Adhesive Backing Treatments for Skin and Leather Objects:
An Annotated Bibliography

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The annotations below focus on adhesive backing treatments of leathers and skins and not on full treatments; in some cases however, notes on consolidation or infills are provided. The information provided is as follows: object, type of leather, condition, reapir adhesive, backing material and repair method used with rationales, as well as results of other materials or methods tested. Leather bookbindings, parchment documents and natural history specimens were not surveyed. Listings do not constitute an endorsement of the treatments nor of materials described. Apologies for any errors or omissions; please send corrections, updates or comments to: carole.dignard@pch.gc.ca .

Alten, Helen, 1992, "A New Approach to Gut Repairs", Abstracts of the International Institute for Conservation-Canadian Group Annual Meeting, Ottawa, Ont., May 31, 1992, Ottawa: IIC-CG, p. 35.

Used reconstituted collagen sausage casing and Rhoplex N-580 pressure-sensitive adhesive to repair a shredded seal gut parkas. The repair had to be flexible and hold in the presence of moisture; the repair had to be sufficiently simple that it could be re-done by non-conservation staff in a small branch museum if necessary; there were as well time constraints.

Angus, Aline and Salwa-Victoria Joram, 1995, "The Conservation of Some Leather Upholstery from Brodsworth Hall", in: *Interim Meeting on the Treatment of and Research into Leather, in Particular of Ethnographic Objects, ICOM Committee for Conservation Working Group on Leather and Related Materials, Amsterdam, 5-8 April 1995,* eds P.B. Hallebeek and J.A. Mosk, Amsterdam: Central Research Laboratory, p. 96-98.

Used Vinamul 3254 vinyl acetate-ethylene copolymer with a thick Japanese paper to tack down the leather upholstery of 18 chairs that had numerous tears and losses. The adhesive was used sparsely, as the paper backing usually held through pressure of the surrounding upholstery.

Angus, A., T. Sturge and A. Arponen, 2006, "Philip Webb Settle", p.325- 328 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Gilt leather panels of a settle attached against wood structure: in very poor condition, pH 2.8, little strength; in areas in poorest condition, paint surface very fragile, significant loss, and leather in these areas was brittle and distorted. Consolidated with 1% Pliantex in toluene. Resin-based adhesives proved unsatisfactory. Wheat starch paste (WSP) was used to adhere the leather back down onto the wood structure: its high water content was useful to further relax the leather during reattachment. Sufficient water was added to allow syringe applications. Finger pressure applied to achieve good contact between leather and wood base. Some slight darkening occurred but most was hidden by paint layer. Alternatives considered: Beva 371, heat-reactivated, however this would have left a significant bulk of adhesive in the object and would have been impossible to remove in the future. (Treatment date: 1994)

Barton, Gerry, 1999, "The Conservation of a Siberian Shaman's Costume", *Zeitschrift Fuer Kunsttechnologie und Konservierung*, Jahrgang 13/1999 Heft 2, p. 337-347.

This vest required only minor skin repairs: skin loops holding metal and other accessories to the coat had broken: after consulting a number of German artefacts conservators, the author said the general consensus was to use a dispersion polyvinyl acetate Planatol AD945B to adhere the skin back together; in a few cases particularly short stubs were lengthened with leather either from the collection of scraps untied from the fringes or with new leather.

Beaumont, I., 2006a, "Alum-tawed Gloves, Having Belonged to Oliver Cromwell", p. 293-295 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Alum-tawed lambskin gloves, 17th c., generally in good condition, had suffered a large loss at the wrist area and adjoining area ofthe laced cuff, and small breaks in the lace work. Repaired breaks in lace work with small pieces of alum-tawed lambskin leather finely skived down, adhered with wheat starch paste. Same materials

used to repair and gap-fill the loss at the wrist and cuff. (Treatment date: 2001.)

Beaumont, I., 2006b, "Altar Frontal. 1756.", p. 307-312 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Gilt leather altar frontal tackrf to wood frame. Paint surface in good condition. No red rot but leather badly damaged with major splits plus tears along tacking edge; distortions, some shrinkage, torn leather at bottom edge had been reattached to wood with glue. Treatment: Removed from frame, released the old repair, humidified, aligned the splits then secured them with temporary Japanese paper facings applied with wheat starch paste, chosen because paste is easily reversible and paper has little bulk so unlikely to leave an impression. However starch paste ended up pulling some of paint and lacquer on surface. Alternative (which does not hold as well as afacing) would have been to align the split by applying small tabs along the back of the split, followed by 1 larger lining over the tabs to cover the splits. Splits were repaired with Reemay backing and 3:1 mixture of Lascaux 498HV:360HV acrylic dispersions. Reemay chosen for its similar structure to leather, does not impose a weave, not too bulky, easily shapes to uneven surface. Adhesive applied to both Reemay and leather, then brought together and Reemay stippled gently into place and weighted. Avoided full lining of frontal because paint layer was fragile and susceptible to damage from water. Frontal was also strip-lined with veg.-tanned calfskin, chosen instead of Reemay because more robust for reattachment to wood frame. Gaps were filled with: new veg.-tanned calfskin; Beva 371; or a filler made with (w/w) 85% Encryl E acrylic dispersion, 9% wax FF, 1% thickener and 5% glass microspheres. (Treatment date: 1998.)

Beaumont, I., 2006c, "Gilt Leather Screen", p. 313-314 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Gilt leather six-fold screen, late 17th -early 18th c.: previous restored with fine fabric lining and wood panels inserted on back. Paint in good condition. Leather panels had large splits. Cover strips along edges were in very poor condition, red rot, no strength. Removed 4 of the 6 leather folds from their structure based on level of repair needed, as this allowed to rejoin edges of splits back together and simplified carrying out repairs. Earlier fabric lining was kept because still holding well; leather and lining treated as one unit. Splits were repaired with Reemay and 3:1 mixture of Lascaux 498HV:360HV acrylic dispersions. Edges were strip-lined with Reemay and same adhesive to strengthen the tacking margin. Fine cracks filled with Aquafil 945 acrylic-based filler, larger fills with pigmented Beva 371 applied with heat. Cover strips too degraded to be reattached for active use that was intended for this screen. New cover strips were installed. (Treatment date: 1998.)

Beaumont, Ian, Yvette A. Fletcher and Roy Thomson, 2006, "Gilt Leather Wall Hangings at Groote Schuur, Cape Town", p. 329-333 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Gilt leather wall hangings (1) 17th c. hangings: old patches on reverse covering holes or thin/weak areas; splits, holes, significant losses, paint in good condition. Repairs: where edges joined to another panel, used archival quality veg.-tanned calfskin with edges skived, adhered with water reversible PVA to the sides with an overlap to allow shrinkage and facilitate joining the panels. Also strip-lined the top and bottom edges of panels to allow fixing to wall. Holes and splits repaired with same materials (PVA and calfskin) and infilled with pigmented Beva melted in with hot spatula. (2) 19th c. hangings: bottom edge had tears, evidence of red rot, weak and damaged stitch holes, small losses. Repaired bottom edge as above (skived veg.-tanned calfskin and water reversible PVA adhesive). (Treatment date: 2004.)

Beaumont, I. and T. Sturge, 2006, "Dining Chairs", p. 287-292 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

(1) Vegetable-tanned goatskin upholstery on a set of eight Victorian dining chairs: damage included splits, losses, flaps and flakes of loose grain surface. Privately owned, needed to be functional. Repaired splits using 0.5 mm vegetable-tanned goatskin: this material matched the original well and could be reduced to appropriate thickness while conserving its strength. Used Hewit Reversible M218 PVAC, selected for its high tack which assists in positioning awkward repairs. Same adhesive used to secure the flaps and flakes of loose grain surface. (2) Four seat covers from 18th c. chairs made of vegetable-tanned goatskin were heavily worn and split, leather was weak, red surface finish was largely missing. Privately owned, needed robust repair to withstand use yet to still match other untreated covers in the set. Splits with gaps were filled with patches of new vegetable-tanned goatskin applied to the back. Splits with no losses were repaired with localized patches of fine Cerex now-woven nylon. The entire back of the leather cover was then lined with Cerex. Cerex chosen rather than Reemay or woven fabric because it is soft, flexible, has low bulk and can be worked onto uneven surfaces. Both patches

and lining were adhered with a 3:1 mixture of Lascaux 360HV: 498HV: this was flexible, wetted the Cerex well and could be brushed on as a thin layer. (Treatment date: 1999.)

Bedat, Isabelle, Céline Bonnot-Diconne and Vincent Cochet, 2007, "The Orlov Coach of the Chaumont-sur-Loire Castle: History and Restoration", p. 20-26 in *Recent Preoccupations Concerning Textiles, Leather Legislation. Post-prints Relating to Leather, Athens, 21-24 April 2004*, ed. T. Sturge, [no city], ICOM-CC Working Group "Leather and Related Materials".

Fine black lacquered (japanned or patent) leather covered the side panels and roof of this circa 1870 coach. Condition : numerous splits and tears, many missing or lifting pieces, and a network of cracks in the japanned surface. Surface cracks in lacquer and paint consolidated with Paraloid F10 8% in acetone and petroleum ethers (Stoddard's solvents). Gaps and cracks in leather side panels and roof (which rested against the coach's wood structure) were filled with pigmented Beva 371, heat-reactivated.

Bell, Bruno, Patricia Hood and Véronique Montembault, 2002, "Conservation-Restauration de la cuirasse et du casque de parade de Napoléon 1er", *Coré n^{o} 12*, p. 18-20.

Treatment of Napoleon 1st's parade cuirass and helmet. It consisted of leather, textile and metal components. Leather parts of the cuirass's shoulder straps were weak and extensively worn and torn; they were backed on the inside with Mowilith DMC2 emulsion and a polyester non-woven fabric.

Bilson, 1995, "The Transfer and Restoration of an Eighteenth Century Gilt Leather Screen", in: *Interim Meeting on the Treatment of and Research into Leather, in Particular of Ethnographic Objects, ICOM Committee for Conservation Working Group on Leather and Related Materials, Amsterdam, 5-8 April 1995,* eds P.B. Hallebeek and J.A. Mosk, Amsterdam: Central Research Laboratory, p. 6-14.

Original leather of the gilt screen was totally disintegrating. Discusses the exceptional treatment of completely removing the original leather from the gilded surface and the transfer of the paint surfce onto a new polyester sailcloth lining, adhered with Beva 371.

Blouet, Élise, 2004, "Une selle de guerre de la Wallace Collection : Étude et conservation", *Coré n^{o} 14*, p. 30-35.

Treatment of a leather saddle dated 1549. Holes in the leather seat were pressure-fitted with a fine polyester fabric fills without use of an adhesive. Alum-tawed leather components were in good condition and not treated. Vegetable-tanned leather parts were still fairly strong condition, the pH was only moderately acidic, no red rot was present, however there were losses, tears and holes. Repairs were carried out by backing with a new aluminium-retanned vegetable-tanned leather, adhered with a Lascaux acrylic dispersion (details not specified). In areas where the saddle leather's original leather lining was also torn or damaged, the lining was backed with the same new leather and Hewit M218 Reversible PVAC dispersion. The stiff painted leather at the front part of the saddle was torn: it was repaired with Hewit 155 PVAC dispersion. (See also Blouet and Beaumont 2004.)

Blouet, Elise and Ian Beaumont, 2004, "The Conservation of a 16th-century War Saddle", in: *In the Saddle: An Exploration of the Saddle Through History*, ed. Lauren Gilmour, London: Archetype Publications Ltd., pp. 43-52.

Treatment of a 16th c. leather saddle, in poor condition. Multi-components.The buff leather was in good confition, with a few tears and splitsand also had a few old repairs (paches and stitches); where it was torn, leather patches were adhered with Hewit M218 Reversible PVA. The vegetable-tanned leather was in fairly poor condition, pH was at 3.0 and was weak in parts; its weakest parts were backed with archival quality leather adhered with Lascaux 498HV:Lascaux 360 HV 3:1 in ratio. The stiff leather apron painted on grain side was split: it was joined with Hewit M218 Reversible PVA and a lining of vegetable-tanned archival-quality leather. (See also Blouet 2004.)

Bonnot, Céline, 1994, "La restauration d'une chaussure du XVIème siècle : exemple de remontage et de support", *Conservation-Restauration des Biens Culturels n^{o} 56*, p. 75-78.

Treatment of a 1560 archaeological shoe from Red Bay, Canada, which needed to be reassembled and mounted: leather was supple but in fragments, delaminating, weak; it was waterlogged when found and received a PEG treatment. Adhesive choice based on CCI's 1992 report on PVAC and acrylic adhesive testing (see Down et al.

1996 and its 2009 update). For this archaeological piece considered Jade 403, Lascaux 360HV, Lascaux 498HV and a mixture of the latter two. Jade fared well in the CCI tests although author found that old stock solutions had become acidic over time; however the Lascaux products did not stick to the PEG-impregnated surface. Used Jade 403 to consolidate delaminating layers. Reassembled shoe by stitching through original holes when possible; where holes were too weak they were backed with Stabiltex and Jade 403 (50% of stock solution).

Bonnot-Diconne, Céline, 2000, "La Restauration des Jazz-bands du Musée d'Art et d'Industrie de Roubaix", *Instruments pour demain: Conservation & restauration des instruments de musique, 9es journées d'études de la Section française de l'ICC, Limoges, 15-16 juin 2000*, Champs-sur-Marne: SFIIC, p. 143-147.

A painted drumskin from a jazz kit had a 53 cm tear on it and was shrunken and deformed. The drum was dismantled and the skin was kept stretched onto a wooden form during treatment. After humidification and reshaping, it was backed by heat-reactivation at 50°C a single sheet of Shibori Japanese paper that was previously coated with Lascaux 360 HV and that was cut to fit the contours of the tear. This adhesive was chosen because it remains sticky after drying and so would allow the backing to slip if ever there is too much tension applied to the skin. The back drumskin was torn in a few small areas, and had old repairs that were detaching; when no backing was needed, it was repaired using Mowilith DMC2; in a few areas it was repaired with the same paper and adhesive as the front drumskin previously described.

Bonnot-Diconne, Céline and François Coulon, 1998, "Restauration d'un kayak esquimau en peau du Musée des Beaux-arts et d'Archéologie de Rennes", *CoRé n° 4*, SFIIC and Éditions Errance, p. 26-30.

Kayak was suffering from many tears and losses and was misshapen. Used Mowilith DMC2 full strength; applied adhesive by brush gradually, over large pieces of the paper backing and clamped using magnets. Used as backing material a Japanese paper backing (Shibori, 100% Kozo fibres, pH=7.4): worked well; 2 layers were added for sufficient strength. Parchment was used as gap-filling material.

Bonnot-Diconne, Céline, Natalie Coural and Madeleine Fabre, 2001, "La restauration d'une tenture en cuir peint du musée départemental de Lunéville", *Technè n°13-14*, p. 141-149.

Treatment of a gilt leather wall hanging made of 15 sewn sections, previously restored, showing a large number and variety of patches, strip linings, fills, etc, some having caused further damage. Traces of past lubricants explained the darkening of the verso. Fat content was high (9%, compared to 5% in leather normally) yet there was no visible excess residues. The pH was 3.45-5.5, the shrinkage temperature 45-50°C, not excessively low. In very poor condition: many deformations, tears, missing areas, degraded sewn areas and stitches, cracks and damages to paint layers. Discusses adhesive options to consolidate paint: Paraloid acrylics (B72, B82, F10), Beva 371, Klucel (for surface consolidation only); Lankrothane polyurethane and PVB were ruled out because of their ageing characteristics. After testing, used 8% Paraloid F10 in toluene because of its excellent ageing properties, its flexibility and its thermoplastic behavior (can be applied at room temperature with subsequent local touch-ups with heat in the range of 55-60 °C). Care was taken to avoid temperatures exceeding 35 °C reaching leather below. Losses: decided to avoid new leather fills and to use toned Beva 371 because of its ease of use for these losses (irregular small shapes) and of inpainting. Applied Beva fills from the back, while the front faced with Japanese paper adhered with Paraloid F10, and subsequently reversed facing with ethyl acetate without affecting the Beva fills. For the full lining, new leather and polyester fabrics were considered; chose polyester cloth for its properties, namely excellent resistance to elongation. Beva 371 film was chosen for its properties, especially adherence and strength despite the original leather's high fat level.

Bonnot-Diconne, C. and J.-P. Fournet, 2007, "Hanging of a XVIIth century Italian gilt leather at the musée des Arts Décoratifs in Paris", ICOM-CC Joint Interim Meeting "UPHOLSTERY+", Krakow, May 13-18, 2007, 10 p. Available http://www.icom-cc.org/54/document/hanging-of-a-xviith-century-italian-gilt-leather-at-the-muse-des-arts-dcoratifs-in-paris/?id=1033

Treatment of a gilt, engraved and painted wall hanging consisting of 28 squares, and which were previously restored with many leather patches, full segment linings or tensioning strips glued on the reverse. These were causing damage, because of the glue that caused stiffening, and because of the weight and uneven stresses created, as well as extra thickness causing stresses at the seams. Original leather had some long tears but no large gaps. It was considered too long and complicated treatment; only where absolutely necessary were some removed. Fragile parts (tears, damaged seams) were consolidated in small sections by backing using a light non-

woven polyester material and Beva 371film reactivated with low heat. Gapfilling was carried out using toned Beva 371 paste, laid from the flesh side to avoid excess, then supplemented from the face side if necessary. Paint flakes were adhered with Beva 371 film, inserted under the paint and reactivated with low heat.

Bonnot-Diconne, C. and J.-P. Fournet, 2007,"Study & Restoration of a Felt Leather Venetian Shield", p. 61-63 in *Recent Preoccupations Concerning Textiles, Leather Legislation. Post-prints Relating to Leather, Athens, 21-24 April 2004*, ed. T. Sturge, [no city] , ICOM-CC Working Group "Leather and Related Materials".

The painted gilt leather shield was damaged on both faces, with tears and losses due to distortion of wood core structure. The leather's pH was 3-3.5, the Ts was 29 to 32 ° C. Consolidated the leather and its polychromy with 8% Paraloid F10 in acetone. Tears and lifting pieces were adhered with Mowilith DMC2 (applied without heat). Surface losses filled with coloured Beva 371.

Bonnot-Diconne, Céline and Jean-Pierre Fournet, 2006, "La Restauration des Cuirs Dorés", *Coré n^{o} 17*, décembre 2006, p. 34-46.

A literature review of treatment options and rationales, materials and techniques for gilt leathers. Author cautions that this summary should not be taken as recommendations of particular treatments, methods or materials. Paint consolidation adhesive must: adhere well to silver leaf, remain flexible to avoid tensions as leather moves, penetrate underneath the paint flakes, be compatible with subsequent parts of treatment, be non-intrusive, stable and reversible. Water-based consolidants e.g. skin glue, cellulose ethers (Tylose), PVAC dispersions (Ponal, Mowilith DM5, Vinamul 3254) can only be used if water is not a problem i.e. if the pH is not too low (above 3). Solvent-based consolidants such as acrylic or vinyl resins (Paraloid B72, Paraloid F10, Rhodopas M) can be considered if the solvent is safe for the varnish and paint layer. Typically the consolidant is applied locally by brush with pressure is applied during drying; if necessary, areas may be additionally secured using a heated spatula. Repairs material: new leather of the same animal species and same tannage as the original is the traditional choice; or, new materials can be used. Fills can be done as 'inserts' that fill the shape of the loss, possibly reinforced with a backing; this technique is most useful for small gaps. For tear repairs or large gaps, edges are skived so as to overlap onto the original, also skived to match. Large fills may need reinforcement with a polyester fabric and adhesive backing. Total backing of a panel with new leather is at times required if the original is very degraded. Adhesive requirements: strength, flexibility (which must also remain with ageing). Skin glue is a traditional choice but there are risks of hardening. PVACs are strong, stable and do not penetrate excessively; they are frequently used by many in the field. New leather, the traditional choice for backings or fills, has been criticized because it reacts differently than aged leather and may lead to stresses, deformations and cracks; for these reasons some prefer synthetic materials, which are expected to 'give' first if stresses occur; they are also considered more neutral and stable. Examples include non-wovens (Reemay) or nylon, most often used for backing tears or small areas; or, synthetic (polyester) sailcloth for larger areas since it resists stretching yet has a certain elasticity. Possible adhesives include Beva 371 Film or Mowilith DMC2. Losses, especially small ones, can also be filled with Beva 371, applied from the back with a hot spatula while the front has a temporary facing.

