 1984 using Beva 371, and the re-examination of the gown in 1996. This costume is part of a permanent exhibition of twenty-four Inaugural gowns from the State of Arkansas dating 1890 to 1980. The gowns were worn by the wives of the Governors of Arkansas including the first Inaugural gown worn by Hillary Rodham Clinton.

My formal training in textile conservation began in 1975, and consisted of internships at four major museums of the East Coast of the United States. This pragmatic training was based on hand sewing techniques to stabilize textiles and costumes. This practicum did not include training in adhesive treatments or an investigation into their possibilities. Therefore, my attitude reflected the position of my mentors at that time that adhesive treatments were not appropriate for textiles. However, it was becoming clear to me by the 1980s that hand stitching techniques alone could not treat the wide range of textile problems I was encountering on a daily basis in an active laboratory. This was especially so for the light-weight fabrics used for costume.

Sometimes when confronted with a seemingly impossible problem, innovations, adaptions, and growth, rather than entrenchment can result. In 1983 the Indianapolis Museum of Art received a collection of twenty-four Inaugural Gowns for treatment from the State of Arkansas dating from 1890 to 1980. The gowns were worn by the wives of the Governors of Arkansas and represented nearly a hundred years of fashion and the personal taste of the Gubernatorial wives.

This collection was formed in 1955. Eighteen original gowns had been gathered and proudly placed in exhibit, and thereafter became Arkansas' best loved museum collection. Prior to this opening, the scant records show that the gowns had been cleaned by a firm in New Jersey, and treated with a preservative, called "Formula X". The exhibition at Arkansas' First Ladies Gowns drew thousands of visitors over the next twenty seven years, and the number of gowns grew to twenty four. By 1982, the gowns were showing the effects of permanent display. During this time, the Old State House did not have air conditioning to mediate the heat and humidity of Arkansas' unrelenting summers. Gowns were grouped in glass and wood cases. The cases were illuminated with overhead fluorescent fixtures, held approximately 6" above the shoulders, and natural light from windows. The toll on these costumes from this environment and lighting was extensive.

In 1983 each costume was examined, and conventional treatments were proposed based on their condition, ranging from cleaning to extensive stabilization. Decorative trims on a mid 1920s gown were reinforced with couching stitches and selected areas of beading were stabilized

with new cotton sewing threads. Slits, tears and loss were stabilized in conventional ways. A cotton and silk lace gown worn in the 1940s was treated with pulled silk organza threads using couching stitches onto an underlayment of dyed nylon net. A gown from 1913 had massive shredding of the lace net and chiffon in the bodice. The sheer layers were separately enveloped with underlayments and overlayments of organza and net, and stabilized with pulled silk organza threads and running stitches.

The earliest gown from 1890 was especially vexing. The fluorescent lighting and humidity had accelerated the breakdown of the weighted silk. The pink silk brocade had loss, tears, a powdery surface, a crisp hand, and prior treatments of pressure sensitive tape. Conventional stabilization techniques using needle and thread and sheer fabrics, would have only perforated the structure and caused the fabric to break down further. This seemed to be a perfect candidate for an experiment rescue mission.

Fortunately, at this time I was working with a dynamic conservation staff at the Indianapolis Museum of Art with specialists for paintings, objects and works of art on paper. By the early 1980s the use of adhesives for support and the consolidation of tears and loss had become widespread in other conservation media, especially paintings. My painting conservator colleagues encouraged me to do some controlled tests with adhesives. So, with great doubt and reluctance, tests were started at the lab bench and spray booth.

The crystalline nature of most adhesives seemed antithetical to the flexibility of a textile structure and prompted a good deal of skepticism about their usefulness for textiles. What I wanted was an adhesive that would allow for drape, ease of handling, a degree of reversibility, and something that would not harm the textile or, with proper precautions, the conservator. Experimentation with polyvinyl acetate resins (PVA's) and wheat paste solutions showed that they had a short time frame for maneuverability before setting up, slow drying time, propensity for moisture to wick into fibres, and added a crispy hand to the treated textile. Next, ethylene vinyl acetate resin-based adhesive, hereafter referred to as Beva 371, was tested. Developed by Gustav Berger as an adhesive for use in relining paintings, this adhesive retains its flexibility and will stick to virtually anything except silicone release paper.

For paintings, Beva 371 is removed from the can at room temperature and mixed with equal parts of VM&P naphtha or other solvents. It is then warmed in a double boiler over a water bath until clear and liquid. In this warmed state, Beva 371 can then be applied to the carrier fabric, such as fiberglass, or to the back of a painting, with a medium nap paint roller, or flocked onto the fabric with a spray gun. It is important to note that this must be done with an exhaust system, or wearing an appropriate respirator. The coated fabric cools quickly, and then is left to cure for twenty-four hours.