Bonnot-Diconne, Céline, Jean-Pierre Fournet and Benoit-Henry Papounaud, 2010, "Historical and Methodological Aspects of the Restoration of a 18th century French Gilt Leather Tapestry in an Historic House: the Maison Mantin Project (Moulins, France)", in: *Multidisciplinary Conservation: A Holistic View for Historic Interiors*, Joint interim meeting of Five ICOM-CC Working Groups, Rome, 23-26 Mars 2010, 11 p. Available online on ICOM-CC website: http://www.icom-cc.org/54/document/historical-and-methodological-aspects-of-the-restoration-of-a-18th-century-french-gilt-leather-tapestry-in-an-historic-house-the-maison-mantin-project-moulins-france/?id=788

Gilt leather panels from the historic Mantin house (Maison Mantin) in Moulin, France were treated. Most panels had been cut into smaller pieces, then reassembled and rehung, pastiche-style. The leather was in poor condition due to climatic conditions and a poor 19th century restoration: the panels had been patched, glue-lined, tacked unto a linen-backed frame and the frame fixed onto the walls. Several panels were uneven, deformed, torn or detaching from the framework because of increase in tension and stiffness due to the old repairs using glue and weak, stretchy leather. The wall hangings were dismantled and the panels worked on individually. The patches, leather backing from the previous restoration and glue layer were removed, and the panels were rejoined using strips of non-woven polyester of different weights (17g/m^2 and 35 g/m^2) and Beva 371, with gaps filled with toned Beva 371. Edges of panels were reinforced with Velcro strips sewn onto polyester cloth, the latter cloth then adhered to the back of the panels using Mowilith DMC2. The original strips of leather covering the front surfaces of the joints, which acted as a frame, were preserved: gaps were filled with toned Beva 371, and deformed or torn pieces were partially or completely backed with non-woven polyester adhered with Beva 371.

After treatment, the gilt leather panels were fixed back onto their original frame using Velcro strips and the joint cover strips placed back in their original position, fixed with upholstery nails.

Boulton, Ann, 1986, "The Examination, Treatment and Analysis of a Pair of Boots from the Aleutian Islands Including a Note About Possible Pesticide Contamination", *J.AIC 25 n^{o} 1*, p. 1-13.

Repaired holes in the feet of the sealskin boots with Beva 371 and goldbeater's skin, applied cold. Clamping was possible by inserting a curved spatula with a cork at its tip inside the boot. Large holes were filled with paper pulp cast sheets made of incompletely macerated Japanese tissue left slightly lumpy, Liquitex acrylic paint for colour, and wheat starch paste. By varying the amounts of wheat starch paste and water in the mixture, and the amount of pressure applied to the drying sheet, different effects were created. As well different colours and textures could be achieved.

Calinescu, Irena and Cara Varnell, 2000, "The Resurrection of an American Film Star: the Beloved Cowardly Lion", *Preprints, North American Textile Conservation Conference 2000: Conservation Combinations*, Ashevill, North Carolina USA, March 29-31, 2000, p. 53-59.

This lion skin costume was in poor condition with many holes and large tears, some previously badly restored with iron-on cloth adhesive tape. Holes and tears were backed with strips of Hollytex non-woven polyester and Beva 371 Film, heat-reactivated with a heated spatula. To fill in missing areas, real lion fur was used: it was cut to fit, edges were skived and it was inserted over the Beva-Hollytex backing and heat reactivated. Edges that remained loose or lifting were secured to the lining with Lascaux 498 HV.

Calnan, Christopher, 1992, "The Conservation of Spanish Gilt Leather - An Introduction", in *Conservation of the Iberian and Latin American Cultural Heritage, Preprints of the Contributions to the Madrid Congress, 9-12 September 1992*, eds Henry Hodges, J. S. Mills and Perry Smith, London: IIC, p. 23-25.

Treatment of Spanish gilt leather. Leather was worn, had multiple tears and losses, was structurally unsound in some areas. Treatment: recommends patches using either a thin leather adhered with a water-based adhesive (Vinamul 3254) or a strong, lightweight, synthetic fabric (Arvex FT78) adhered with Beva 371. A stronger bond is achieved if the area around the patch is primed with a dilute solution of Beva 371. If a full backing is required, when panels are too structurally unsound to support themselves adequately, polyester support fabrics such as Arvos FT78 or the heavier-weight sailcloths can be applied using Beva 371 or Vinamul 3254.

Calnan, Christopher, Rosemarie Selm and Betty Haines, 1991, *The Conservation of Automobile and Carriage Leathers*, London: Science Museum, 65 p.

This study consists of a comprehensive series of tests undertaken for the treatment of automobile and carriage leathers. It provides an evaluation of 7 support fabrics; of 36 adhesives; of various adhesive coatings and their effects on fabric properties; of bonding techniques (application methods); of the dot pattern application method; of various infilling techniques and materials. Authors found following most suitable for bonding support fabrics to upholstery leather: Beva 371 solution, Beva film, Lascaux 360HV, mixture of 1:1 Lascaux 360HV: Lascaux 498HV, Vinamul 3252 and Vinamul 3254. The 2 Beva products produced the strongest heat-activated bonds and the more flexible bond than any of the solvent-based adhesives tested. See also: Selm 1991.

Calnan, Christopher, 1991, "Conservation of Leather Upholstery on the 1894 Panhard-Levassor Motor Car at the Science Museum, London", in*: Conservation of Leather in Transport Collections*, ed. Christopher Calnan, London: UKIC, p. 31-34 [36 p.].

Treatment of automobile upholstery leather that was very fragile, brittle, had a cracked and delaminating grain and suffered from numerous losses and tears. Applied the materials and techniques recommended in the Calnan et al. 1991 publication. Nearly all of the leather pieces required support patches (i.e. backings) either to repair tears or to reinforce seams, edges or weak areas: used Beva Film because it is quick, gives good bond strength, does not stiffen and is easily reversible. Where access was difficult for the hot spatula, used Lascaux 360:498 1:1. Where a full backing was required used Beva 371 in dots, heat reactivated onto Reemay 2410. [Note: Sturge 2005 p. 160 states: 'The use of Beva in a dot pattern (Selm 1991) on the support has proved unsuccessful in the long-term, with previously treated items requiring re-treatment']. Patches of goatskin was used for some infilling, adhered with Vinamul 3254. Polymer patches using Encryl E acrylic polymer mixed with waxes and microspheres were also used. Lankrothane was used as a consolidant.

Cameron, E., J. Spriggs and B. Wills, 2006, "The Conservation of Archaeological Leather", p. 244-263 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

General discussion on the conservation of wet and dry archaeological leathers, including repair.
(1) Wet leathers: if split and torn, reshaping and re-assembly may be carried out after consolidation and drying treatment. Adhesive must be able to stick to the previously treated surface (e.g. PEG impregnation, etc).
(2) Dry leathers: possible condition: desiccated, often vegetable-tanned leathers in worse condition than rawhides or 'pseudo-tanned' skins. Where necessary, repair, backing and reconstruction can make use of a range of acrylic resins or other conservation adhesives. Backing materials may include Japanese kozo (mulberry fibre) papers and non-woven polyesters. Solvent reactivation of adhesive films often works well. Possible fill materials include glass microballoons and pastes derived from cellulose fibres.

Chapman, Vivien, 1987, "The Conservation of a Group of North American Indian Moccasins: A Textile Conservator's Approach", in: *Recent Advances in the Conservation and Analysis of Artifacts, University of London Institute of Archaeology Jubilee Conservation Conference*, ed. J. Black, London: Summer School Press p. 207-210.

Discussion on the treatment of a set of 5 Native American pairs of moccasins. Four (Woodland Indian, Iroquois, Mohawk) made of semi-tanned skin: skin in relatively good condition, some insect damage, holes and tears. One pair (Huron) was black-tanned skin: its surface pH was 4; was stiff and friable; had holes and was torn and in tear areas the skin tended to split. Used Cellofas CMC 4HC sodium carboxymethyl cellulose: produced a good bon, reversible, flexible, did not stain. Used chamois leather because sympathetic to original skins; chambered its edges for the repairs. For the black-tanned skin also used a polyurethane adhesive to butt-joint tears.

Chiotasso, Laura, and Costantino Sarnelli, 2007, "Conservation of a Leather Antependium", in: *The Conservation of Gilt Leather, ICOM-CC Interim Meeting, Working Group "Leather and Related materials," Brussels, 225-27 March 1998*, ed. Theodore Sturge, [no city]: ICOM-CC Working Group "Leather and Related Materials," p. 45-47 [88 p.].

Treatment of a carved and gilded leather fragment found concealed in an altar. Treatment for this object of worship took into account that it will be periodically used. Leather was in poor condition overall; cracking on leather and paint surface; pH of 5 was adequate; had a large tear with strong deformation, and losses along edges. Powdery areas on flesh side were consolidated with 10% Paraloid B72 in acetone; delaminating sections reattached with 50% Paraloid B72. To avoid possible mechanical traction caused by the strong deformation, the leather fragment was lined on the flesh side with a polyester gauze adhered with Mowilith DMC2; adhesive chosen for its ease of application and good aging properties in dark lighting. Polyester gauze chosen for its combination of correct thickness and good resistance to mechanical traction. Other backings tested: nylon net was not strong enough; new leather and non-wovens were too thick for the right resistance to mechanical traction. Tears were filled with mixture of powdered leather and Paraloid B72.

Chiotasso, L.M. and C. Sarnelli, 1995, "Some Remarks on the Conservation and the Exhibition of Ethnographic Leather", *Interim Meeting on the Treatment of and Research into Leather, in Particular of Ethnographic Objects*, *ICOM Committee for Conservation Working Group n^{o} 10 'Conservation of Leathercraft and Related Objects', Amsterdam, 5-8 April 1995*, eds P.B. Hallebeek and J.A. Mosk, Amsterdam: Central Research Laboratory, p. 99-104.

An Inuit parka at the Pigorini National Museum in Rome was weak and torn. Used Stabiltex 4/3 polyester multi-filament cloth adhered with Neovil R PVAC emulsion, chosen because it viscous, quick-drying, had low penetration and good flexibility. Brushed sparsely onto the surface of the parka and on the Stabiltex backing and the Stabiltex was then pressed onto the skin. Carried out repair in a humidity chamber at 70%RH. This adhesive gave better results than acrylic resins; also better than Neovil AB52 or BM400 PVAC emulsions which produced a less flexible bond.

Clark, Thurid, 1985, "Conservation of an Aboriginal Wallaby Skin Water Bag at the Australian Museum", in: *Recent Advances in Leather Conservation, Proceedings of a Refresher Course Sponsored by FAIC, June 1984*, ed. Sonja Fogle, Washington DC: FAIC, p. 62-64.

Treatment of a wallaby skin water bag tanned with emu bush leaves: skin was dry, brittle, torn, seriously deformed, pH of 3.6. Because access to the interior to apply the backing was limited, used nylon gossamer heat-reactivated with Beva 371 to temporarily secure the tears on the front side (facings). Backing repair was then

carried out using Primal AC 235 and Japanese mulberry paper, after which the facings were removed. Filled with paper pulp and CMC.

Collins, Catherine, 1986a, "Conservation Techniques for Ethnographic Leather Artifacts: Application to the Paul Kane Collection", *Leather Conservation News, vol. 3 n^{o} 1*, fall 1986, p. 14-16.

Describes repairs to a number of Northern Plains brain-tanned skin clothing, where the skin was weak and torn, was suffering from losses, or could be brittle and stiff. When the skin was still flexible, the repairs were done by stitching, with or without a backing. Repairs on brittle and stiff skins were carried out using Jade 403 PVAC emulsion and Pellon spun-bonded polyester fabric of medium weight and with feathered edges: this spun-bonded fabric is strong in all directions and non-ravelling. The backing did not cause a noticeable effect on the drape of the clothing, as the skin was already stiff.

Collins, Catherine, 1986b, "Conservation Techniques for Ethnographic Leather Artifacts: Application to the Paul Kane Collection", in: *Symposium 86: The Care and Preservation of Ethnological Materials, Proceedings*, Ottawa: Canadian Conservation Institute, p. 62-67 [272 p.].

See notes above.

Cruickshank, P., V. Daniels and J. King, 2009, "A Great Lakes Pouch: Black-dyed Skin with Porcupine Quillwork", *The British Museum Technical Research Bulletin* 3, p.63-72. Available at http://www.britishmuseum.org/research/publications/online_journals/technical_research_bulletin/bmtrb_volume_3.aspx

Black-dyed skin pouch, very degraded (due to iron); former treatment (consolidated with soluble nylon and adhesive-backed with nylon net) now had to be reversed. Decision to minimize use of adhesives; to avoid water (risk of staining and accelerating iron-catalysed degradation); and to avoid heat and pressure that a hot-spatula would require. For the flap: a gel of Klucel G in industrial methylated spirit (IMS) secured paper repair patches to reverse; Klucel G in IMS chosen because quick to dry (thus not likely to stain). A nylon net overlay was also applied by stitching around fragments (no adhesive). For main bag: mulberry paper with Klucel G gel as above were used to strengthen brittle skin edges. Then used Paraloid F10 free film, reactivated with white spirits, to adhere the paper-backed skin edges to a cotton fabric lining. As well for further protection, a nylon net overlay coated with Lascaux 498 HV 10% w/v was solvent-reactivated with IMS onto skin's brittle, broken edges on one side and the cotton lining on the other; Lascaux 498HV chosen because it can be solvent-reactivated, adheres well on both textile and skins, and would not affect the Paraloid F10 securing the cotton lining.

Cruickshank, Pippa and Vanessa Sáiz Gómez, 2009, "An early gut parka from the Arctic: its past and current treatment", in: In: *Scraping Gut and Plucking Feathers: the Deterioration and Conservation of Feather and Gut Materials*. Available online on the ICON website: http://www.icon.org.uk

Gut parka, probably Alaskan late 19th c. The1987 tear repairs by one author (PC) done with goldbeater's skin and 15% w/v Butvar B98 in IMS were holding well. Some tears and losses left in 1987now required treatment to provide sufficient strength for vertical display. Backing material: tested goldbeater's skin and fine mulberry kozo paper. Paper typically good where greater strength is required. Criteria: adequate strength plus visual qualities with respect to translucent gut substrate. Used paper rather than goldbeaters' skin for the large repairs at the underarms, to provide structural strength when hung on display, and goldbeater's skin for smaller infills as it is sympathetic to the original material and almost visually imperceptible. Adhesive: Klucel G 10-15% w/v in acetone has been used in the past for temporary tabs or facings, but considered too weak for permanent structural repairs. Criteria: wanted water-based so that water can also soften gut during the repair. Tested Vinamul 3252 VAE emulsion 50% v/v and 5% w/v isinglass. Vinamul 3252 remains tacky at room temperature (Tg=3°C) but adhesive would not be left exposed and parka won't be on open display. Isinglass considered because: compatible with gut (collagen-based); can be mixed with acrylic resins to produce a remoistenable dried film; it gives a matt, smooth and strong bond; but, concerned about its high degree of reaction with RH might cause stresses on the gut or join to fail; also it is susceptible to biological attack. UsedVinamul 3252 applied with sable brush: it gave a flexible, strong bond. Larger holes infilled with mulberry paper.

Cruikshank, [Philippa] Pippa, 2001, "Leather Shrouds – A Rare Find in Jordan", in p. 63-70 in *Leather Wet and Dry*, ed. B. Wills, London: Archetype Publications.

Three desiccated leather shrouds from Jordan Valley of large size, very fragmentary, extremely dry and brittle. Treatment done on site, with limited facilities and limited conservation materials. Needed adhesive or consolidant that could withstand hot dry climate (high Tg) and that imparted strength and flexibility. As

consolidants, used Mowital B30H polyvinyl butyral diluted 2.5% w/v in ethanol for shroud of thinner leather, and Super Epoxy 10% v/v diluted in acetone for thicker leather. Super Epoxy was better at improving leather's flexibility but gave unacceptably shiny finish to thinner leather. Also investigated, but ruled out: Paraloid B72 in acetone (Tg too low), Mowital B30H in acetone or IMS, Klucel G in IMS, Mowilith 50 PVAC resin in acetone (PVACs increase in acidity with age) and Pliantex in acetone (provided good strength and flexibility but could not travel to site with this flammable product and would have been dangerous to use on site without fume extraction). Limited to using only acetone and ethanol on site. For reconstruction/repairs used HMG cellulose nitrate with Japanese paper.

Cruikshank, Philippa, 1987, "The Conservation of a Model Eskimo Kayak Involving the Treatment of Gut", *Leather Conservation News vol. 4 n^{o} 1*, fall 1987, p. 1-12.

A model kayak made of gut at coaming, parkas on the figures and floats. Gut was hard, brittle, torn, split. Tears in the coaming and miniature parkas were repaired with Mowilith 50 in acetone and dyed goldbeater's skin. Gut that was hard and inflexible was treated with 10% v/v PEG 400 in IMS. Mowilitlh 50 was chosen because it is a quick-drying organic solvent-based resin and it adhered well to PEG-treated areas.

De La Baume, Sylvia, Véronique Montembault et Jacques Le Maho, 1993, "Les Bottes de l'Abbé Richard de Boscherville - Reprise de Traitement, Étude et Restauration", *Conservation-Restauration des Biens Culturels n^{o} 5*, p. 20-25.

Describes the treatment of medieval archaeological leather boots. There were tears and large losses, and the soles were missing, and had been impregnated in neats-foot oil. Neatsfoot oil was removed followed by 15% PEG 400 impregnation and freeze-drying. Tears were backed with gauze adhered with Mowilith DM5. Fills were made with vegetable-tanned leather dyed with aniline dyes, pared down at the edges and adhered with Mowilith DM5.

Dicus, Diana, 1995, "Stabilization of a Large Rawhide Shadow Puppet. Ethics, Materials, Micro-Environment", in: *Interim Meeting on the Treatment of and Research into Leather, in Particular of Ethnographic Objects, ICOM Committee for Conservation Working Group n^{o} 10 'Conservation of Leathercraft and Related Objects', Amsterdam, 5-8 April 1995*, ed. P.B. Hallebeek and J.A. Mosk). Amsterdam: Central Research Laboratory p. 59-66.

Describes the condition, treatment and storage box construction for a rawhide shadow puppet from Cambodia which suffered from numerous tears and separations and presented particular challenges due to its non-flat surface. Repairs were made using a flat backing bridge made of Aiko 109-S Kozo (s) Japanese tissue, adhered with Lascaux 498HV acrylic emulsion, with no fills. Lascaux 498HV was easy to apply, had good ageing characteristics, is water-based so penetrated amd softened the paper and hide well, it dries as a clear, non-tacky flexible film, has an acceptable pH and is removable with acetone. The Japanese paper was effective, added little additional bulk, was flexible thus created less stress when handled. Paper bridges were torn to size; flat bridge repairs were applied while the hide was moist and relaxed by local humidification. Kozo paper was pasted with the Lascaux and applied on the rawhide verso. Paper repair in contact with the hide was burnished, weighted and covered for slow drying. No fills were required. A parchment butt or scarfed repair was not as adaptable to the surface problems as the paper repair could be.

Dignard, Carole and Gaelen Gordon, 1999, "Metal Ion Catalysed Oxidation of Skin: Treatment of the Fur Trim and Collar on a Velvet Cape", *J.CAC*, vol. 24, p. 11-22.

Describes the backing of the fur trim and collar on a cape. The skin was very weak (virtually no tensile strength) and extensively torn, with a few losses. Presence of iron, probably due to the black dye or mordant, suggests degradation due to metal ion catalysed oxidation. Stabiltex (Tetex) flocked with Beva 371 was used, heat-reactivated. Individual tears were first backed with 'band-aids' (narrow strips), and then the whole fur trim was backed with 5 large pieces of Beva 371-covered Tetex. Some infilling carried out using inserts of a commercially-tanned black suede or of a sheepskin fur, secured in place with the Tetex-Beva 371 backing. Where necessary in a few small areas, infills of black suede or of sheepskin fur were adhered to the overall backing.

Dignard, Carole, 1992, "Tear Repair of Skins with Minimal Access to their Backs: the Treatment of a Kayak", *Leather Conservation News vol. 7 n^{o} 2*, p. 1-8.

A Labrador Eskimo kayak suffered from 21 extensive tears with minimal access to their back. Repaired using a mixture of 25% w/v Acryloid B72 in ethanol + 15% w/v EHEC ethylhydroxyethyl cellulose high viscosity grade

(added to increase overall flexibility): this mixture is reversible, stable, moderate in strength, flexible, tacky with minimal penetration into the skin. Adhesive was brushed onto Japanese paper Kurotani Heavy no.224 backing material, chosen because it is strong yet flexible, compatible and has good handling properties. Acryloid (Paraloid) B72 alone was not flexible enough. Beva 371 or other adhesive in aromatic solvents were not feasible options because of health and safety issues (limited extraction capacity). Fills consisted of a paste of paper pulp and methylcellulose. Discussion of clamping techniques using magnets or Parafilm bands.

Dignard, Carole, 1989, "La réparation des peaux d'un kayak", *Proceedings of the 14th Annual IIC-CG Conference', May 27-30 1988, Toronto, Ontario, Canada*, ed. Johanna G. Wellheiser, Toronto: IIC-CG, p. 159-165.

Same treatment as in the above *Leather Conservation News* publication. (In French.)

Doyal, Sherry and Marion Kite, 2006, "Ethnographic Leather and Skin Products", p. 184-191 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

General discussion on the conservation of ethnographic leather and skin objects, including ethics. Mending approach: mend should be weaker than object being repaired; repair should fail first when object subject to dimensional change; some prefer to use 'like with like' materials, i.e. repair materials similar to original to avoid or minimize possible tensions. Sewing may be an alternative option. Repair may be in the form of sutures (strips), patches or full lining. If new skins are used criteria include matching the grain, weight, colour, spine direction, flesh or hair side; other options include membranes (goldbeater's skin, fish skin, sausage casing) and polyester or nylon non-wovens. Adhesives: basic criteria include viscosity (to avoid excess penetration), flexibility, suitable strength (weaker than original skin), suitability with respect to shrinkage temperature. Options include Beva 371, Paraloid B72, wheat starch paste, pharmaceutical clear gelatine or parchment size, although others are possible.

Dudley, David, 1981, "Conservation of Leather Wall Hangings in the James J. Hill Mansion", *Journal of AIC vol. 20*, p. 147-9.

Wallhangings in the dining room paneled walls of this historic house dated 1891. Leather was dry and brittle, several tears, losses and distortions. The leather panels were backed with 'Tetco' polyester monofillament silk-screen fabric sprayed with several applications of the PVA resin AYAA/AYAC and the Tetco polyester mounted onto an aluminum honey-comb core panel. The Tetco fabric was adhered to the leather and the aluminium panel using a vacuum hot table.

Dumka, Heather, 2007, "Conservation of a Beaded Skin Parka", p. 5-9 in *Recent Preoccupations Concerning Textiles, Leather Legislation. Post-prints Relating to Leather, Athens, 21-24 April 2004,* ed. T. Sturge, [no city], ICOM-CC Working Group "Leather and Related Materials".

As per Dumka 2006.

Dumka, Heather, 2006, "The Re-treatment of an Inuit Beaded Skin Parka", *JCAC*, vol. 31, p. 23-32.

Inuit caribou skin parka, heavily beaded, had numerous tears. A previous restoration (leather patches sewn onto skin) that distorted the shape and caused/aggravated tears needed to be removed. The very thin, flexible skin was degraded (Ts= 30°C) and had little strength. Fringe along hem was discoloured and brittle (possibly due to water damage). Backing material: leather/skin was rejected because finding one as thin as parka skin would be difficult and costly; it was felt that Japanese paper would not be strong enough, considering heavy weight of beaded panels; Reemay and Hollytex spun-bonded polyesters were deemed too stiff and heavy; woven fabrics were deemed more difficult to work with and not as visually compatible as a non-woven. Decided on Cerex spun-bonded nylon fabric: similar drape to parka's skin and easily available. Choice of adhesive: Jade 403 or mixtures of Lascaux 360HV and 498HV considered but not chosen to avoid use of water (Ts was very low). Beva Film (1 mil) left Cerex surface too shiny; concerned that it was too thick, may stain through parka skin. Decided on Beva 371 in toluene 1:1 spayed onto Cerex and heat reactivated (65-70 °C) because of its ease of application and sufficient strength without staining skin or causing shine. Applied as patches onto torn areas and as a full lining to further strengthen skin supporting beaded panels.

Dumka, Heather, 1991, "The Conservation Treatment of Three Gutskin Parkas", *J.IIC-CG*, vol. 16, p. 17-22.

Treatment of three gutskin parkas from the Glenbow Museum which were torn and misshapen. Chose pig gut

(hog sausage casing) over beef sausage casing, sheep prophylactic or goldbeater's skin because it had the best weight and colour, was sympathetic to the original gut and was easy to use. For small tears used a mixture of 5% Acryloid (Paraloid) B72 and 2.5% Klucel G in 100 ml ethanol. Gut needed to be kept damp to make it flexible during treatment. For larger tears an aqueous adhesive was best to keep the gut damp during treatment; Archivart PVAC emulsion was used because it would not let go after setting if water was applied to adjacent sections.

Falcao, Lina P. B., 2007, "Conservation of Chinese Shadow Puppets of Kwok On Collection – of Fundacao Oriente", p. 78-80 in *Recent Preoccupations Concerning Textiles, Leather Legislation. Post-prints Relating to Leather, Athens, 21-24 April 2004,* ed. T. Sturge, [no city], ICOM-CC Working Group "Leather and Related Materials".

Treatment of Chinese shadow puppets, made of rawhide, dyed or painted, and oil-coated. Condition: tears, stains, surface deformations, losses, darkening, loss of transparency (probably due to aged oil or smoke), some puppets were tacky. To repair the tears: Beva Film was heat-reactivated onto goldbeater's skin, then this adhesive+backing was cut to a tear's size and heat-reactivated to support the tear.

Falcao, Lina P. B., 2007, "The Conservation of Gilt Leather Upholstery: a Practical Study", in: *The Conservation of Gilt Leather, ICOM-CC Interim Meeting, Working Group "Leather and Related materials", Brussels, 225-27 March 1998*, ed. Theodore Sturge, [no city]: ICOM-CC Working Group "Leather and Related Materials", p. 52-53 [88 p.].

Treatment of gilt leather upholstery on three Portuguese chairs. Grain layer was silvered, varnished and painted and had thick white ground. Leather in good condition except at folds, where there were tears and grain layer was cracked. pH was 4-4.5. Substantial losses and cracks in the white ground and paint layers, probably from use and environmental changes. Consolidation of paint layers: silver leaf was consolidated to leather with 1% ppv Klucel G in ethanol, while 10% Paraloid B72 in xylene was used for paint layers. Small splits along folds were backed with polyester organza and Beva Film to flesh side, applied by heat reactivation. Cracks and small losses filled with Polyfilla; very small gaps in grain layer were filled with Beva Film reactivated with heat.

Fenn, Julia, 1984, "Some Practical Aspects in the Choice of Synthetic Resins for the Repair of Ethnographic Skin and Gut", *Adhesives and Consolidants, Preprints of the Contributions to the Paris Congress, 2-8 September 1984*, eds. N.S. Brommelle, E. M. Pye, P. Smith and G. Thompson, London: IIC, p. 138-140.

Gives adhesives that have often been found to be useful, or not so useful, for 3 groups of skins. General selection criteria: stability and reversibility (e.g. avoid emulsions generally); bonds with adequate strength; adequate penetration; should not stain. (1) Waxed and oily skins: their oily/waxy surface is typically difficult to bond. General recommendation: Beva 371 paste, brushed on because it adheres well, remains flexible, is soluble in solvents that are typically non-damaging to skins. (2) Very porous skins with a napped texture or for rawhide: criteria inludes that it should not penetrate to discolour the surface; should remain very flexible. General recommendation: Beva 371 paste, brushed on, for reasons as in (1). Skins with pigments rubbed onto them: Beva 371 may not be suitable as it could alter the appearance. General recommendation: Elvace 1874 PVAC emulsion diluted 50% by volume in a 1% aqueous solution of Modocoll ethyl hydroxyethylcellulose, whipped in a foam. The Elvace is viscous, non-penetrating, quick-drying, slightly acidic pH, and was found to be more reversible than other PVAC emulsions (it forms a soft gel when organic solvents are applied to dry film); the Modocoll is added to improve its flexibility. (3) Gut: often in need of repairs by backing cracks, breaks and holes. General recommendation: Klucel G hydroxypropyl cellulose or Modocoll EK 1200 ethyl hydroxyethyl cellulose in water: both give a good bond, and do not alter the translucency very much. Elvace 1874 or CM Bond M2 PVAC emulsions give a stronger, less visible bond than the above, but may not be as stable. Also discusses consolidation of rotted leather with Klucel G (caused unacceptable darkening), Pliantex (gave best strength and flexibility but caused unacceptable darkening) and with acrylic (Paraloid) B72 in diethyl benzene (best result, good appearance).

Fernandez-Bolanos, M. Paz and M. Isabel Herraez Martin, 1992, "Conservation and Restoration of the Sword of Boabdil, King of Granada", *Conservation of the Iberian and Latin American Cultural Heritage, Preprints of the Contributions to the Madrid Congress, 9-12 September 1992*, eds. Henry Hodges, J. S. Mills and Perry Smith, London: IIC, p. 38-41.

Treatment of the sword of Boabdil's scabbard, circa 13th c. Some losses in the leather and worn areas with loss of grain. Pliantex was used to consolidate worn areas showing loss of grain. Mould of the leather grain was

taken and used to create a patch (fill) made up in Pliantex thickened with natural earth pigments. The patches or infills were adhered with Pliantex over a layer of Bondina non-woven polyester support fabric previously adhered to the leather with Mowilith DMC2.

Fletcher, Yvette, 2006, "Leather Components from Panhard et Levassor Automobile. 1899", p. 302-306 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

The leather components were black veg.-tanned cattle hide of various weights. Treatment designed for indoor museum display. (1) Hood: heavily oiled; worn at folds with small associated tears, some loss of surface; several large tears, lower edge of hood flap torn with small losses. Holes and tears were patched with archival quality veg.-tanned calf leather adhered with reversible PVA adhesive. Small losses infilled with pigment-colored Beva 371 melted in with heat spatula. (2) Rear seat: good condition, some wear at corners and edges; squab cushion poor condition, splits and losses to leather cover due to inappropriate new foam cushion. Cushion sides were lined with archival quality veg.-tanned calf leather and adhered with reversible PVA adhesive. (3) Seat fall: very fragile condition, heavily oiled, old repair patch, tears, small losses. Seat fall was relined with lightweight spun-bonded polyester (Reemay), considered preferable to woven fabric because of absence of surface nap and that it can move equally in all directions. Adhered with a 3:1 mixture of Lascaux 498HV:360 HV. Losses infilled with pigmented Beva 371. (4) Front seat: back of seat had several small splits and holes, surface losses. Splits and holes were patched with archival quality veg.-tanned calf leather adhered with reversible PVA adhesive. (Treatment date: 2003.)

Fogle, Sonja, ed., 1985, *Recent Advances in Leather Conservation, Proceedings of a Refresher Course Sponsored by FAIC, June 1984*, Washington DC: FAIC.

Provides a variety of useful information on leather conservation including adhesive backing repairs. (See individual authors.)

Goepfrich, Jutta and Brigitte Dreyspring, 2005, 'Fabulous beasts – leather, silk and gold: recent research on, and conservation of, 12th century footwear from the episcopal tombs in Trèves Cathedral,' *Preprints of the ICOM Committee for Conservation 14th Triennial Meeting, The Hague, 12-16 September 2005*, vol. 2, ed. Isabelle Verger, London: James and James, p. 243-248

Treatment of 12th century shoe fragments recovered from episcopal tombs in Trèves cathedral. Consisted of red-brown vegetable tanned goat leather upper, with appliqué work made of leaf-gilt leather partly underlain with silk, small stone decorations, and cork soles. The fragments were flattened, and the leather was extremely stiff, brittle, desiccated, showed signs of shrinkage and only medium fibre cohesion. Shrinkage temperature ranged between 41-50°C. Previously restored in 1937 and coated with a nitrocellulose lacquer which caused some darkening, stiffening and desiccation but probably helped stabilize and preserve the associated textile fibres. The treatment aimed at increasing the short-term flexibility of the fragments for reshaping, reassembling the fragments and placing the shoes on specially constructed mount. The nitrocellulose lacquer was not removed for fear of destroying the fragile silk. After humidification and reshaping using Gore-Tex membrane sandwich, reassembled leather fragments with isinglass glue and rice starch paste; used sumac-tanned new leather cross pieces as backing, at right angles to the fold on the back side.

Goepfrich, Jutta, 2007, "Conservation of a Deformed African Dance Costume with Painted Rawhide and Raffia Fabric", p. 10-13 in *Recent Preoccupations Concerning Textiles, Leather Legislation. Post-prints Relating to Leather, Athens, 21-24 April 2004*, ed. T. Sturge, [no city], ICOM-CC Working Group "Leather and Related Materials".

Treatment of an African dance costume which included a tunic and leggings made of raffia with painted goat rawhide sewn onto it. Painted rawhide was suffering from insect holes, tears, shrinkage and deformations, and some localized darkening probably due to heat damage. Ts = 45 °C. Repaired with fine goat parchment thinly pared down at the tears, applied with 7% gelatinized isinglass. Small tears were filled with parchment shavings.

Goepfrich, Jutta, 1999, ""The Granulated Donkey?" Shagreen: Some Aspects of Conservation", *Preprints of the ICOM Committee for Conservation 12th Triennial Meeting, Lyon, France, 29 August-3 September 1999*, vol. 2, ed. J. Bridgland, London: James and James, p. 685-690.

A shagreen or chagrin (oriental embossed leather) pistol case, covering a parchment and wooden core, was torn and had losses. The shagreen was repaired and infilled with parchment glue and skived very thin calf parchment.

The vegetable-tanned leather strap that was torn in 2 pieces was adhered as a butt-end repair using Planatol AD95 PVAC adhesive (no backing was used).

Gottsman, S., 2009, "A gut skin parka from the ethnographic collection of the Reiss-Engelhorn Museum." In: *Scraping Gut and Plucking Feathers: the Deterioration and Conservation of Feather and Gut Materials*. Available online on the ICON website: http://www.icon.org.uk

Treatment of a seal gut parka, Chukchi, 19th century: the parka was completely flattened, distorted, dry and brittle, creased along the hemline and the sleeves; the gut strips were partly torn. Previously repaired by sewing (some possibly pre-dating collection). Tears requiring structural strength were repaired with medium quality of Kozu Japanese paper backings: this paper was sufficiently strong but still flexible enough to line well around the creases of the gut material. Methylcellulose Methocel 4AM 2% w/v in water was used as thte adhesive. This allowed gentle drying with little tension on any of the materials. In a few areas with gaps where applying the backing on the inside was not possible yet where additional strengthening was necessary for display mounting (e.g. at the shoulders and the hood), the same repairs were applied as facings, toned in with water colours.

Heine, Hildegard, 2003, "Treatment of an Inuit Waterfowl Foot Skin Bag from Arctic Québec", *J.CAC 28*, p. 16-26.

A small Inuit skin bag made out of waterfowl foot skin presented several challenges: many distorted tears in the extremely thin skin; restricted access to the interior of the bag; and serious deterioration in the skin as indicated by the low shrinkage temperature. The skins were softened through humidification with ethanol/water vapor followed by localized ultrasonic misting, and the bag was reshaped. Tears were realigned, then temporarily faced with Klucel G and Japanese paper, which then allowed for tears and holes to be backed using 70% Beva 371 stock solution diluted in toluene, used without heat, applied by brush, spatula or syringe, and Japanese paper as backing. Other materials tested for the backing repairs: Beva 371 film formed from the stock solution and reactivated with xylene; Acryloid (Paraloid) B72 50% in 1:1 acetone: toluene; Nylon gossamer; and Hollytex. Avoided water-based adhesives and heat reactivation because of skin's low shrinkage temperature. Where necessary, delaminating keratin scales were consolidated with 30% Acryloid (Paraloid) B-72 1:1 in acetone: toluene.

Hermans, Johan, 1992, "Fans on Skin: Their Conservation and Storage", *Conservation of Leathercraft and Related Objects Interim Symposium, ICOM Committee for Conservation, London, UK, 24-25 June 1992*, eds Pieter Hallebeek, Marion Kite and Christopher Calnan, London: Victoria and Albert Museum, p. 42-44.

Mentions that repairs to fans made of skin materials (vellum, parchment, thick and thin leather, suede, 'chicken-skin' (hide of aborted calves) are done with minimal tabs or strands of fibre from Japanese Tengujo paper or lens tissue, adhered with almost dry wheat starch paste or Klucel G in Industrial Methylated Spirits.

Hill, Linda K., 1986, "The Conservation of Eskimo Seal-Gut Kagools", *SSCR Bulletin n° 7*, Scottish Society for Conservation and Restoration, p. 17-19.

Two seal gut parkas were seriously deteriorated, very dry, brittle, creased, cracking and splitting along fold lines, holes, shrunken. Flexibility was improved by impregnating with PEG 400. Repaired with nylon gossamer and 50%w/v Mowilith B50 (sic) PVAC resin in acetone. This adhesive adhered well to the PEG-impregnated skin; the nylon was compatible and could be dyed to match original.

Horelick, Loren Anne, Kelly McHugh, and Odile Madden, 2011, "What's Going on With Guts: Assessing Adhesives Used to Repair Cultural Objects Made of Gut Skin", in: *Proceedings of Symposium 2011 – Adhesives and Consolidants for Conservation*, Ottawa: Canadian Conservation Institute, 18 p. Available online: http://www.cci-icc.gc.ca/symposium/2011/Paper%209%20-%20Horelick%20et%20al.%20-%20English.pdf

Describes a study of adhesives for gutskins. Criteria included an adhesive that avoided stiffening the gut and excessive penetration. Based on online survey, literature review, and list of adhesives used at National Musem of the American Indian (NMAI) and National Museum of Natural History (NMNH), selected the following adhesives for testing: the acrylic emulsions Lascaux 498/Lascaux 360 HV mixture (3:1) or (1:1); the vinyl acetate ethylene (VAE) emulsions Elvace 45675 CX and Jade 403; 12% sodium alginate / arrowroot paste mixture; wheat starch paste, alone or mixed with methylcellulose (3:1) or with Jade 403 (3:1); methylcellulose alone or mixed with Jade 403 (3:1); Acryloid F-10 stock solution in mineral spirits (40% solids); Acryloid F-10 cast film, heat-reactivated; 5% BEVA 371 Original Formula in xylene; BEVA 0.25 mm cast film, heat-

reactivated; 15% AYAA PVAC resin in acetone; and 20% Acryloid (Paraloid) B-72 acrylic resin in acetone. The adhesives were bonded to summer seal gut and the quality of the bond was examined by SEM. Authors found that the mixture of Lascaux 498/360 HV (3:1) adhered more intimately to gutskin that had been dampened prior to application. Acryloid (Paraloid) B-72 did not adhere well to the gutskin or goldbeater's skin perhaps because of bubbles formed during volatilization of the acetone solvent; synthetic resins applied in mineral spirits and xylene and as a heat-set film without solvent did not show this bubbling phenomenon. Use of less volatile solvents could be important not only for an intimate and continuous adhesive bond but also to protect fragile gutskin from forces imposed during solvent volatilization. Phase 2 of project is ingoing.