Most textile and costume structures are lighter in weight than in painting canvases. Hence, a heavy application of Beva 371 provided by roller would be inappropriate. Excess adhesive, when heat set, could move into the textile and give it the appearance of being wet. Therefore, the possibility of spray coating or flocking the surface of the carrier fabric was considered. Tests were conducted using the following variables: different proportions of Beva 371 to solvent; different combinations of air pressure and adhesive; different number

of passes of spray coats; and different carrier fabrics such as organza, chiffon, net, broadcloth, and muslin. It was found that the flocking attached itself equally well to all kinds of fabrics, leaving a whitish web-like residue on the surface. When cool, the flocked surface is dry to the touch, yet retains a degree of tooth. The Beva 371-coated carrier fabric adheres to numerous types of fibers and fabric structures with varying degrees of temperature and pressure. The flocking on the carrier fabric melts at 60°C, collapses, and, with moderate pressure, makes an immediate, strong bond with the surface of the textile. Where there is textile loss, the Beva 371 moves away from the surface and into the interstices of the carrier fabric. If the exposed carrier fabric areas are not heated, the Beva 371 can also be removed with a solvent carried in a cotton swab, using a rolling action.

With this information in hand, I was keen, yet skeptical to try this technique for the stabilization of the Eagle gown. A pink organza fabric was spray coated with Beva 371-coated underlayments were then heat-set using a Sealector II® tacking iron, and with a layer of silicone release paper between the spatula and the surface of the costume fabric. Since the organza was sheer, the treatment concentrated on stabilizing the gown, not aesthetically compensating the design loss. I was pleased with the results, the relieved to see no deleterious affects to the costume. The costume was then placed on a custom-designed mannequin and then shipped to Arkansas in its own padded box. There the costumes were placed in an environmentally controlled exhibition space with visitor activated lighting. The treatments were well received by the administration and the viewing public.

After this personal breakthrough, subsequent experimentation and utilization showed that Beva 371 had further beneficial qualities: Strength, reversibility, pre-consolidation, colour blending, flexibility, and ease of use. The following case studies will illustrate these properties.

A late nineteenth century suite of furniture in Cincinnati, Ohio proved to be a vehicle for Beva's 371 qualities of strength. The scrim fabric was badly ripped due to the jute bands giving way and the metal springs breaking through. The scrim was removed by extracting the tacks and moving the fabric away from the tack heads. The scrim fabric showed fraying and extensive parallel tears at the sides, and around the tack heads. Glazed cotton scrim was a very common and inexpensive fabric in the late nineteenth century used to cover backs and bottoms of furniture. Due to its low worth it could have been replaced with a modern fabric. However, it was the intention of this pilot project to preserve as much of the original construction and material as possible. Conventional hand sewing of the scrim fabric to a fabric support would have been prohibitive in time and cost, an especially important consideration since this fabric would not be seen. Hand sewing may also be extremely intrusive to the structure, and may not produce a stable structure capable of withstanding tension when attached. The thermoplastic adhesive was chosen to stabilize the scrim. The scrim fabric was first realigned with controlled heat, pressure, and steam. A brown polyester organza was spray coated with Beva 371 in the same manner as before. The brown carrier fabric was then cut into strips and then placed on the back of the scrim fabric. Initial placement was made with finger pressure and then the two surfaces were bonded with a heated artist's spatula. After the springs were re-tied, and new webbing was secured, the scrim fabric was then re-attached with the same set of tacks using the same tack holes. The Beva 371

spray-coated support fabric provided colour compensation, structural stabilization, and tensile strength without a great expense of time.

At 1803 costume worn by Charlotte Robertson, wife of the founder of Nashville, Tennessee demonstrated how flexible Beva 371could be. When unfurled from a shoe box, a pile of yarns proved to be a one piece dress, measuring 51" from the back neckline to back hem; hand constructed of a plain weave fabric of brown silk warps, indigo dyed cotton wefts, and gold and green warp-face brocaded stripes. There were major areas of fading and/or yellowing of the blue cotton throughout, especially on the sleeves, upper bodice, and front skirt. There were extensive areas of brown silk warp loss throughout the entire dress. A dark blue organza fabric was spray-coated with a solution of equal parts naphtha and Beva 371. Lengths of the Beva 371-coated fabric were cut and then pinned out onto a work surface, flocked side up. The skirt panels were placed, face up, on the support fabric. Realignment of the dress fabric was achieved by pinning on the grain of the fabric. When areas were sufficiently aligned, initial bonding was made with finger pressure. This is possible because Beva 371at room temperature has a 'tooth' which allows for partial adhesion. At this time it is easy to lift or peel the dress fabric away from the Beva 371-coated support fabric. When the final adjustments were made the two surfaces were bonded with a heat spatula. Furthermore, the flexibility of Beva 371allowed the original fabric to retain memory, ie. evidence of use, creases, stitch lines, folds, etc.