Hornbeck, Stephanie, 2005, "The Treatment and Preparation for Exhibition of a Composite Material Ceremonial Warrior's Costume from the Loma People in Liberia", in: *Recovering the Past: The Conservation of Archaeological and Ethnographic Textiles,* Preprints, 5th North American Textile Conservation Conference, November 9-12, 2005, compiled by Emilia Cortes and Suzanne Thomassen-Krauss, p. 161-167.

Patchwork costume (tunic, pants and headdress) from Liberia made from leopard and antelope fur, dyed wool felt, leather appliqués, clawed eagle feet and talismanic text packets. Leather was seriously degraded with surface powdering and losses; pH was 4.0. Consolidants: Beva 371 in xylenes and Paraloid B72 in acetone/ethanol worked but created noticeable darkening as compared to 2% Klucel G in ethanol. Used one coating of Klucel solution applied by brush. For the tears and losses: tested Beva 371 Film, Paraloid F10 in mineral spirits, AYAT PVAC resin all in film form to ensure only surface penetration; tested 3 thicknesses of Hollytex non-woven polyester, 2 thicknesses of Japanese paper and goldbeater's skin; and tested reactivating by spraying solvent with an atomizer, with hot spatula or with a hot-air pen. AYAT was not flexible enough for this application, while both Paraloid F10 and Beva were successful; decided on Beva for its history of successful use on leathers. Goldbeater's skin was too thin for this application; Hollytex 2.8 mm and Japanese tissue conformed to the leather well. Solvent reactivation was effective but decided it was preferable to avoid wetting. Treated leather by backing with Hollytex 2.8 mm covered with Beva Film, tacked on with hot spatula at 80 °C.

Howard, Brian R. and April H. Berry, 1995, "Three Chairs for Leather Conservation", *Objects Specialty Group Postprints*, vol. 3, compiled by J. Lauffenburger and V. Greene, Washington DC: American Institute for Conservation of Historic and Artistic Works, p. 3-9.

Two 17th century leather upholstered chairs were treated. Their chair backs were very deteriorated (desiccated, stiff, red-rotted in some areas with large complex tears and large losses; extremely friable). Pliantex was applied as a consolidant. Tears were repositioned with sutures made of Reemay coated with flocked Beva 371. Areas of loss were compensated (with new pieces of skived mineral tanned leather attached with Beva 371, coloured with microcrystalline wax/rosin and toned with dry pigments), then the leather back was completely lined with two layers of Reemay flocked-sprayed with Beva 371, applied with heat. For one of the chairs thin chrome- tanned leather was attached, flesh side out, to the reverse of the Reemay lining, to create an appearance similar to the original panel. In areas where the leather was less damaged tears were repaired with new skived leather inserts and filled with the same wax-rosin mixture; or mended with Beva coated Reemay sutures applied to the reverse, and the tears were filled with microcrystalline wax toned with dry pigments.

Iafrate, Sara, Anna Valeria Jervis, Mariabianca Paris, Marcella Ioele, Laura D'Agostino, 2013, "The Restoration of the 17th Century Altar Frontal from the Oratory of Saint Dominic in Orvieto: Backing Reinforcement, Lining and Tensioning System According to Minimal Intervention", , p. 40-47 in: *ICOM-CC Leather and Related Materials Working Group, Postprints of the 10th Interim Meeting, Offenbach, August 29-31, 2012*, ed. Céline Bonnot-Diconne, Carole Dignard and Jutta Göpfrich, Offenbach: DLM Deutsches Ledermuseum Schuhmuseum.

This altar frontal consisted of gilt leather with decorative patterns painted with pigments and oil medium lacquers. The leather support was thin and structurally compromised by numerous losses and tears; some areas were especially brittle and fragile. Shrinkage temperature: 44-55°C. Previously restored with canvas strips adhered with animal glue, and with stitches now causing deformations. Old glued patches and inappropriate stitching were removed. Following a minimal intervention approach, locally applied backing reinforcements to mend tears and to reinforce weakened leather edges, rather than full relining. Cerex 1.0 polyamide non-woven fabric was used as backing material, glued to the back of the frontal with Beva Film. For infilling inserts, alum tawed leather was chosen for its mechanical and aesthetic characteristics. Cerex 1.0 was applied with Beva Film as a sacrificial layer to sit between the leather infills and the original leather. The alum-tawed leather inserts were then glued with a water-based adhesive, a mixture of Evacon R (2 parts) and Tylose 4% solution in

distilled water (8 parts). Tests showed the "sacrificial layer" reduced the joints' resistance to shear stresses and gave it a breaking load lower than that of ancient leather; this layer also improved the infill treatment's reversibility because low peel strengths could be used without need of humidity to soften the adhesive.

Jackson, K and A. Hughes, 2009, "Gut reaction. The History, Treatment and Display Techniques of Gut Garments at the Pitt Rivers Museum." *Scraping Gut and Plucking Feathers: the Deterioration and Conservation of Feather and Gut Materials.* Available online on the ICON website: http://www.icon.org.uk

(1) Seal gut cloak with neck-cape from Aleutian Islands, early 19th c., which was ripped, discolored, friable, greatly misshapen and inflexible. (2) Gut parka from Baffin Island, hip length, early 20th c., which was misshapen, flat, gut was brittle with long tears and holes, some tears previously tacked close with a few stitches now causing damage. Both garments had likely been lubricated in the past. Backing materials tested: lamb, cow and pig intestine (sausage skins), goldbeater's skin, synthetic sausage skin and Japanese tissue. Synthetic sausage skin was unsuccessful at conforming to the shape of the garments' natural gut. Japanese tissue was good but visually noticeable (did not maintain the translucency of the gut). Adhesive criteria: adequate strength, flexibility, reversibility and ease of use. Adhesives tested: Klucel G 5% w/v in water; Klucel G 5% w/v in IMS; wheat starch paste; Paraloid B72 5% mixed with 2.5% Klucel G w/v in IMS; and 10% w/v arrowroot and sodium alginate paste in water. (1) Cloak: Pig intestine used: thin enough to be unobtrusive, conformed to gut contours and supplied adequate support. Used with 10% arrowroot and sodium alginate paste: most compatible; its water-based properties useful in locally softening and reforming gut which improved the bond. (1b) Cloak's skin border was weak, in poor condition with large losses. Repaired with Japanese tissue (Paper Nao K-37), most suitable even though was noticeable if looking closely; used with wheat starch paste, chosen for its good working time, its tack can hold the substrates together whilst curing and its high reversibility. (2) Parka: repaired with strips of pig intestine: was transparent and conformed well to highly contoured gut surface. Adhered with 5% Klucel G in water, chosen because water helped to soften and reshape the gut and align the tear. Patches applied were 2cm wider and longer than tear area.

Jervis, Anna Valeria, Silvia Checchi, Antonella Di Giovanni, Stefano Ferrari, Maria Rita Giuliani, Marcella Ioele, Michael Jung, Marica Mercalli, Federica Moretti, 2013, "The Study and Conservation of a 12th Century Pair of Ceremonial Sandals with Arabesque Decoration from Castel Sant'Elia's Collection of Liturgical Garments", p.48-57 in: *ICOM-CC Leather and Related Materials Working Group, Postprints of the 10th Interim Meeting, Offenbach, August 29-31, 2012*, ed. Céline Bonnot-Diconne, Carole Dignard and Jutta Göpfrich, Offenbach: DLM Deutsches Ledermuseum Schuhmuseum.

Pair of 12th c. ceremonial sandals made of different materials: sole made of vegetable-tanned leather, cork and of alum-tawed leather; upper made of very thin vegetable-tanned goat leather with gilt veg.-tanned leather appliqués; also with silk taffetas, silk threads, metallic rivets and elements and parchment. Condition: many losses, large areas of the upper were missing on both shoes; folds and creases; all organic materials were quite fragile. Shrinkage temperatures: for the upper, approx. 49°C; could not be measured for the gilt leather; for the alum-tawed skin, 35- 43° C. Fragile and detached parts of the gilt leather layer were supported with non-woven polyamide fabric (Cerex) adhered with Beva Film. Tears were mended by adhering the adjacent margins with 8% Tylose MH300P cellulose ether in water. It was decided not to compensate gaps and losses, as the incompleteness of these objects is to be taken into account and preserved in its historical meaning. A support t was planned that would address the shoes' shape and protection (treatment still in progress at time of writing).

Kaminitz, Marian and Judith Levinson, 1988, "'The Conservation of Ethnographic Skin Objects at the American Museum of Natural History", *Leather Conservation News vol. 5 n° 1,* p. 1-7.

Summary of treatment approach for semi-tanned or untanned skins at this museum. Typical mending and backing materials used include gold-beater's skin, fish skin, long-fibred Japanese tissue papers and synthetic non-wovens (polyester Reemay, Cerex spunbond nylon, or nylon gossamer tissue). Adhesives include starch pastes, cellulose ethers, polyvinyl acetate resins, Beva 371, and acrylic resins (Acryloid/Paraloid B-48N or B-72). Beva 371 is used as well for infills. Case studies:

(1) Jivaro bird necklace from Ecuador: tears at bird's necks (head and body completely separated), skin dry, brittle, papery thin and very weak; supported weight of bodies using a cotton thread and repaired tear at neck with tabs of goldbeater's skin coated with Acryloid (Paraloid) B48N and solvent-reactivated.

(2) Mangbetu harps made of a mammal or reptile skin stretched and sewn over wood resonator chamber: skin pieces had split and had shrunken, leaving gaps. Typically splits and gaps were spanned and filled using Japanese paper and various adhesives, however for some harps the gaps were filled with a mixture of Beva 371,

microballoons and dry pigments, applied in thin layers over an insert of Japanese paper or synthetic non-woven. (3) Hidatsa buffalo heart membrane water bag: skin was dry, brittle, very delicate, misshapen, with a 2.5 cm area of loss. Loss was filled with 2 layers of goldbeater's skin adhered together with gelatine, cut to shape of loss and lightly tacked in place using AYAA resin and a heated spatula. No backing used.
(4) An archaeological llama skin bag from the Atacama desert in Chile, desiccated,fragmentary, tears with curling edges: tears were backed with toned Japanese paper strips and wheat starch paste.

Keller, Heinz, 1986, "Restoration of a Roman Leather Helmet with Ear-Muffs", in: *Symposium on Ethnographic and Water-logged Leather, ICOM Committee for Conservation Working Group on Leather and Related Materials, Amsterdam*, *9,10, 11 June 1986,* ed. P. Hallebeek, Amsterdam: CL Publication, p. 4-5.

Reshaping and repair of a brittle and torn Roman leather helmet of the 4th century which was brittle, torn, and in several fragments. Used animal glue to adhere the detached fragments in place and to fill the interstices (no backing).

Kitchin, John and Marion Kite, 1992, "The Restoration of Vellum and Silk from a Bugatti Chair", *Conservation of Leathercraft and Related Objects Interim Symposium*, *ICOM Committee for Conservation, London, UK, 24-25 June 1992,* eds Pieter Hallebeek, Marion Kite and Christopher Calnan, London: Victoria and Albert Museum, p. 48-50 [64 p.].

The vellum seat of a Bugatti chair from around 1880-1904 was severely torn in several directions. Adhesion of this vellum was very difficult, perhaps due to earlier wax and oil treatments: parchment size, cold curing animal glue or Evo-Stik Resin W polyvinyl acetate would not hold. After humidification, it was glued with warm Scotch glue [a high-quality bone glue] to another but larger sheet of vellum. A hot-table at low heat (approximately 50-55 °C) was used to avoid premature chilling.

Kite, M., & Thomson, R., 2006, *Conservation of Leather and Related Materials*, Oxford: Elsevier.

Authoritative textbook on leather conservation. Individual chapters on certain types of collections, and individual case studies are herein referenced individually.

Kite, Marion, 2006, "Furs and furriery: History, Techniques and Conservation", p. 141-169 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

General discussion on the conservation of furs. Sewn repairs to torn fur skins unlikely to be an option. Adhesive repairs: criteria: must not penetrate and impregnate skin, strong enough to hold firmly and not peel when skin is flexed, adhesive compatible with skin's shrinkage temperature, stable, non-yellowing, removable. Aqueous adhesives must be used in a way that avoids wetting skin to avoid shrinkage and hardening on drying. Backing materials: strong, light, flexbile, multi-directional nature similar to that of skin. Options include leather, goldbeater's skin, Japanese tissue (*kozo* mulberry fibre and *mitsumata* papers), non-wovens (Holytex, Reemay, Pellon, Cerex, nylon gossamer) and Tetex (polyester crepeline). Adhesive options: Beva 371, wheat starch paste alone or with sodium alginate, isinglass, Lascaux 360HV and Lascaux 498HV, Jade 454 and Jade 402, Apretan MB Extra (formerly Mowilith DMC2) and AYAF PVAC resin solution. Access to the back of the pelt gives best results; linings and interlinings may need to be unstitched to gain access. Provides as well a summary of 2 fur treatments also described in Kite 1990 and 1991.

Kite, Marion, 1999, "The Conservation of a 19th Century Salmon Skin Coat", *Preprints of the ICOM Committee for Conservation 12th Triennial Meeting, Lyon, France, 29 August-3 September 1999*, vol. 2, ed. J. Bridgland, London: James and James, p. 691-696.

Treatment of an Eastern Siberian salmon skin coat generally in good condition but with small tears and holes. Used goldbeater's skin and cooled isinglass (approx. 7-10% w/v in water) for the repairs.

Kite, Marion, 1996, "Gloves", *Preprints of the ICOM Committee for Conservation 11th Triennial Meeting, Edinborough, U.K., 1-6 September 1996*, vol. 2, ed. J. Bridgland, London: James and James p. 735-741.

Discusses the conservation of leather gloves in general. The repair of a pair of fine suede gloves c. 1660-1680 was done using nylon gossamer and Beva Film, heat-reactivated. The nylon gossamer was cut 2 mm larger all around the split.

Kite, Marion, 1991, "The Conservation of a Wet Weather Hat from the Uniform of a Marshal General of the Portuguese Army, and a Chinese Fur-lined Kesi Robe c. 1800", in: *Paper and Textiles: the Common Ground, Preprints of the Conference held at the Burrell Collection, Glasgow, 19-20 September 1991*, compiled by F. Butterfield and L. Eaton**,** Glasgow: Scottish Society for Conservation and Restoration, p. 105-115.

Treatment of a Chinese Kesi Robe made of alum-tawed furskin. Fox fur skin was thin and papery. Old repairs, now destroyed due to insect damage, had been done with starch paste and oriental paper similar to paper used in the robe's interlining. Tested wheat starch alone and in combinations with sodium alginate because it was felt that these options were most compatible and were similar to the previous oriental repair which had held well (except for the insect damage). Sodium alginate increases flexibility of the starch paste. Aimed at avoiding wetting the skin as much as possible, and to produce the least shrinkage of the patches and of the skin on drying. Patch repairs were carried out with a 2:1 wheat starch paste: sodium alginate (5g in 150 ml water) mixture used as dry as possible. Also tested a number of *kozo* and *mitsumata* paper; chose one most suitable among *mitsumata* type. Beva Film was tested and found unsuccessful: the repair held well but was not visually satisfactory, as the Beva penetrated the skin, making it look translucent. (Also described in Kite and Thomson, 2006, p.163-165.)

Kite, Marion, 1990, "A 1740's Horse Hair Hat, A Busby c.1827 and a Fur-lined Cape c.1936", *Preprints of the ICOM Committee for Conservation 9th Triennial Meeting, Dresden, GDR, 26-31 August 1990*, vol. 2, ed. Kirsten Grimstad, Los Angeles: ICOM-CC, p. 616-621.

One of objects described consisted of an ermine-lined hood of a blue felt cape, French, 1936. The fur lining was grubby from wear and damaged, split and in two areas had shredded into small fragments, with, in some areas, hard adhesive residues from a previous restoration. Fur treatment involved heat reactivating Beva Film on nylon gossamer to repair an ermine fur that lined the hood of a fur-lined cape. SF2 silicone adhesive gave as good results in terms of adhesion and strength but was more visible. Mowilith DMC2 was not tested but deemed unsuitable as it would not give a good enough surface adhesion to the skin when used as a light film. (Also described in Kite and Thomson, 2006, p.161-163.)

Kite, Marion, Roy Thomson and Aline Angus, 2006, "Materials and Techniques: Past and Present", p. 121-129 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Overview of treatments of leather objects in general. Decisions based on condition assessment and identification of tannage; must also assess past treatments, especially if oils are present; earler treatment steps (e.g. consolidation) will influence rest of treatment. Repair materials that are further discussed include: new leather, polyester sailcloth, spun-bonded polyester fabrics (Reemay, Cerex, Vilene), Japanese tissue or woven textiles. Adhesives further discussed include Beva 371, PVAC and EVA emulsions (PVA M155, PVA M218 ('Hewit Reversible'), Vinamul 3254), acrylic emulsions (Lascaux 360HV, Lascaux 498HV or mixes), acrylic resin Paraloid B72 (said to be rarely used but used as a consolidant), wheat starch past, sodium carboxy methyl cellulose (CMC) 1-5% in water and animal glues (said to be difficult to use since must be applied hot and they have a high moisture content; past treatments with these glues have become embrittle and bond has failed). Fill materials discussed: leather; Japanese tissue; Beva 371.

Kronthal, Lisa, 2001, "Conservation of Chinese Shadow Figures: Investigations into their Manufacture, Storage and Treatment", *J.AIC vol. 40 n^{o} 1*, p. 1-14.

Discusses treatments of Chinese shadow figures and their rationales. They were repaired using either Beva 371 in solvent form or as a heat-reactivated film, or with dilute gelatine solution, chosen for: their good adhesion to the oiled rawhides and to the goldbeater's skin backing, their compatibility with the backing, rawhide and and tung oil coating, their long-term stability, and the resulting flexible and transparent bond. Paraloid F-10 and PVAC resins were tested but found to adhere poorly to either the goldbeater's skin or the tung-oil-coated rawhide surfaces; as well as to lack the strength required by some of the mends. Backings tested include Japanese gampi paper and oiled papers but these were discarded because of their differential ageing when in contact with the acidic skin and oil, their dimensional incompatibility with respect to the rawhide and the resulting visual inconsistencies. Skin products were given primary consideration due to their visual and chemical compatibility with the skins, however reconstituted collagen was discarded because of its short collagen fibres resulting in a product with a very short shelf life that becomes quickly brittle upon removal from package; and natural skin condoms, although strong, were considered too thick and visually obtrusive.

Goldbeater's skin (from sheep appendix) was used; it produced a strong, stable, flexible mend, was unobtrusive, maintained transparency of skin when viewed by transmitted light, was visually and chemically compatible with the skin and was compatible with the tung oil coating. [See also notes on these treatments in Kronthal et al. 2003.]

Kronthal, Lisa, 1997, "Conservation of Chinese Shadow Puppets from the Anthropology Collection of the American Museum of Natural History", *Objects Specialty Group Post-prints*, vol. 5, Washington DC: American Institute for Conservation of Historic and Artistic Works, p.32-51.

As per Kronthal 2001. Over 300 of the 1500 shadow puppet collection were found to be priority 1 need of treatment. In most cases the treatments involved removal of old storage materials stuck on their sticky tung oil finish, mending of tears within the skin or reattaching separated elements.

Kronthal, L., J. Levinson, C. Dignard, E. Chao and J. Down, 2003, "Beva 371 and Its Use as an Adhesive for Skin and Leather Repairs: Background and a Review of Treatments", *J.AIC* vol. 42, p. 341-362. [See also subsequent comments by Gustav Berger and reply by Kronthal et alii. in "Letters to the Editor." *J.AIC* 43, 2004, p. 1-2.]

Article presents a review of the literature and authors' research and practical experience in skin and leather treatments using Beva 371 (both the 'Original Formula' paste solution and the Beva 371 Film), focusing on the versatility of the adhesive and the variables that affect bond strength. A group of 58 skin and leather objects treated at the American Museum of Natural History from 1985 to 2000 were assessed, of which 48 had been treated with Beva 371 solution or Film, and both predominantly by heat-reactivation: tear repairs and fills had mostly remained intact but 10% showed some degree of failure, due to unsuitable treatment decisions (choice of backing - nature, size, thickness; degree of heat used and length of time; degree of saturation of adhesive into skin). Other past treatments of which 8 were with PVAC resins (AYAA or AYAC) and 2 with Lascaux 498HV dispersion showed considerable treatment failure, also most likely due to unsuitable treatment decisions. Mentions that for Chinese shadow puppets treated as per Kronthal 2001, stronger bonds were obtained through direct application of Beva 371 solution to the repair surface, left to dry then applying over it Beva Film with appropriate lining.

Léautey, Ingrid, 2001, "Action sur les cuirs de harnais de Compiègne", *Coré n^{o} 11,* p. 33-34.

A short report on the treatment of historic harnesses of the 19th century. The heavy metal components attached and hanging from the leather caused physical stresses and damage. The leather was torn, broken in areas, quite weak and its pH was very acidic. Leather was consolidated with Plexisol P550 acrylic adhesive and backed using this adhesive and Reemay (71g) non-woven polyester, chosen after tests indicated it gave very resistant and strong repairs. Some open stitches were stitched down to further strengthen and secure the repairs.

Long, D., 2001, "The Treatment of a 19th Century Buckskin Jacket", p.150-154 in: *Objects Specialty Group Postprints 8,* Washington DC: AIC.

A beaded 19th century buckskin jacket had previously been restored with excessive amounts of neat's-foot oil and crude patches. Shoulders had multiple tears and holes, most covered with patches, and skin was thinned and weakened in areas. Fringe was partially detached. After removing the excess oils, repairs were carried out using a large piece of very thin chamois cut to fit, skived down at the edges and adhered with a small amount of 1:1 mixture of Jade 403 and very dry Aytex P wheat starch paste. (Neat's-foot oil was first partially removed with Stoddard solvent or petroleum benzine on suction table to reduce weight by one third and improve colour & appearance).

Lougheed, Sandra, Janet Mason and Jan Vuori, 1983-1984, "Repair of Tears in Fur Skin Garments", *J.IIC-CG* vol. 8 & 9, p. 13-22.

Describes the treatment of 2 caribou furskin parkas (a koolitang and an amautik) and a 1903 Ukrainian sheepskin coat, all three with the fur on the inside of the coats and suffering from extensive tears and losses. Access was very difficult. Sewing was tested as a repair technique but the furskin was often too weak to withstand the stresses, it was difficult to align the cracks and the thread was conspicuous. Adhesive selection criteria: good working properties (due to difficult access), suitable strength, viscosity, tack, drying time, flexiblity. For the backing: suitable strength, thinness, flexibility with multi-directional fibre make-up and stability. Jade 454 with 2 plies of nylon gossamer tissue were used. Risk of adhesive yellowing with ageing considered not a major problem as the repairs were on the inside. AYAA or Acryloid (Paraloid) B72 mixed with EHEC or Klucel G were also tested. Provides details of 5 different ways of applying the backings.

Mannina, Loredana and Angela Lombardo, 2013, "Research on New Working Methods with Leather in Historical Artworks: Restoration Work of a Frontal Altar in Gilt and Painted Leather from Central Sicily", p. 66-73 in: *ICOM-CC Leather and Related Materials Working Group, Postprints of the 10th Interim Meeting, Offenbach, August 29-31, 2012*, ed. Céline Bonnot-Diconne, Carole Dignard and Jutta Göpfrich, Offenbach: DLM Deutsches Ledermuseum Schuhmuseum.

Treatment of the frontal altar of gilt and painted leather circa 18th c. in poor condition. Leather perimeter was extensively nailed on a wooden frame , which had led to splits and tears, losses and abrasions, and made the leather less resistant to mechanical stress. Decorative layers had discolored, were cracking and metal leaf and oxidized. The pH was 5.9, adequate. Losses were compensated with the use of new leather, compatible in elasticity and thickness with the original, adhered with a mixture of Plextol B500 and Tylose 3% (Plextol B500: Tylose, 9:1). Tylose was added in order to thicken the acrylic resin and reduce risk of seepage into the leather. It was decided to avoid a total lining that could have created problems (e.g. stresses due to limited movement); instead, frontal was reinforced locally with backing bands. Used only the dermis part of the new leather in order to have a material with high elasticity but low rigidity. An elaborate tensioning structure was designed.

Marchand, Caroline, 1998, "Conservation of a Kayak", *Canadian Museum of Civilization's website,* http://www.civilization.ca/cmc/exhibitions/aborig/watercraft/kayak/kayak1e.shtml. Created March 5 1998. Accessed August 2011.

A Copper Inuit kayak was suffering from several large tears, some out of alignment and most , difficult in access; also several old repairs or fills needed to be reversed. Most of the splits were backed with Japanese Kuratoni paper #219 and adhered with a relatively high concentration of Acryloid (Paraloid) B-72 in ethanol. After the skins were stabilized, the splits were filled with inserts of good quality lambskin cut to the shape of the split. The fill inserts were glued to the Japanese backing paper with Acryloid (Paraloid) B-72 and then inpainted with waterpaints.

McCarthy, Debbie, 1986, 'A Case Study: the Treatment of a Pair of Sixteenth Century Shoes", *ICCM Bulletin*, *vol. 12 n° 1&2,* p. 83-87.

The leather inner sole of a pair of cloth shoes was in a few pieces. Repaired with a piece of polyester gauze using a small amount of PVAC (brand not mentioned).

McFarlane, Meghan, 2009, "The Treatment and Analysis of a Hausa Horse Bridle', *Conservation of Three-Dimensional Textiles: Preprints, 7th North American Textile Conference, Québec City, Canada, September 30-October 3, 2009*. (CD-ROM).

Treatment of a Hausa horse bridle collected in 1912. Bridle bands and strap were constructed from a multi-layer structure of vegetable tanned leather, plant fiber, and woven cotton. The leather strap was largely intact but lifting and torn in some areas; a darker leather noseband fringe was in worse condition, stiff, with numerous detached elements. Both were suffering from red rot. After consolidating with 1-2 coatings of 'red rot cocktail' (1:1:1 SC 6000 wax: isopropanol: 2% Klucel G in isopropanol), torn and lifting leather was set down with heat-reactivated Beva 371 Film. The loose or detached pieces of noseband fringe were not reattached: treatment was considered through the use of a lining, but the stiff resulting fringe would have stood out straight, rather than moving and draping in a manner consistent with healthy leather.

Montembault, Véronique, 2001, "Treatments of Archaeological Leather in France", p.45-50 in: *Leather Wet and Dry*, ed. B. Wills, London: Archetype Publications Ltd.

Discusses treatment of waterlogged archaeological leather in general as practised in France, and use of PEG. Reconstruction carried out avoiding adhesives and using form-fitted supports and stitching through original sewing holes whenever possible. If adhesive is necessary, Mowilith DMC 2 and non-woven fabric are used.

Morrison, Lynn, 1988, "Some Suggested Materials for the Repair and Reconstruction of Archaeological Leather", *Preprints for the UKIC 30th Anniversary Conference*, compiled by Victoria Todd, London: UKIC, p. 107-111.

Adhesives for archaeological leather are used for example for relaminating leather, lining weak areas and attaching replacement materials. Properties sought: strength combined with flexibility; tolerance of moisture in leather; suitable tack and viscosity; no shrinkage or distortion upon drying; no penetration causing darkening or stain; no emission of damaging volatiles; retains its solubility upon ageing; minimal discoloration, embrittlement

or breakdown upon ageing; minimal health hazard; ease of use. Had reservations concerning the stability of PVAC emulsions. Investigated several cellulose ethers mixed with various other resins as substitutes, and suggests 5% Klucel G in IMS with a 10% Vinamul 3252 PVAC emulsion. As backing material, sought: long-term stability, pest-resistant, multi-directional structure, flexible, strong, available in range of weights, visual suitability, can be dyed. Suggests using Tootal non-woven, 80% viscose- 20% nylon blend as a backing material instead of nylon gossamer or polyester non-wovens because the viscose blend can be dyed.

Morrison, Lynn, 1986, "The Conservation of Seal Gut Parkas", *The Conservator 10*, p.17-24.

General review of treatments of gut parkas. The gutskins are often found weak, crushed and folded into stiff little packages. If a plasticizer such as PEG is used to lubricate and reshape the gutskin then an adhesive used for repairs need to be able to stick to the PEG-impregnated surface. A case study is reported: used sausage skin and Mowilith DMC2. Mowilith was diluted with a little distilled water: it adhered to the PEG 400 treated gut parka; had good tack; water-based, thus allowing to work with the dampened gut; invisible appearance; pH appropriate for skin. Was brushed on wet to sausage skin backing which was chosen because similar to the gut i.e. fine, slightly transparent, similar tensile strength, flexible; it can take dyeing or paint; it has good ageing properties. Both the sausage skin and the gut were dampened as necessary to eliminate creases for the repair. Investigated other backings: fish skin, goldbeater's skin, cow gut, lamb prophylactics, nylon gossamer, silk paper; and several adhesives: Klucel G in water; Vinamul 6815; Klucel G 1% in Vinamul 6815 30:70 in water; Klucel G 1% in IMS and Paraloid B72 and acetone 30:70; Paraloid B48N in toluene; Paraloid B82 in toluene; Pliantex; HMG; gelatine; Mowilith 30 in amyl acetate; Mowilith 50 in IMS and acetone.

Munro, Katharine, 1989, "The Treatment of a Feather Headdress", *Proceedings of the 14th Annual IIC-CG Conference', May 27-30 1988, Toronto, Ontario, Canada*, ed. Johanna G. Wellheiser, Toronto: IIC-CG, p. 172-179.

Deals mainly with treatment of the feathers and structural reshaping and stabilization of the headdress, but mentions that a 2 cm tear in one of the 2 rawhide strips at the base of the headdress was backed with transparent membrane adhered with a mixture of Acryloid (Paraloid) B72/Ethulose/ethanol (25g/10g/100ml).

Murray, W., 1994, "Conservation of a Pair of Fish-Skin Boots", *SSCR Journal 5(3)*, p. 13-14.

Treatment of a pair of 'Eskimo boots' made of panels of scaly fish-skin stitched with gut or sinew, and with mammal skin on the soles, decorative side panels and rims. Skin was stiff and brittle, but fairly strong and undeteriorated; it had a sticky yellowish dressing on surface, and some small tears and losses. Decided to avoid introducing any new materials into skin and leather; no backing or adhesive treatment was carried out (only cleaning, reshaping and support).

Newey, Hazel and Peter Meehan, 1999, "The Conservation of an 1895 Panhard et Levassor and a 1922 Prototype Austin Seven Motorcar: New Approaches in the Preservation of Vehicles", *The Conservator 23*, p. 11-21.

Treatment of two motorised vehicles, one of which (the 1895 Panhard et Levassor) had leather upholstery. The upholstery had split along some of the folds and pleats with loss of the top surface in some places. The splits were repaired using Vinamul 3254 (VAE) and where the leather required reinforcing, the same adhesive and Arvex FT78 woven polyester fabric were used. Gaps were filled with new leather.

Nieuwenhuizen, Linda, 1998, "Synthetic Fill Materials for Skin, Leather and Furs", *J.AIC* 37, p. 135-145.

Article centres on fill materials and their moulding or colouring to replicate textures surfaces. Fills proposed include: a mixture of Beva Film, dry pigments and glass microspheres; a mixture of Acryloid F10 with glass microspheres; a synthetic fur adhered with Acryloid F10. Backings are described for 2 objects: a Northwest Coast deerskin drum which had several tears and losses; and a stuffed and mounted lizard which was part of Mario Merz 1989 installation, and which now had a large tear at its tail. Both were backed with polyester spun-bonded fabric which was feathered-edged, and Beva Film applied at 65 °C, then filled with the Beva mixture previously mentioned.

O'Donnell, Alexandra Allardt, 1997, "No Object Is Frozen in Time: Revisiting Traditional and Nontraditional Leather Treatments as a Collaborative Effort", *Objects Specialty Group Post-prints*, vol. 5, Washington DC: American Institute for Conservation of Historic and Artistic Works, p. 142-151.

Provides a retrospective discussion of the author's use of Pliantex as a consolidant in a 1973 treatment, as well as of past and present use of leather dressings.

O'Donnell, Alexandra A., 1993, "Polyurethane Fills for Leather", *Leather* Conservation News vol. 9, p. 16.

A short description of polyurethane and papier maché fills for leather, which can be cast in silicone RTV mohter molds to successfully replicate the grain of leathers. The polyurethan fill can then be attached to leather fill margins with Paraloid B72 in toluene, and hairline joins of the fills blended in with a mix of microcrystalline wax, Paraloid B72, Cabosil fumed silica and Tint-all commerical tinting compound. The fill is flexible, holds along contact points on edges, and is readily bendable. Polyurethane should not be exposed to UV or sunlight to prevent its degradation.

Owens, Sarah, 2011, "Stitch, Patch and Adhere: Combinations and Sequence of Treatment of a 17th Century Leather Glove", in: *Incompatible Partners? Icon Textile Group Forum Postprints*, London: The Institute of Conservation.

Treatment of an early 17th century leather glove with an embroidered gauntlet. Leather was creased and distorted, there were tears and slits, and access was restricted. After contact humidification and reshaping, tears and slits were treated with patches of Reemay and pre-cast Beva 371 Film, in combination with strips of the pre-cast adhesive film. Reactivated using heated spatula. Inside of glove: combined adhesive treatment with stitching, i.e. adhesive-treated the tears and stitched a patch support to open seams.

Pandozy, Stefania, ed. 2011, "Wayang shadow theatre puppets", in *Esperienze del Laboratorio Polimaterico / Reports from the Ethnological Materials Laboratory*, Città del Vaticano: Edizioni Musei Vaticani, p. 46-51.

Brief summary of treatments of painted and gilded shadow puppets (30 in their collection) made of cured buffalo leather: in poor condition, deformed skin, lacerated and fractured along perforations, stiff. Paint and gold leaf consolidated with Jun Funori adhesive and 2% Klucel G. Repairs at the perforations were carried out using Japanese paper, curlo and 50% Zin-shofu purified wheat starch adhesive and Tylose MH 300P.

Paris, M., A. V. Jervis and L. Rissotto, 2008, "The Restoration of a Gilt Leather Portière of the 16th Century: Study of a Magnet-based Support Structure", p. 332-339 in: *Preprints of the ICOM-CC 15th Triennial Meeting, New Delhi, India, 22-26 September 2008, vol. 1*, ed. J. Bridgland, New Delhi: Allied Publishers Pvt Ltd.

Treatment of the gilt and painted 16th c. leather *portière* or door curtain hanging from the Bardini State Collection in Florence. *Portières* were usually lined but in this case the lining had previously been removed. It was severely distorted, creased from having been folded in a box for over 30 years, suffering from water stains and some tears, fragile but not degraded. Minor tears were mended using wheat starch paste. A major tear was mended inch by inch with wheat starch paste, after (where necessary) having reinforced the tear edges with Japanese paper. On the reverse of particularly fragile or thin areas, Japanese paper backings (patches) were adhered with wheat starch paste. Tiny losses were filled with a paste of cellulose powder and Klucel G cellulosic adhesive. Larger losses were filled with calf alum tawed skin of same thickness as the original leather. A large part of the treatment involved producing a magnet-based support structure that would not restrain the leather but would allow it to move with climatic fluctuations.

Paris, Mariabianca, Lidia Rissotto, Maria Cristina Berardi, 2002, "The 16th-century Leather Ceremonial Buckler in the Bagatti-Valsecchi Museum in Milan: a Case Study", p. 785-791 in: *Preprints of the ICOM-CC 13th Triennial Meeting, Rio de Janeiro, 22-27 September 2002, vol. 2,* ed. Roy Fontobel, London: James & James (Science Publishers).

Treated a leather and wood ceremonial shield. It had undergone a previous radical restoration that included reattaching the leather covering to the wood frame with animal glue. Leather was analysed and found to be in good condition, however was suffering from splits, deformations, serious hardening causing detachment from wood support (buckling on internal side leading to nails being pulled out of frame). Only moderately sized deformed areas were treated mostly near splits and losses, by humidification and application of pressure; more extensively deformed and rigid areas were not treated to avoid damaging tensions. Leather coverings where detached were reattached to wooden frame with thin nails: this mechanical method was chosen as it seemed best suited to the characteristics of the material and the environmental conditions the object would have to face as it

would allow some (admittedly minimal) movement of the leather.

Peacock, Elizabeth E., 1983, "The Conservation and Restoration of Some Anglo-Scandinavian Leather Shoes", *The Conservator 7*, p. 18-23.

Discusses various adhesives (including Pliantex and Beva 371) and backing materials for archaeological leather treated with glycerol. Pliantex performed well for consolidating, bonding, lining as well as proving 'acceptable as a conservation material'. Used Pliantex with Bondina T 1780 non-woven polyester fabric for a backing treatment as well as Pliantex for consolidation.

Rae, Allyson and Barbara Wills, 2002, "Love a Duck: the Conservation of Feathered Skins", p.43-61 in: *The Conservation of Fur, Feathers and Skin*, ed. M. M. Wright, London: Archetype Publications Ltd.

A Patagonian birdskin cloak and an Inuit birdskin parka both posed different challenges: cloak's skin was thicker and more robust, parka skin was delicate and posed access problems (skin was on inside). Condition: tears, some areas very weak, in particular in areas where feather shaft protrudes through skin. General criteria for adhesive and backing material: long-term stability, reversibility, compatibility. Adhesive treatment was preferred to stitching to avoid puncturing the weak skins. Cloak repaired on reverse with Japanese kozo paper, chosen because sufficiently strong without altering flexibility, and expected to give under strain. Used 10% v/v Mowilith 50 in acetone, chosen because provided flexible bond and ages well. Birdskin parka: fragile, access very difficult. When back side could be accessed by reaching in from sides of tear, used Japanese kozo paper brushed with 50% v/v Apretan MB Extra PVAC emulsion (identical to Mowilith DMC2), then carefully positioned. This adhesive allowed longer working time than solvent-based adhesives and ages better than other emulsions. Where access was easier, used goldbeater's skin because it was also sufficiently strong and flexible, but matched original skin more closely and was deemed more compatible (being proteinaceous); however it is difficult to work with. Best results obtained by applying adhesive onto birdskin then applying goldbeater's skin over. For a large tear that was impossible to access from back, facings with small tabs of goldbeater's skin were successful and unobtrusive.

Raphael, Toby, 2003, "Mixtures of Paste and Acrylic Adhesives", p. 99-100 in: "Use of Adhesives on Leather Discussion." *The Book and Paper Group Annual 22*.

Discusses adhesive blends for leather and skins, and in particular how cellulose ethers and/or wheat starch paste (WSP) are useful as additives to acrylic adhesives, to improve reversibility or control other properties such as bond strength, drying time, ageing properties, plasticity, etc.

Raphael, Toby, 1985, "The Completion of Missing Areas", in: *Recent Advances in Leather Conservation, Proceedings of a Refresher Course Sponsored by FAIC, June 1984*, ed. Sonja Fogle,Washington DC: FAIC, p. 71-75.

Discusses ethical considerations and provides practical information on the following type of leather gap-filling systems: pigmented wax, pigmented synthetic resin, leather paste (pigment, leather fibres and wax or resin), skived leather inserts and photographic inserts.

Regni, Marina and Roberta Tucci, 1998, "Le tambourin : instrument de musique populaire italien – utilisation, technologie, conservation", *CoRé n^{o} 4*, SFIIC and Éditions Errance, p. 33-36.