Fragile silk flags also lend themselves to this method of consolidation. A Civil War flag from the 1860s was quite brittle with major slitting of the silk throughout. After wet cleaning the flag was stabilized with two different dyed organza fabrics that were sprayed-coated with Beva 371. The first step in consolidating the flag was to realign the silk fabric while the flag was face down. The silk was butted together and held in place with small strips of the Beva 371 flocked organza, acting as a bridge, and held in place with finger pressure. After a large area was realigned, it was then backed with a full lining of the Beva 371-coated organza.

Although the above costumes were not cleaned, subsequent work with Beva 371-coated fabrics has shown it to be useful as a pre-stabilizing step before wet cleaning. The adhesive is not soluble in water. When Beva 371is flocked onto nylon net and lightly bonded to a textile surface before wet cleaning it allows dirt, stains and accretion to be disposed into the aqueous solution, while still providing structural security to the object.

It has been nearly fifteen years since I first employed Beva 371as a consolidant for textiles. My own testing and observation met my original criteria for a suitable adhesive. With the advent of the UKIC Adhesive Survey I was curious as to how it would hold up under empirical testing. Recent studies by the Canadian Conservation Institute (CCI) published in **Studies in Conservation** 1996 have shown that Beva 371 has desirable properties in the categories of pH, volatiles, tensile strength and flexibility. However, in the yellowing category it was rated fair in dark aging, and poor in light aging. But, from my own first hand experience, I have not noticed any discolouration of the flocked surfaces. My observation is that once sprayed on the carrier fabric, it requires no special storage or handling. It appears to have a long shelf life, in that when a support fabric is spray-coated with Beva 371, the fabric can be used as soon as the solvent has volitized which is generally

within minutes, and/or can be used ten years later. To continue my own personal investigation into the long term results of using Beva 371, I thought this was a good time to look back at my earliest treatment of 1984.

In November of 1996, the day after the presidential election, I returned to Little Rock to assess the collection of Inaugural gowns. They had moved the precious gowns in July to an off-site facility to allow for extensive foundation repair and HVAC upgrading of the Old State House. It was good to see the gowns again, still on their mannequins and lined up, not unlike the famous Chinese tomb soldiers. Each costume was re-documented with a concise Condition Report, and with colour slides. My eye did not notice any discernible fading, accretion, or deterioration of the gowns since they were treated and while on exhibit, except for one notable exception. The only significant change was the earliest gown treated with Beva 371. This gown was still stable where it was treated with the underlayments of Beva 371 sprayed-coated organza. In addition, the areas treated with Beva 371 had not yellowed, nor had they attracted particulate matter. But, I found that over the course of time and movement, the skirt had continued to slit in areas that had not been treated as described before. Most likely this damage occurred during the last move. Before leaving the survey site, the gowns were given a protective cover of acid-free tissue paper. Here they would stay until their return to the new exhibition space in the Old State House scheduled for 1999. During this interim, it is proposed that the Eagle gown will have on-site treatment to stabilize the new tears, using a more extensive treatment of underlayments spray-coated with Beva 371.

In conclusion, I would like to reiterate that Beva 371 can be sprayed on fabrics of a variety of weaves, weights, finishes, and dye ranges. The advantages of its use is that the carrier for the adhesive is an appropriate new fabric and not the original fabric surface. In the method it is non-penetrating and non-staining. The spray-coated surface is not tacky at room temperature. However, it does have 'tooth', and can therefore be used to hold fragile or frayed areas temporarily in place with slight finger pressure. It has very low peel strength, thereby making it easy to remove the Beva 371-sprayed carrier fabric using mechanical action (lifting, or rolling, ie. peeling). Beva 371 can be re-activated by contact with low heat and pressure. Beva is not reversible in aqueous solutions, making it useful as a consolidant before and during wet cleaning. It is reversible via reheating and contact with commercial dry cleaning solvents such as Perchloroethylene (Perc) , as well as, common solvents such as Mineral Spirits and Naphtha. Beva 371 is not a "band-aid" for every problem. It is often used in concert with traditional hand sewing techniques such as running, blind, spannstitch, couching, whip, and back stitches. Furthermore, Beva 371 is flexible, allowing the original fabric to drape and retain memory, ie. evidence of use, creases, stitch lines, folds, etc. This quality is important to curators, historians and conservators who want to keep the construction, wear and treatment record visible on an object.

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Note: The Beva® used in these tests was purchased from Adam Chemical Co. Prior to February 1987. Beva is a registered trademark owned by Gustav Berger, and has been since 1987. Only Conservator's Products Co. (P.O. Box 411, Chatham, NJ 07928) manufactures Beva® products, which are regularly tested by Gustav Berger.