Discusses usage, manufacturing techniques and conservation of the Italian *tamburello* (tambourine). In general, recommends for skin tear repairs and gap-filling the use of Japanese paper or good quality animal skin membranes (gutskin etc), and natural or synthetic adhesives. Selection criteria: size and thickness required of the repairs, transparency, reversibility.

Richardson, H., 2002, "The Conservation of Plains Indian Shirts at the National Museum of the American Indian, Smithsonian Institution", p.7-24 in: *The Conservation of Fur, Feather and Skin,* ed. M. M. Wright, London: Archetype Publications Ltd.

Treatments of 45 Plains Indian shirts with holes, tears, torn fringes discussed in terms of similar problems encountered and solutions used. Tested: Beva 371 Film (0.25 mm) by heat-reactivation; Beva 371 liquid formula thinned out in toluene, brushed on; Paraloid F10 brushed on and as a heat-reactivated film (applied 4 layers onto Teflon fabric); and 30% AYAA in acetone, brushed on. Activation temperature for films: 65 °C. Butt joins were carried out on some torn hides; for these, Beva Film was most successful: strong, flexible, no

seepage into surrounding hide. Paraloid F10 film also held well; Paraloid F10 liquid and Beva 371 liquid failed and stained. Some butt joins were successfully completed with Jade 403 and 'knitting' hide fibres together. For backing repairs, both heat-activated films were strong and flexible, while liquid adhesives failed quickly at edges; decided to use Beva Film, for consistency with butt join repairs. Tested Japanese tissue, Hollytex and Reemay non-woven polyesters and Cerex non-woven nylon 6,6; each were strong, flexible, could be feathered and coloured. Each were used depending on object's needs. Reemay was slightly too thick but particularly inconspicuous at feathered edges; it remained matte so most inconspicuous when facings rather than backings were necessary. Cerex was so thin that shine of adhesive showed through, however its great flexibility made it most appropriate on very thin damaged hides. Damaged fringes were supported on back with Japanese kozo paper on which a layer of Beva 371 (liquid) was brushed on, then heat activated onto skin.

Ruppel, Jorun Rebekka, 2002, "An Arctic Sealskin Float: To Inflate or Not To Inflate", *The Conservator 26*, p. 32-41.

Treatment of a sealskin float which was extremely sticky and smelly, flat, very stiff with sharp folds/creases and two cracks believed possibly from storage or handling, plus a hole believed to have originated from use. Re-inflated after softening through immersion in a 9:1 water:ethanol bath. After drying, crack area was re-softened with water/ethanol solution to allow reshaping, and edges were butt-joined (no backing) with water-based Mowilith DMC2 PVAC dispersion, chosen because of its moderate tensile strength, flexibility and ageing properties. Applied first a dilute solution on both sides of crack, then when almost dry, the undiluted adhesive.

Scheibner, Sabine, 1999, "Kleine Massname - Grosse Wirkung; Restaurierungmassnahmen an einem Harmonium d'Artistes", *Arbeitsblätter für Restauratoren 1/99, vol. 32 n^{o} 1*, p. 166-168.

Describes the treatment of torn harmonium bellows. The torn leather bellows were repaired using a 1:1 mixture of Mowilith DM5 and Mowilith DM115. (In German.)

Schulze, Andreas, 2003, 'The 'Miracle Man' from Doebeln: The History and Conservation of a Late German Gothic Period Movable Christ Figure', *Leather As a Covering Material, Interim meeting of the ICOM-CC Leather Group*, Vic (Barcelona), 18-20 October 2000, Museu dell'Art de la Pell and Universitat de Vic, p. 57-61. Available: http://www.icom-cc.org/54/document/proceedings-of-the-icom-cc-lrm-working-group-interim-meeting-vic-2000/?id=990

Conservation, stabilization and re-integration treatment of leather segments on an articulated Christ figure made of wood with moveable joints covered with painted leather pieces and an internal skin pouch. Object had received an oiling treatment which caused many problems with the wood, metal fixtures, prime coats and paint layers. Original leather pieces were in poor condition. An oil-dressed white leather especially commissioned for the restoration, was set under the original fragments, or for missing areas. Gelled parchment glue was used for adhering and goldbeater's skin as a support under the weakened original leather. Former mobility could not be regained at the elbows and wrists due to leather having become severely brittle, hardened and damaged; some mobility could be regained at the joints of neck and shoulders.

Selm, Rosemarie, and Thomas Bilson, 1992, "The Conservation of an Eighteenth Century Sedan Chair", *Conservation of Leathercraft and Related Objects Interim Symposium, ICOM Committee for Conservation, London, UK, 24-25 June 1992,* eds Pieter Hallebeek, Marion Kite and Christopher Calnan, London: Victoria and Albert Museum, p. 45-48 [64 p.].

Torn and distorted portions of the leather were humidified, realigned and supported on the flesh side with Beva Film and Cerex 30, a non-woven nylon fabric. Large holes were lined with Beva Film and Arvex FT78, a woven polyester fabric, and infilled with new leather cut to fit the areas of loss. A coating of malleable wood filler was used on the leather fill to build -up the cavity and it was given a finish of polymer fill compound (acrylic resin, synthetic wax, hollow glass microspheres and acrylic pigments) to replicate the enamelled leather finish. A varnish of 10% Paraloid B72 mixed with either 0.5% or 1% wax in toluene were applied to the surface of the polymer. Where the leather had become detached from the frame and distorted, the edges were strip lined with skived new leather and Vinamul 3254.

Selm, Rosemarie, 1991, "The Conservation of Upholstery Leather - an Evaluation of Materials and Techniques", in: *Conservation of Leather in Transport Collections*, ed. Christopher Calnan, London: UKIC, p. 15-22.

A summary of the Calnan et al. 1991 publication.

Selm, Rosemarie A., 1989, "The Conservation of a 17th Century European Padded Saddle", in: *International Leather and Parchment Symposium, ICOM-CC Leathercraft and Related Objects Working Group, May 8-12 1989, Offenbach am Main, Germany*, Offenbach am Main: Deutsches Ledermuseum, p. 265-279.

Treatment of a 17th c. European padded horse saddle, made of woven and no-woven textiles, wood, metals and leathers. The leather skirt lining and leather saddle covering were delaminating. Acryloid (Paraloid) B72 film cast at 15% in acetone was heat-reactivated or solvent-reactivated (with acetone), with Reemay as a backing material. For some leather "shreds" too small for adhering to the B72 film, a 30% B72 solution was used by brush application. Consolidation was considered but it was decided that providing an adhered patch support was sufficient.

Sheetz, Ralph and Allen Cochran, 1978, "A Method of Stabilizing Weakened Upholstery Leather", *Studies in Conservation* 23, p. 86-89.

Mentions using Duco Cement (cellulose nitrate plasticized with camphor) to repair upholstery leather from a chair; and Beva 371 to line weakened upholstery leather.

Shenton, Helen, 1988, "The Use of Membranes in Conservation: the Case Histories of a Tortoiseshell Bookbinding and the lady Clapham Doll's Mask", *Preprints for the UKIC 30th Anniversary Conference*, compiled by Victoria Todd, London: UKIC, p.76-80.

A doll's mask dated 1693 made of black silk over a laminated paper body and lined with a skin thought to be parchment (labelled 'chicken skin'). The parchment lining had suffered splits and losses, was broken at the seams and had curled. Describes the use of fish skin (fish swim bladders) and, when more strength was required, of goldbeater's skin, and parchment size for the stabilisation of the parchment lining of a doll's mask.

Singer, Lois V. and Johan M. Hermans, 1988, "Conservation of Folding Fans", *The Conservator 12,* p. 15-24.

Treatment of 3 fans, one of which was made of kid leather and painted. For this fan, all tears were re-joined on the back with rows of minute bundles of Tengujo fibres and very dry wheat starch paste, approximately three fibres per 2 mm were introduced. As the right hand fold was missing, a new thin parchment fold was attached on the right hand side, overlapping 1 mm, using wheat starch adhesive.

Spicer, Gwen, 1995, "Supporting Tears in Leather", *Leather Conservation News*, *vol. 11 n^{o} 1&2*, summer and fall 1995, p. 4-6.

Describes use of solvent-reactivated Acryloid B72 film on Hollytex #3529 (stiff weight), for treatments of leather upholstered chairs (18th and 19th c.) and a leather covered coffer. This technique devised as a means of supporting a tear in leather without attaching the leather overall to the structural support below (wooden coffer, upholstery stuffing). The coffer was torn with losses, and brittle from red-rot. 30% Acryloid B72 film cast in xylene:acetone 1:1: adhesive was used, applied on 1 side of the Hollytex non-woven polyester backing of stiff weight. This Hollytex was chosen because needed to insert it under the leather without it flexing. To make the backing covered with adhesive film: applied 2 coats of adhesive onto silicone release Mylar & let dry. The adhesive film was then cut to shape, positioned onto Hollytex and placed into solvent chamber with a dish of acetone: xylene 1:1. The backing+ film was then inserted behind the leather and tacked on by injecting acetone with a syringe, then weighted. This allowed backing the torn areas while minimally adhering onto the wood coffer, or to the upholstery material, below.

Spriggs, James A., 1988, "The Worcester Pilgrim Project", *Conservation Today - Preprints for the UKIC 30th Anniversary Conference*, ed. V. Todd). London: UKIC, p. 112-116.

Treatment of boots from an archaeological find. The boots' elements (soles, rands, heels and vamps, heel stiffeners and boot legs) had separated during burial, original stitching had decayed; castor oil had been applied as a 'first aid' treatment which fostered and led to mould growth; grain was delaminating in areas; there were extensive losses and tears The boots were cleaned, lubricated, reshaped, repaired and mounted. They were repaired with Bondina non-woven polyester fabric and Pliantex, after consolidation with PEG 600.

Stone, Thomas, 1989, "The Conservation of Skin and Semi-tanned Leather at the Canadian Conservation Institute: Three Case Histories", in: *International Leather and Parchment Symposium, ICOM-CC Leathercraft and Related Objects Working Group, May 8-12 1989, Offenbach am Main,*

Germany. Offenbach am Main: Deutsches Ledermuseum, 1989, p. 229-242 [324 p.].

Three case histories. (1) Repair of tears on fringes of a Cree coat, using lamb membrane and Jade 454: treatment initially carried out in 1981 but had not held well when examined in 1989. (2) A torn Caribou Eskimo parka treated in 1982 (see Lougheed et al. 1983-84), re-examined in 1988 and holding well. (3) A torn kayak (see Dignard 1992).

Storch, Paul, 1989, "Military Leather Objects in the South Carolina State Museum Collections: Manufacture, Condition and Treatment", in: *International Leather and Parchment Symposium, ICOM-CC Leathercraft and Related Objects Working Group, May 8-12 1989, Offenbach am Main, Germany*. Offenbach am Main: Deutsches Ledermuseum, p. 221-227.

Various treatments for military leather objects. Repairs of torn straps, of a split seam on a light dragoon helmet or on edged weapon scabbards were done using Paraloid B72 1:1 in acetone and goldbeater's skin. The author explains the technique used when access to the back was difficult (for scabbards).

Storch, Paul, 1986, "A Non-Sewn Alternative to the Inlay Technique", *Leather Conservation News vol. 3 n^{o} 1*, fall 1986, p. 17.

Repair and loss compensation of a Native-tanned historic vest which had 3 large holes along its lower margin; edges of holes were abraded and misshapen, skin was weak and thin, one loss area was stained and stiffened. In general, main consideration for backing and infilling is that repair not interact with object, that it be stable and reversible, that it not overlap or obscure the original skin. Used chamois leather to fill the loss, with a fish skin backing tacked onto the back of the skin vest using dots of Butvar B-73 in butanol. This adhesive was chosen to avoid the moisture and low pH of water-based adhesives. Butvar gives good adhesion, chemical compatibility to skins, relatively good resistance to oxidation. Butvar B73 was found reversible by applying butanol. In one instance the Butvar caused darkening; author suggests in this case using instead Acryloid B72, or sewing. Infills were carried out using chamois.

Sturge, Theo, 2013, "Some Reflections on the Past Treatment of Gilt Leather, and Recent Remedial Work Where This Has Failed", p. 112-118 in: *ICOM-CC Leather and Related Materials Working Group, Postprints of the 10th Interim Meeting, Offenbach, August 29-31, 2012*, ed. Céline Bonnot-Diconne, Carole Dignard and Jutta Göpfrich, Offenbach: DLM Deutsches Ledermuseum Schuhmuseum.

Describes various past treatments and re-treatments by the author including:
(1) Six fold gilt leather screen from *Charlecote Park UK,* 18th c., with Chinoiserie paper restricting access to back. Extensive splits in leather had been repaired with leather and animal glue, probably in late 19th c. Repairs had failed, repair leather now had severe red rot and had lost virtually all of its strength. Old treatment was removed and new repairs were carried out with archival-quality calf leather and a mixture of Lascaux acrylic resins (3 parts 498HV : 1 part 360HV, added to give more flexibility.
(2) Wallhangings in *Dokkum Town Hall,* the Netherlands, previously treated by van Soest in the 1980's: leather has been strip lined and repaired with gold painted leather, and a layer of net applied over the new leather and onto the original, but not over the whole back. Strip linings and repairs were now failing. Rather than re-conserve all the leather, those areas which had failed were re-treated. Surplus adhesive was removed mechanically and leather of the strip lining was re-attached with Evacon-R ethylene vinyl acetate co-polymer dispersion, chosen for its high tack (which made it easy to position pieces and reduced drying time) and comparatively high strength. Where net was detaching or blistering, re-adhered with mixture of Lascaux acrylic resins (3 parts 498HV: 1 p. 360HV), chosen because less tacky than the Evacon-R, had longer working time and was more flexible. Where leather was weak in areas where the net and leather at the corners did not meet, a patch of 34 gsm Reemay non-woven polyester was applied over the surface and overlapping the net, adhered with the Lascaux mixture.

Sturge, T, 2007, "Gilt leather wall hangings at Dyrham Park. A trial for rehanging", *ICOM-CC Joint Interim Meeting "UPHOLSTERY+"*, Krakow, May 13-18, 2007, 6 p. Available at http://www.icom-cc.org/54/document/gilt-leather-wall-hangings-at-dyrham-park-a-trial-for-rehanging/?id=994

Describes the rehanging of segments of a gilt leather wall hanging, which involved the application of a calf leather strip lining around the perimeter, adhered with the acrylic dispersions Lascaux 498HV and 360HV in a 3:1 ratio. The softer 360HV was added to give a more flexible adhesive. The hangings could them be mounted on frames (strainers) and mounted.

Sturge, Theodore, 2006a, "The Gold State Coach. 1762", p. 265-267 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Coach's leather roof, 1762, silvered and lacquered with 45 layers of decorative finish: a major split had opened up in front quadrant, smaller split in rear quadrant, numerous small cracks. Patch of polyester sailcloth was inserted behind the largest split: chosen for good dimensional stability, resistance to rot, would not allow adhesive to penetrate from one side to the other (to avoid sticking leather roof with patch to timber underneath). Vinamul 3254 (chosen for its toughness and relative fluidity which made it possible to insert into tight gap) was inserted between humidified leather and sailcloth, then sandbags and left to dry. Smaller split with tight, difficult access were simply filled with Beva 371. (Treatment date: 1996.)

Sturge, Theodore, 2006b, "Dog Whip – Believed to Be Eighteenth Century", p. 268-270 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Dog whip made of wooden handle with a leather grip and raw hide thong. Wood handle was broken and missing, and leather grip had dropped off. Leather grip was reattached with 3:1 Lascaux 498HV: 360HV mixture applied at each end to wood handle with centre section left free of adhesive. (Treatment date: 1995.)

Sturge, Theodore, 2006c, "Fire Bucket", p. 271-273 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

As per Sturge 2000g. (Treatment date: 1995.)

Sturge, Theodore, 2006d, "Fireman's Helmet", p. 274-275 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Helmet, 18th c., made of degrained veg.-tanned cattle hide with hatband of veg.-tanned sheepskin. Main body in good condition but brim was in poor condition, pH 2.5, severe red rot; repairs needed to be relatively inconspicuous. Consolidated with 3% Pliantex. Flakes of lether tacked down with 3:1 Lascaux 498HV:360HV, chosen because it does not soak leather. Hole in brim filled with new veg. tanned calfskin, butt jointed to original leather, then further reinforced with Stabiltex (chosen for strength and relative transparency) covered with Beva Film and heat reactivated. Stabiltex and Beva Film also applied across splits on rim. (Treatment date: 1999.)

Sturge, Theodore, 2006e, "Jewellery Box", p. 285-286 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Wooden box covered with red veg.-tanned sheepskin skiver: had a few splits and an area of loss on lid. Leather very thin: any backing repair had to be light enough not to show through. New leather was deemed too bulky as backing material; used fine Japanese paper for most of work. To keep thickness down chose wheat starch paste because could give strong bond, is not bulky (most is water) and does not cause stiffening, however must use very sparingly to avoid overwetting and darkening leather. In areas where leather was curved by padding, splits were repaired incrementally by backing with several small pieces. Skived sheepskin skiver used as a patch to back and infill the area of loss, adhered with 3:1 Lascaux 498HV:360HV mixture. (Treatment date: 2000.)

Sturge, Theodore, 2006f, "Court Gloves", p. 296 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

White leather gloves with small splits between fingers. Repaired using Lascaux acrylic dispersions 498HV and 360HV in a 3:1 ratio, pre-coated on a very fine white silk fabric, and heat-reactivated onto the gloves. A heat-reactivated adhesive was used because it enabled the spread of the adhesive to be controlled; it gave a very rapid bond; also method was easier to work with, given the awkward location of the repair inside the glove. (Treatment date: 1998.)

Sturge, Theo, 2005, "Leather Upholstery: Options for Repair", in: *Fur Trade Legacy: the Preservation of Organic Materials*, Preprints from the workshop of the 31st Annual Conference in Jasper, Alberta, 17-18 May 2005, Ottawa: Canadian Association for Conservation, p. 155-163.

Discusses problems encountered in treatments of upholstery leather, including problems and options for red rot, and various treatment and repair options. Discussed various options of lining materials. Leather can provide a material in sympathy with original leather characteristics; discussed quality of materials, long term stability, its reaction to water, its mouldability, and the way to pare and finish edges. Reemay non-woven polyester also

discussed: random weave, range of weights, strength, toning, how to use it with water-based adhesives. Discusses adhesives and their various application techniques (wet, solvent reactivated, heat reactivated), with a focus on the properties and uses of Beva 371 paste, Beva Film and of Lascaux 498HV and 360HV acrylic dispersions. States that the use of Beva in a dot pattern has proved unsuccessful in the long-term, with previously treated items requiring re-treatment. Also discusses treatment of areas of lost colour and surface finish; and finishing, including whether to lubricate, feed or dress, and the use of microcrystalline wax polish.

Sturge, Theodore, 2000, *The Conservation of Leather Artifacts: Case Studies from the Leather Conservation Centre*, Northampton: The Leather Conservation Centre, 40 p.

In the 'Materials' parts of this publication (p. 24-32) the author explains common options and rationales. Adhesives used include Lascaux 498HV and 360HV most often as a 3:1 mixture, as this works well in particular as a solvent reactivated adhesive, although he also may use it with heat or as a wet adhesive. Acetone, toluene, xylene and 1,1,1-trichloroethane are discussed as reactivation solvents for it. Other adhesives used include Beva 371, Beva Film, wheat starch paste, Vinamul 3254, sometimes thickened with carboxy methyl cellulose, Hewit M155 PVAC nd Hewit M218 Reversible PVAC. Backings most frequently used are new vegetable-tanned leathers, Reemay non-woven polyester, and polyester sailcloth.

Ibid, 2000a , "The Waterloo Saddle", p 8-9.

The seat of an 1815 saddle was red-rotted and weak, torn at some lacing holes and had a large split and gap at one end. The holes were repaired with Reemay and a 3:1 mixture of Lascaux 498HV and Lascaux 360HV. The gap was repaired with the same adhesive mixture but using a backing of oak bark tanned leather that was moulded to fit. A further piece of the same hide was then moulded to fit into the gap.

Ibid., 2000b, "Gilt Leather Chasuble", p. 10-11.

An 17th c. silver gilt chasuble was weak, had split in places, had 2 small missing areas. Needed an unobtrusive repair that would not change the drape. Chose wheat starch paste (10g powder in 100 ml water cooked in double boiler 2-3 hrs, stirring regularly) and flesh split vegetable tanned calf skin.

Ibid., 2000c, "Jockey's Saddle and Boots", p. 12-13.

An 1831 saddle; a hole with splits in the saddle was repaired with new pigskin and a mix of Lascaux 498HV:360HV. Torn stitching was restitched where possible, and where this was not possible it was repaired with Beva Film heat-reactivated, with a Reemay backing.

Ibid., 2000d, "Suitcase", p. 14.

A circa 1900 suitcase made of embossed veg. tanned calf skin was heavily worn, scuffed, some of the seams had collapsed, some losses. Repaired with Hewit M155 PVAC dispersion, applied wet to both the new calfskin backing and to the original leather. Adhesive was allowed to dry until it was starting to become transparent before making the join. New calfskin also used to fill missing areas.

Ibid., 2000e, "Python Skin Chair", p. 15.

The seat of this 1930 chair was upholstered with python skin, and the rest of the wood en structure was covered with python skin applied directly to the wood base. The python skin had become very delicate and the edges of the seat were worn through to the wood and with losses. Some of the scales were lifting or loose; these were adhered with wheat starch. Damaged areas python skin was repaired using Hewit M218 Reversible PVAC and new python skin fills that could be slipped and tacked under the edges. Small cracks were filled with acrylic filler based on Encryl E.

Ibid., 2000f, "1906 Renault Landaulette", p. 16-17.

Vegetable-tanned leather upholstery of a 1906 Renault Landaulette: Front seat had some areas splitting, weak, fragmentary, with losses. It was repaired with Beva 371 impregnated into Reemay and heat reactivated (at approx. 100 C) onto the upholstery. The Beva was first applied warm by brush onto the Reemay and when dry, ironed into the Reemay to ensure high integration. Solid Beva was also used as a fill material for cracks and small areas of loss. The interior upholstery was in excellent condition with very small splits; these were repaired with new veg. tanned calf attached with Hewit M218 Reversible PVAC.

Ibid., 2000g, "Fire Bucket", p. 18-19.

A painted fire bucket of veg. tanned leather was suffering from large losses at its rim (made of leather over a wooden lath). Losses at the rim were repaired with Lascaux 498HV:360HV mix (3:1) and new oak bark tanned

cattle hide, moulded to conform to the rounded shape. Lascaux 498 HV was used for the sprung joint at the exposed lath.

Ibid., 2000h, "Gilt Leather Wall Coverings", p. 20-21.

Gilt leather wall coverings were suffering from many splits that were not in alignment. There was no access to the back. A blind clamping system was devised: a sandwich of card, silicone paper, Reemay, silicone paper and card was made, holes punched through and strong thread inserted through and back. The first layers of card, silicone paper and Reemay were then inserted through the tears to fit against the back of the leather. Vinamul 3254 (EVA) thickened with carboxy methyl cellulose (CMC) was then inserted through the tears with a spatula. The thread was then pulled and wedges applied against the top layers of silicone paper and card to hold the repair in place. The thread was cut to release the sandwich. Very small gaps were filled with Beva 371 and a heated spatula; larger areas were filled with new veg. tanned calf skin, fixed with Vinamul.

Ibid., 2000i, "Club Chair", p. 22.

Two chairs had large splits and substantial tears on their sides with no ready access to the back. Repaired with vegetable-tanned calf skin, pared down at the edges, and using 3:1 Lascaux 498HV:360HV mix that was applied to both the new (2 coats applied) and the old original leather (1 coat applied), left to dry and solvent-reactivated using 1,1,1-trichloroethane.

Sturge, Theo, 1999, "Gilt Leather Wall Coverings: Some Options for Repair", in: *The Conservation of Decorative Arts*, ed. Velson Horie, London: Archetype Publications and UKIC, p. 65-69.

Overview of repair options for gilt leather. Fills not discussed. Repair and lining materials discussed: Japanese tissue; Reemay; sailcloth; leather. Adhesives: Vinamul 3254, with or without 1% CMC in water; Lascaux acrylic dispersions 360Hv and 498HV, or mixtures; Beva 371; animal glue; parchment size; wheat starch paste. Provides many useful, practical insights, rationales and pros and cons for choosing between various options according to the problem and situation at hand, and provides various case study examples. Discusses: types of problems encountered (includes condition and various constraints e.g. sensitive varnish layers); types of repair possible; application techniques (wet, solvent reactivated or heat reactivated), with advice and tips on their use; solvents; modifiers, tackifiers (e.g. CMC); reversal; repair when access is limited; safety considerations.

Sturge, Theo and Aline Angus, 1996, "The Conservation of 17th Century Gilt Leather Wall Coverings at Frewen College, Northiam Near Rye, UK: A Case Study", *Leather Conservation News*, Vol. 12 number 2, Fall 1996, p. 1-5.

Describes the treatment of 17th c. gilt leather wall coverings, adhered with animal glue onto paper and wood panels, and of wall cover strips. After testing Vinamul 3254 and CMC, decided to use glue size: although it is not usually used as it requires heat and water and gives a brittle film, it was felt it was acceptable because (1) it had been the original adhesive (2) it was applied only in small areas (3) the leather was tacked onto the wood as well, hence no flexing was required. Used with Japanese paper. Glue was brushed on, hot, while leather still flexible after humidification. No shrinkage or damage to leather. Pressure applied using a frame and garden canes. For the wall cover strips, used polyester sail cloth and heat reactivated Beva 371.

Sturge, Theo, and Ian Beaumont, 2007, "The Callendar House Leather, Conservation, Restoration or What?", in: *The Conservation of Gilt Leather, ICOM-CC Interim Meeting, Working Group "Leather and Related materials," Brussels, 225-27 March 1998* , ed. Theodore Sturge, [no city]: ICOM-CC Working Group "Leather and Related Materials", p. 48-51 [88 p.].

Treatment of panels of late 19th century gilt leather attached to boards with a water soluble adhesive. Condition: varied widely; some panels suffered from very large losses, some were virtually complete; some were robust and flexible, some badly cracked, distorted and brittle. Owner required reconstruction that involved piecing together various damaged panels to create 7 panels out of the 18 damaged originals; the rest were then replicated from new leather. Where the leather in need of support could not be fully removed from the boards because of its fragility, it was backed with Reemay and a 3:1 Lascaux 498HV: Lascaux 360HV mix. Where the panels were built up as pieces from a variety of panels and assembled away from the board, they were mounted onto polyester sail cloth with the same acrylic emulsions mixture, and bonded by solvent activation (1,1,1 trichloroethane or xylene). Direct application of the water-based adhesive mixture was not practical because the leather expanded rapidly upon contact with water, thus preventing accurate alignment of joins. One coat of adhesive was applied to reverse of leather plus two thick coats of adhesive onto sailcloth; a paint-roller was used rather than a brush because it could more evenly distributed the adhesive, avoiding variations due to brush lines. Losses were replaced with replica pieces moulded from pigmented Beva 371.

Sturge, Theodore, Ian Beaumont, Ruth Rodriguez and Elise Blouet, 2006, "Gilt Leather Wall Hangings, Levens Hall", p. 315-324 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

60 individual panels of gilt leather mounted onto wood subframes with tacks, 18th c. Leather stable, no red rot, many splits, small holes, distortions but no large losses; several old patches present. Most badly damaged panels were removed from subframes and fully lined; least serious cases only strip-lined; and some partially damaged were repaired only with localized backings. Reemay chosen for repairs because: no weave structure; quite thin (e.g. versus sailcloth) (needed to fit into subframes); can accommodate leather's change in size due to water in adhesive; wetted well; good contact with leather; no need to finish cut edges. Disadvantage was its limited strength, a problem at the tacking margin so strengthened it by strip-lining a thicker Reemay atop which was strong without overly increasing the bulk. For the worst splits, first realigned tears with temporary Japanese paper facing and wheat starch paste: this worked but is slow to dry and water caused leather to swell and distort; to avoid these problems used instead Japanese tissue paper tabs tacked onto the back with Beva 371 applied with heat: quick to apply and no water hence no swelling and distortion but alignment is less accurate than with facing. Repair adhesive: used 3:1 Lascaux 498HV:360HV applied by brush on both the back of leather and on Reemay: was effective however can cause swelling of leather leading to misalignment of tears. When fully lined, additional thicker Reemay strip-lining was applied while adhesive from first layer still wet. Very small holes were repaired with skived veg.-tanned, aluminium retanned calfskin patches. Fine cracks along the split lines were filled with pigmented Aquafil 945, a flexible acrylic resin-based filler; larger cracks and gaps were filled with pigmented Beva 371 applied with heat spatula: although not perfect as a fill material, it is tough, flexible and sticks reasonably well, however it can pull away at edges and texture is not ideal. After reinstalling panels found that those that had not been fully lined (only strip-lined or with localized backings) reacted unevenly to a temporary humidity problem in the walls and in some areas the outline of the repairs became visible from the front; this highlighted a potential pitfall of partial linings and patches, weighed against the benefits of being less intrusive. (Treatment date: 2000.)

Sturge, Theodore and Nina Frankenhauser, 2006, "Sedan Chair", p. 279-284 in: *Conservation of Leather and Related Materials*, eds. Marion Kite and Roy Thomson, Oxford: Elsevier.

Sedan chair, 18th c., frame was covered on outside with veg.-tanned black patent leather calfskin. Leather in good condition but with many large and small splits and some distortions. Repair materials: for flat surfaces, leather used for larger repairs and Reemay for smaller repairs, adhered with a 3:1 mixture of Lascaux 498HV: 360HV.Clamping involved using vacuum suction from the front, or, where back was accessible, a card sandwich pulled together with ropes. For the curved roof with no access to the back, the clamping methods previously described would not work and so a different approach was devised. Moulded leather was considered but deemed not stiff enough to hold the curved shape. Glass fibre reinforced polyester (GRP) was used for each large split: it was stiff enough to hold but has some flexibility to allow adjusting to fit. Th GRP was cast to curved shape against a plaster of Paris mould, then adhered as a backing to the leather roof sections using the Lascaux 3:1 mix. (Treatment date: 2000.)

Szalay, Zoltàn, 1980, "Conservation and Restoration of Dyed and Embossed Leather Objects", p. 168-169 in: *Conservation within Historic Buildings, Preprints of the Contributions to the Vienna Congress, 7-13 September 1980*, ed. N.S. Brommelle, Garry Thomson and Perry Smith, London: IIC.

Painted and gilded Baroque chasuble from western Hungary: torn in few areas, small holes on edges and shoulders; extensive cracks and holes in dyed surface, especially at folds. Glued leather using Elastosil 0.7 silicon adhesive produced by Wacker Chemie GmbH, used because it is strong and elastic. Author cautions to avoid any excess spreading of adhesive because it cannot be removed without trace. Used veg.-tanned sheep leather as 'replacement' material (fills).

Talland, V., C.M. Tsu, D. Fullick, and B. Mangum, 2007, "The Conservation of Leather Wallhangings at the Isabella Stewart Gardner Museum", in: *The Conservation of Gilt Leather, ICOM-CC Interim Meeting, Working Group "Leather and Related materials," Brussels, 225-27 March 1998*, ed. Theodore Sturge, [no city]: ICOM-CC Working Group "Leather and Related Materials,", p. 21-26 [88 p.].

This article describes the materials, condition, analysis, degradation mechanisms and documentation of these gilt wall hangings; Part II of this project in Tsu et alii (1999) describes the treatment.

Thomson, Roy, 2006, "Gilt Leather", p. 88-93 in: *Conservation of Leather and Related Materials*, eds Marion Kite and Roy Thomson, Oxford: Elsevier.

General discussion on the conservation of gilt leather. Some of the challenges include damage associated with use (e.g. often were in damp or unsuitable environment), and complications with past treatments such as overoiling and surface coatings.

Trupin, Deborah Lee, 2003, "The Conservation of Frederic E. Church's Leather Arm Chair", p. 67-73 in *The Textile Specialty Group Postprints 12*, Washington DC: AIC.

Leather upholstery from an 1870 armchair with significant tears and losses, especially to seat. Repaired using small piece of goldbeater's skin coated with Jade 403, allowed to dry for a minute then pressed into place behind a tear. Flat magnets used as clamps. Two large losses were gap-filled with vegetable-tanned leather, thinned to desired thickness and skived at edges, adhered with Jade 403. Edges of holes remained a distracting light colour; to improve appearance and protect flaking and fragile original finished surface, covered seat and arm pads with Stabiltex sheer polyester fabric lightly adhered to top of trim with Jade 403. [See also Talland et al. 2007.]

Tsu, C. Mei-An, Diane Fullick, Valentine Talland and Barbara Mangum, 1999, "The Conservation of Gilt Leather Wall Hangings at the Isabella Stewart Gardner Museum. Part II", *Preprints of the ICOM Committee for Conservation 12th Triennial Meeting, Lyon, France, 29 August-3 September 1999*, vol. 2, ed. J. Bridgland, London: James and James, p. 708-713.

A set of 18th c. Italian leather wall hangings were treated. Tears were repaired with Japanese paper strips perpendicularly across the break with Beva 371. Small areas of loss were supported with Japanese paper patches; polyester batiste was chosen to support particularly weak sections or larger losses. The hangings were then strip-lined with Dacron 56 woven polyester taffeta and Beva Gel; Beva 371 was first applied as a barrier in these areas of the leather to prevent moisture from the Beva Gel to reach the leather, to give a reversible interlayer and to provide flexibility. Delamination occurred between corium and grain leather; consolidation was carried out with warm Beva 371.

van Kempen, Danielle, 2007, "The Conservation of the Gilt Leather from the Former Dining Room of Maria-Louise van Hessen-Kassel in the National Ceramic Museum 'Het Princessehof' in Leeuwarden, The Netherlands", p. 109-111 in: *Recent Preoccupations Concerning Textiles, Leather Legislation. Post-prints Relating to Leather, Athens, 21-24 April 2004*, ed. T. Sturge [no city], ICOM-CC Working Group "Leather and Related Materials".

A 20 year old treatment to 18th century gilt leather hangings consisted of a Lycra-and- linen strip-lining, and leather permanently fixed to the wall; tears had been repaired with leather inserts glued to reverse with Mowilith, further strengthened with Nylon patches glued with Mowilith over the inserts. The Lycra had now degraded, and because leather could not adjust to environmental changes there were now deformations, puckering and sagging, especially at old tear repairs. Old lining, repairs and adhesive were removed mechanically. New losses and tears were backed and filled with thin Japanese paper adhered to reverse with 5% w/v parchment size; to gap-fill, layers of thick Japanese paper used as new inserts, fixed from the front onto paper backing with parchment glue. To hang the leather panels, strip-lined each with narrow linen canvas strips sewn or glued to reverse with 15% w/v parchment glue; a linen cord was then passed through the canvas strips at the top and hung to hooks; the sides and bottom were also secured with the cord connected to spring clips, allowing the leather panels to move as necessary.

van Kempen, Danielle, 2005, "Dilemmas and solutions on the conservation treatments of three gilt leather rooms in The Netherlands", *Preprints of the ICOM Committee for Conservation 14th Triennial Meeting, The Hague, 12-16 September 2005*, vol. 2, ed. Isabelle Verger, London: James and James, p. 263-269.

This paper is based on the treatment of 3 gilt pieces similarly treated and focuses on the treatment of a 1686 embossed gilt leather hanging in the Simon van Gijn Museum, which the gilt leather maker Mensing (1869-1952) had conserved and enlarged by adding new panels and borders, and backed the whole with thick black paper adhered with animal glue, followed by coarse linen adhered with starch glue. It was decided to keep this previous restoration even though this leather was in poor condition. To close (bridge) the small lacunae, Japanese paper backings were applied with starch glue to the reverse of the old linen backing. Small holes were

filled with a mixture of Japanese paper fibres, starch glue and a drop of Mowilith DMC2, while larger fills were done with 3 layers of Japanese paper adhered with starch glue. (For the other 2 gilt leather hanging treatments – one described in van Kempen 2007 - parchment glue was used instead of starch glue.) Discusses the mounting system, which, for this climate-controlled room equipped with back-up systems in case of power failure, involved individual leather panels fixed onto a honeycomb plate using dots of starch glue mixed with Eukaline 3650 polyvinyl acetate dispersion.

van Soest, Henk, 1985, "Skived Leather Repairs"; and "Mending, Dyeing, and Relining"; in: *Recent Advances in Leather Conservation, Proceedings of a Refresher Course Sponsored by FAIC, June 1984*, ed. Sonja Fogle, Washington DC: FAIC, p. 58-59.

Gives practical information on skived leather fills. Used Mowilith DMC-2 to stick the skived leather fill to the edges of the leather. Relines the fill by brushing Mowilith DMC-2 through the Tergal polyester net backing, then puts it under glass weight.

Volken, Serge and Marquita Volken, 1995, "The Conservation of a Pair of Bucket Top Boots", *Leather Conservation News*, *vol. 11 n^{o} 1&2*, summer and fall 1995, p. 1-4.

Used Japanese paper with heat-reactivated Mowilith DM-5 to mend and fill waxed 'Russian leather' boots that were cracked, broken and extensively torn with nine large pieces completely detached. Previous restoration had applied patches of chrome-tanned leather. The Japanese paper was of heavy weight for the exterior surfaces, and of lighter weight for the interior because one needed something that would conceal both interior and exterior, but without changing the final thickness of the boot; a leather insert would have been visible. Applied by heat-reactivation: two sheets of paper were torn to shape and feathered, coloured with acrylic paint and applied, one to the interior and one to the exterior, to sandwich fragments of the boot in between them. Paper fills were inserted as necessary within the sandwich.

Vuori, Jan, 1985, "A Possible Adhesive for Native Tanned Skin", *Leather Conservation News, vol. 2 n^{o} 1*, fall 1985, p. 6.

Describes possible alternatives to Jade 454 PVAC emulsion: PVAC resins or acrylic resins (25% in denatured ethanol) made more flexible by the addition of EHEC cellulose ether (10% - 20%).

White, S.J. and D.M. Sully, 1992, "The Conservation of a Siberian Parka: A Joint Approach", *Conservation of Leathercraft and Related Objects Interim Symposium, ICOM Committee for Conservation, London, UK, 24-25 June 1992*, eds Pieter Hallebeek, Marion Kite and Christopher Calnan, London: Victoria and Albert Museum, p. 54-57 [64p.].

Repair of the degraded and torn hood of a semi-tanned reindeer skin parka. Gives a table of results of tests using Kuranai Japanese tissue, Kempi silk Japanese tissue, Bondina non-woven polyester, a polyester interlining tissue, silk crepeline, nylon tissue and goldbeater's skin, each with: arrowroot start/sodium alginate paste in water, 25% Vinamul 3252 in water, 7% Klucel G in isopropanol, 30% Paraloid F-10 in white spirit, 10% Mowilith 50 in isopropanol, 50% Mowilith DMC2 in water, 50% Paraloid C-10LV in acetone and 5% gelatine in water. The most suitable were Kuranai paper with either Klucel G, starch paste, Vinamul 3252 or gelatine; Kempi silk paper with Klucel G; silk crepeline with Paraloid F-10 or C-10LV; or goldbeater's skin with either Paraloids. Klucel G with Kuranai tissue was used. Heat was avoided due to fear of hydrothermal damage to the degraded skin.

Wills, Barbara, ed., 2001 *Leather Wet and Dry*, London: Archetype Publications Ltd, 77 p.

(Relevant articles cited individually.)

Wills, Barbara, 2001,"Excavating Desiccated Leather: Conservation Problems on Site and After", p. 51-62 in: *Leather Wet and Dry,* ed. B. Wills, London: Archetype Publications Ltd

Discussion of ideal properties for consolidation and reconstruction of ancient, dry archaeological leather, including uses of acrylic resins, polyvinyl butyryl, Lankrothane polyurethanes, EVAs, Klucel G and epoxies. Case study of dry leather from a 1995-96 dig at Gabati, Sudan: consolidated more robust leathers with Mowital B30H polyvinyl butyryl (PVB) 10% w/v in acetone; favored because stable at high temperatures (museum stores may reach 60° C) and provided strength, although did not cure brittleness and caused some darkening. For most fragile pieces, used Devcon 5-minute Epoxy 5% v/v in acetone: although not 'reversible' (although no consolidant can be truly reversed) and it caused some darkening, it was only consolidant found that was stable at high temperatures and able to confer strength and resilience. Overall Devcon compared to PVB provided

greater strength, resilience and pliancy. Paraloid B72 had too low a glass transition temperature (Tg) for this hot climate. Backing and fills were carried out using HMG (cellulose nitrate) for butt joins reinforced with a Japanese kozo paper backing. In contrast another treatment of medieval sandals from a site near Khartoum could be carried out at the British Museum: after testing 2 resins with high Tgs, found Paraloid B99 was not as suitable as Devcon Epoxy (50% v/v in acetone), which conferred sufficient strength and pliancy needed to withstand return trip to Khartoum. Also used HMG and Japanese paper for butt end repairs and backing; gap-filled where needed using epoxy with microballoons and pigments.

Wills, Barbara, 2000, "A Review of the Conservation Treatment of a Romano-Egyptian Cuirass and Helmet Made from Crocodile Skin", *The Conservator 24*, p. 80-88.

Discussion of a 10 year-old treatment and different choices that would be made now. The archaeological crocodile skin cuirass, consolidated with Acryloid B72, was in several pieces; it was repaired to form main constituent pieces, then assembled and mounted using modern goat-leather tabs to which short lengths of Velcro had been stitched. The flesh-side part of each tab was adhered to interior of cuirass using Mowilith DMC2. Originally these tabs were intended as temporary, but they were found to be strong enough and useful to be kept for permanent display. Other backing materials such as Bondina non-woven nylon and Reemay non-woven polyester did not adhere as well. Vinamul 3252, 70% w/v was chosen because it could give better bond than organic solvent-based adhesives. Dyed Japanese kozo paper was used to back and further reinforce the joins on smaller fragments. Ten years later, in retrospect, the author would consider a different adhesive because of questioning on the use of PVAC emulsions: they remain tacky on drying, possess only partial reversibility, have a low pH and produce acetic acid as a degradation product (re: research by Y. Shashoua, British Museum). Alternatives that would be considered: Paraloid B72 at high concentrations or HMG (cellulose nitrate) as they provide strong, reversible bond. Klucel G in IMS or water could have been used for adhering the Japanese paper and for less load-bearing joins, as it is stable, 100% reversible, retains colour, pH and flexibility; at high concentration of 10-20% it might even have been used for attaching the leather and Velcro strips.

Wills, Barbara, Yvonne Shashoua and Dean Sully, 1992, "Approach to the Conservation of a Mexican Saddle and Anquera", in: *Conservation of the Iberian and Latin American Cultural Heritage, Preprints of the Contributions to the Madrid Congress, 9-12 September 1992,* (eds. Henry Hodges, J. S. Mills, and Perry Smith), London: IIC, p. 179-183.

Mexican saddle and anquera (rump cover) of vegetable-tanned cowhide and metallic decorations: leather was acidic, powdery and red, and there were several cracks and tears. Backed and repaired tears in the saddle and anquera using Japanese paper (kozo) and Vinamul 3252 (VA/E copolymer emulsion). Kozo Japanese paper used because it has high adaptability and sufficiently strong load-bearing properties, it is durable because it contains very strong and dimensionally stable fibres and it easily allows colour matching. Other backings considered but not as suitable: gold-beaters' skin, polyester and nylon non-wovens and modern tanned leathers. Degreasing, acid stabilization, consolidation also discussed.

Wouters, Jan, 1989, "A Comparative Investigation of Adhesives Used for the Restoration of Leather Objects", in: *International Leather and Parchment Symposium, ICOM-CC Leathercraft and Related Objects Working Group, May 8-12 1989, Offenbach am Main, Germany*, Offenbach am Main: Deutsches Ledermuseum, p. 43-54.

Describes leather to leather adhesion tests using various adhesives and recommends a selection according to: bond strength, water-vapour permeability, bond flexibility (suppleness) and reversibility: tapioca starch paste; 2% Tylose MH300 methylhydroxyethyl cellulose; 50% Keimfix PVAC emulsion; 50% Mowilith DM5 PVAC-acrylic copolymer emulsion; and 10% gelatine 100-110 weight grade. Further tests planned on accelerated ageing.

* * *

Other Useful Articles When Considering
Adhesive Treatments for Skin and Leather Objects

Abdel-Maksoud, Gomaa and George Panagiaris, 2007, "Experimental Study for the Evaluation of Some Polymers Used for the Treatment of Vegetable Tanned Leather", p. 64-68 in *Recent Preoccupations Concerning Textiles, Leather Legislation. Post-prints Relating to Leather, Athens, 21-24 April 2004*, ed. T. Sturge, [no city], ICOM-CC Working Group "Leather and Related Materials".

Consolidation tests of new and artificially aged vegetable-tanned leather with 6 different polymers. Tested 2, 4 and 6% in acetone of each the following: Paraloid B72, Paraloid F10 and cellulose acetate; and 2, 4 and 6% in water each of Tylose MH 300P, Mowilith DMC2 and parchment glue. Assessed by measuring L*a*b* colour change, absorption of water, tensile strength and elongation. All polymers generally improved leather as compared to the untreated control, both before and after ageing. Most to least successful: Paraloid B72, Paraloid F10, cellulose acetate, Tylose MH 300P, Mowilith DMC2 and parchment glue.

Angus, Aline, 2008, "The Furnished Room – Gilt Leather", in: *The Furnished Room: Forum of the Icon Textile Group, March 2008, The Victoria and Albert Museum, London*, eds D. Phipps and Rachel Langley, The Institute of Conservation (Icon) , p. 9-12.

Short discussion on issues concerning the treatment of gilt leather.

Cardwell, Karen, 1991, "A Chemical Investigation of PVA Based Adhesives in Book Binding", *AICCM Bulletin*, *vol. 17 n^{o} 1&2*, p.21-29.

Discusses PVACs and EVAs in commercial bookbinding and bookbinding conservation.

Dreibholz, Ursula, 1988, "The Marburg Parchment Colloquium", *Leather Conservation News, vol.4 n^{o} 2*, p. 11.

Gives information on current traditional techniques for treating parchment used in Europe.

Down, Jane L., Sherry Guild, Greg Hill, Doris St-Jacques, Kate Westbury, Elissa O'Loughlin, Elzbieta Kaminska, R. Scott Williams, Joe Iraci, and Season Tse, 2011, "Update on the CCI Adhesive Tape and Heat-Set Tissues Project", in: *Proceedings of Symposium 2011 – Adhesives and Consolidants for Conservation,* Ottawa: Canadian Conservation Institute, 28 p. Available online at: http://www.cci-icc.gc.ca/symposium/2011/Paper%205%20-%20Down%20et%20al.%20-%20English.pdf

Presents research on stability and reversibility testing for a whole range of adhesive water or solvent reactivated tapes and heat-set tissues including some made in the lab such as wheat starch paste on paper, Lascaux 498HV on paper, Lascaux 360 HV on Japanese paper made as a heat-set tissue and made for solvent-reactivation with ethanol, Beva Film on paper etc. The tested properties include: pH of fresh products; colour change of both sides of the product after thermal aging; photographic activity test (PAT); mechanical and solvent removal of the products from 1870s commercial printing paper and resin-coated photographic (RC) paper before and after thermal aging and after 1 year of dark aging.

Down, Jane L., 2009, "Poly(vinyl acetate) and Acrylic Adhesives: A Research Update", p.91-98 in *Holding it All Together: Ancient and Modern Approaches to Joining, Repair and Consolidation,* eds. J. Ambers, C. Higgitt, L. Harrison and D. Saunders, London: Archetype Publications in association with the British Museum.

Down, Jane L., M.A. MacDonald, J. Tétreault and R.S. Williams, 1996, "Adhesive Testing at the CCI - An Evaluation of Selected Poly(vinyl acetate) and Acrylic Adhesives", *Studies in Conservation 41*, p.19-44.

Feller, R.F., and M. Wilt, 1990, *Evaluation of cellulose ethers for conservation*, Los Angeles: Getty Conservation Institute, 160 p.

Solvent-soluble cellulose ethers were found to not have good ageing properties, EHEC in particular was not

recommended; hydroxypropyl cellulose of lower molecular weights (Klucel G and L) are also thermally unstable, although less so. Water-soluble EHEC (Ethulose) appear to have good ageing properties. Methylcellulose, CMC have excellent stability.

Foskett, Sarah, 1994, "An Investigation into the Properties of Isinglass", *SSCR Journal, Vol. 5 n^{o} 4*, p. 11-14.

Discusses chemistry and properties of isinglass as well as its uses in conservation.

Haines, Betty, 1985, "The Strength of Leather", in: *Recent Advances in Leather Conservation*, Proceedings of a Refresher Course Sponsored by FAIC, June 1984, ed. Sonja Fogle, FAIC, p. 10-12.

Hansen, Eric F., Michele R. Derrick, Michael R. Schilling and Raphael Garcia, 1991, "The Effects of Solution Application on Some Mechanical and Physical Properties of Thermoplastic Amorphous Polymers Used in Conservation: Poly(vinyl acetates)s", *J.AIC* 30 p. 203-213.

Discusses the effect of solvent choice on various physical properties of PVAC resin adhesives, including tensile properties, glass transition temperature and solvent retention of cast film.

Haines, Betty, 1985, "The Conservation of Leather Bookbindings", *Adhesives and Consolidants, Preprints of the Contributions to the Paris Congress, 2-8 September 1984*, eds. N.S. Brommelle, E. M. Pye, P. Smith and G. Thompson, London: IIC, p.50-54.

Discusses various treatments for leather bookbindings including a series of consolidation tests. The polyurethane resin Lankrothane 1304 diluted 1:1 in petroleum ether and applied by brush to the leather was judged to be the most useful, not only penetrating well but was superior in improving the leather's scuff resistance; it also reduced the leather's absorption of sulphur dioxide by 90%. Lankrothane is not reversible however any consolidation treatment would be difficult to reverse. Other polymers that were successful in penetrating at least halfway into the leather were: Titekote H-51 (a moisture-curing urethane), Plexisol BV396 and Paraloid F10. Klucel G was also included in these tests but did not penetrate beyond the surface. Also discusses the development of a stable binding leather (aluminium retanned leathers), the retannage of intact leather covers. Several polishes were tested and SC 6000, an acrylic/wax emulsion blend was found to lighten the leather, impart a pleasant sheen, and to reduce a veg.-tanned leather's absorption of sulphur dioxide by 90%.

Haupt, Margaret, Deborah Dyer and Jim Hanlan, 1990, "An Investigation into Three Animal Glues", *The Conservator 14*, p. 10-16.

Compares the properties of gelatine, rabbit skin glue and isinglass.

Hickman, Pat, 1987, *Innerskins, outerskins, gut and fishskins*, San Francisco Craft and Folk Museum.

Huxtable, Merryl and Pauline Weber, 1987, "Some Adaptations of Oriental Techniques and Materials Used in the Prints and Drawings Conservation Department of the Victoria and Albert Museum", *The Paper Conservator 11*, p. 46-57.

Gives details on preparation and working properties of wheat starch paste, with or without sodium alginate.

Larsen, René, Dorte Vestergaard Poulsen Sommer, Kathleen Mühlen Axelsson, Steen Kristian Frank, 2013, "Transformation of Collagen into Gelatine in Historical Leather and Parchment Caused by Natural Deterioration and Moist Treatment" p.58-65 in: *ICOM-CC Leather and Related Materials Working Group, Postprints of the 10th Interim Meeting, Offenbach, August 29-31, 2012*, ed. Céline Bonnot-Diconne, Carole Dignard and Jutta Göpfrich, Offenbach: DLM Deutsches Ledermuseum Schuhmuseum.

Reports that some ddegraded parchment documents having undergone water-based treatments have been co-related with the presence of some level of gelatinisation damage, a finding which is consistent with the fact that direct exposure to water can cause gelatinisation of such degraded fibres. Caution is needed with water or alcohol based-treatments since they pose a risk of accelerating the morphologic transformation of degraded collagen fibres, especially in the case of parchment.

Luybavskaya, E.A., 1990, "Investigation of Properties of Protein Glues", *Preprints of the ICOM Committee for Conservation 9th Triennial Meeting, Dresden, GDR, 26-31 August 1990*, ed. Kirsten Grimstad, Los Angeles: ICOM-CC, p. 47-50.

Discusses properties of protein adhesives (gelatine, glues, etc.).

Munn, Jesse, 1985, "Examination and Treatment of Vellum", in: *Recent Advances in Leather Conservation, Proceedings of a Refresher Course Sponsored by FAIC, June 1984*, ed. Sonja Fogle, Washington DC: FAIC, p. 16-18.

Information on the use of goldbeater's skin, fish membrane and gelatine for vellum repair. As well discusses how fills are patched with vellum or parchment. Mentions adding sorbitol to make gelatine film more flexible.

Phenix, Alan, 1985, "Lining without Heat or Moisture", *The Conservator 9*, p. 45-47.

Discusses various adhesives that can be used by solvent-reactivation to line paintings, thus without the use of water or heat (purely pressure-sensitive ones were investigated but found to require solvent-reactivation to achieve a satisfactory peel strength). Compares quantity of solvent sprayed to the resulting peel strength. Minimum peel strength acceptable was judged to be 500 g per 2.5 cm. Compares the various adhesives' solubility region and colour before and after ageing, and their mechanical properties.

Phenix, Alan and Gerry Hedley, 1984, "Lining without Heat or Moisture," *Preprints of the ICOM Committee for Conservation 7th Triennial Meeting*, Copenhagen, Denmark., 10-14 September 1984, p. 84.2.38-84.2.44.

See above. Solvent reactivated various adhesives. The acrylic water-borne dispersions Plextol B500 thickened with Acryol ASE-60 was successful but Primal AC634 was not. The acrylic resin Acryloid B72 was successful if reactivated with a 20% solution of itself in toluene. Solvent reactivated acrylic pressure-sensitive adhesives such as Primal N560, N580, N1031 were not successful. Obtained excellent results with solvent-reactivated Fabri-Sil silicone pressure-sensitive adhesive.

Pretzel, Boris, 1993, "Evaluation of Adhesives Commonly Used in Textile Conservation", *Newsletter of the ICOM-Committee for Conservation Working Group of Textiles*, Number 2, p. 11-16.

Scientists and conservators from the British Museum evaluated a series of adhesives applied to a jap silk with a polyester crepeline backing material: Mowilith DMC2, Mowilith DMC2 + DM5, Lascaux P550-40TB, Lascaux 360 +498 1:1, Vinnapas EP1, Vinamul 3252, Vinamul 3254, Texicryl 13-002, Paraloid F10 and Beva 371. Factors evaluated were: peel strength; hot peel strength; reversibility; pH of adhesive; ease of application of adhesive to support; ease of handling adhesive on support; necessity for fume extraction during application; heat sealing temperature; staining of silver; tear strength of adhesive applied to paper; glass transition temperature of adhesive film. Vinamul 3252 and Mowilith DMC2 scored best.

Puglia, Alan and Priscilla Anderson, 2003, "Solvent-Set Book Repair Tissue", p. 3-8 and "Solvent-Set Mending Strips", p 100, 101 in: "Use of Adhesives on Leather Discussion." *The Book and Paper Group Annual 22*.

Presents the development and technique for use of a custom-toned, alcohol-remoistenable Japanese paper 100% kozo repair tissue prepared with a film of Lascaux 498HV acrylic adhesive, used to repair leather bookbindings. Consolidating the leather first with the Lascaux 498HV in alcohol (approx. diluted 1:5 in isopropanol) prepared the leather surface for improved adhesion. Wheat starch paste would require long drying times, risk permanent darkening and hardening of the leather and is difficult to reverse without placing the leather at further risk from moisture. This custom-made adhesive repair tissue allows quick repairs (generally less than 45 minutes) and are reversible using heat or solvents.

Ralston, Nicola L., 2000, *Parchment/Vellum Conservation Survey and Bibliography*, Technical Conservation, Research and Education Division, Historic Scotland, Edinborough, 40 p.

Provides an extensive bibliography on parchment and vellum history, technology and conservation.

Ruzicka, Glen, 1985, "Rare Book Conservation at the Library of Congress", in: *Recent Advances in Leather Conservation, Proceedings of a Refresher Course Sponsored by FAIC, June 1984*, ed. Sonja

Fogle, Washington DC: FAIC, p. 84-86.

Notes that wheat starch paste is the preferred adhesive in bookbinding conservation.

Shashoua, Yvonne, 1992, "Evaluation of Primal N-580 (aka Rhoplex N-580 in Canada) pressure sensitive adhesive for textiles and leather", *Conservation Research Report n^{o} 1992/27*, The British Museum, London, UK, 9 p.

The n-butyl acrylate emulsion Primal N-580 was tested for its suitability as a backing adhesive for degraded textiles or leathers, in terms of colour stability, reversibility, tack, pH, bond strength and reactivity with metals, all before and after ageing, and was found to have good stability and to form strong bonds with organic materials. However bonds may not be fully reversed without risking damage to weak or friable objects.

van Steene, G., and L. Masschelein-Kleiner, 1980, "Modified Starch for Conservation Purposes", *Studies in Conservation* 25, p. 64-70.

Gives the properties of various starches, and of starches mixed with various modifiers. Acid hydrolysed wheat starch presented the most favourable qualities for the backing of brittle textiles (the acid hydrolysis improved the flexibility and adhesiveness of the starch).

Wouters, J., 2000, "The Repair of Parchment: Filling", *Reviews in Conservation* 1, pp. 77-86.

Literature review of the different materials and techniques developed over the years in conservation to fill damaged areas of parchment. In particular discusses the use of skin-like products in sheets (parchment, goldbeater's skin), which are expected to be quite strong intrinsically and possibly too strong for use as infills for degraded weak parchments. Compares sheet-fills to various 'leafcasted fills', that is, pastes made of a liquid plus fibres (cellulosic fibres, paper pulp, parchment powder), sometimes with an adhesive or other additives, that are blended and reformed into films for infilling. Different 'leafcasting' formulations are presented and their properties discussed. The literature is surveyed chronologically, followed by an overall discussion.

Wouters, Jan, Gely Gancedo, An Peckstadt and Lieve Watteeuw, 1992, "The Conservation of the Codex Eyckensis: the Evolution of the Project and the Assessment of Materials and Adhesives for the Repair of Parchment", *The Paper Conservator 16,* p. 67-77.

This article, a sequel to Wouters 1989, gives details on a research project (tests only) into materials for parchment repair. Authors' preferred backing materials were parchment or goldbeater's skin because they are most compatible with parchment. Preference was for adhesives that can also be used as consolidants. Information is given on how to prepare home-made goldbeater's skin from fresh cattle gut. Starch, Tylose MH300, Klucel G, parchment glue, gelatine, Mowilith DM5 (full strength or 50%), Plextol D360 (full strength or 50%) and Acryloid B72 were compared in terms of accelerated aged samples undergoing the following tests: tensile strength, water vapour permeability, dimensional changes, whiteness and opacity, suppleness, reversibility. The best results for adhering original parchment to original parchment was found to be with gelatine; for adhering repair parchment to repair parchment, Mowilith DM5 diluted 50% in water; for adhering repair parchment to goldbeater's skin, starch and Tylose MH300. Infilling was investigated by leafcasting using reconstituted parchment from an aqueous suspension of hide powder slightly thickened with Tylose MH300.

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