Conservation of an 18th century *targe*: stabilization and visual reintegration

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Introduction

For historical leather objects which have suffered deterioration in the form of tears, splits and areas of losses, a suitable conservation treatment will often be to add some form of structural support in order to stabilize and prevent further damage. This can be done by inserting repair patches or even a full relining underneath the original material. Although a relevant approach, this form of treatment is not a straightforward one as there is a range of decisions to be made both in terms of repair material, adhesive and the practical, hands- on task of adding the new material without risking or compromising the original. Choices should be based on the condition of the object as well as take into account well known conservation issues like reversibility and minimal intervention. Even if not a first priority, aesthetic considerations will also in most cases be present in the decision making process, maybe more so when the object is historical as opposed to archaeological.

The following case study discusses the conservation of an 18th century Scottish *targe* from the collections at Leeds Royal Armouries, a project in which several of the above mentioned issues had to be considered in order to stabilize the object and at the same time visually reintegrate areas of damage and losses.

A Scottish *targe*

The term *targe* (from Old Franconian *targa,* "shield") refers in general to a round, concave shield used by infantry troops from the 13th to 17th centuries. From the beginning of the 17th century until what is known as the Battle of Culloden in 1746, the targe was the Scottish Highlander´s main means of defence (Dunbar 1979: 207). The Battle of Culloden was a part of the Jacobite Rising, a rebellion instigated by Charles Edward Stuart, whose goal was to overthrow the House of Hanover and restore the House of Stuart to the British throne. Charles Stuart's army consisted mainly of Scottish Highland clansmen, among these the officers were often armed

with pistol, broadsword and a targe. The Jacobite army was defeated by the Government army at Culloden, and in the aftermath of the battle efforts were taken to further integrate Scotland into Great Briton. As part of these efforts was the banning of wearing a tartan and carrying a targe. Many targes were either destroyed or captured by the Government army, the latter often the case if they were finely decorated with brass or silver studs.

The survival of this particular targe, dated 1745, in the collection of the Royal Armouries is most likely a result of this tradition of capture during the mentioned rebellion. The targe is 495 mm in diameter, it is constructed of boards of pinewood which is faced with thick leather and backed with skin. The front leather is decorated with concentric rings of brass studs (Fig. 2). Three of these studs are missing, including the central one which may have differed from the others in size and form. Both the leather and the skin is fastened with iron nails on the inside edge of the targe. On the inside it is also possible to spot, by three pairs of parallel holes, where three enarmes (arm grips) have once been fastened to the wood with nails. These were most likely made of leather, two to be attached to the forearm and the other as a grip for the left hand. Most targes only had two enarmes (Dunbar 1978: 205), which make the Royal Armouries targe unusual in this regard. The skin used on the inside of Scottish targes was commonly cow, goat or in some cases deerskin. The skin used for the Royal Armouries targe will remain uncertain due to the condition of the skin. In new skin or old skin in good condition it is usually possible to discover what animal was the source by investigating the pattern of the hair follicles on the grain side. The skin in question is not in a good condition and the grain side is worn down to such a degree where it is no longer possible to make out the distinct pattern and thereby the animal it came from. Based on the fact that the skin is relatively thin, it can nonetheless be assumed that it is goat or deerskin rather than cow. That the skin is worn down is in itself not necessarily something which would require action to be taken in terms of conservation. However, when combined with large tears, splits, loose pieces and areas of complete losses it became clear that treatment was needed to stabilize and prevent further damage (Fig. 1 & 3). In addition to above mentioned damage, the hide is also quite stiff with the torn edges bent upwards instead of laying flat against the wooden boards.

Fig.1: Back side of targe

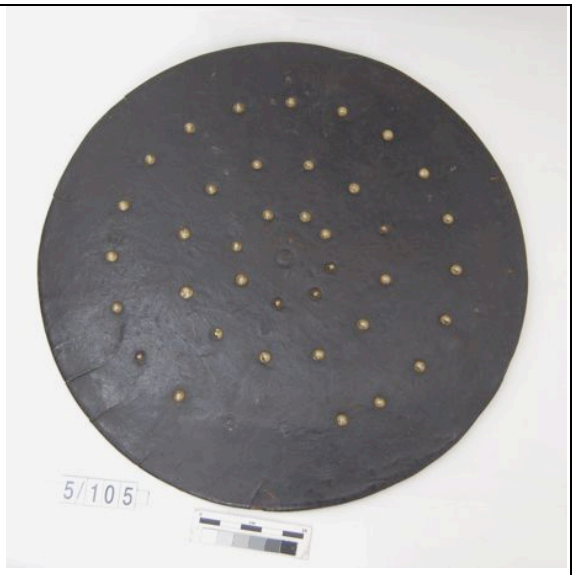

Fig.2: Front side of targe

Fig.3: Back side of targe at an angle

Fig.4: Loose pieces of hide

Repair materials and aesthetic considerations

An important point in the decision making process concerning choice of treatment was the intended possibility of displaying the targe at some point in the future, even hanging from the wall. To accomplish this without danger of increasing tears and loss of skin a solution where the remaining skin was adhered to an added underlying material was chosen. It can be argued that this was not a minimum intervention solution. Such a solution could be to leave the targe as it was, considering it would be safe from further damage if kept lying flat front side down. Kept this way it would be accessible for research but it would not be fit for public display. In this case the possibility of display overruled minimum intervention, although still with the notion of keeping the full integrity of the object and adding as little new material as possible.

When it comes to choosing a support material for leather or skin there are a range of suitable choices available as well as there is more than one way of applying them. The decisive factors in this regard should be both the character and condition of the skin even though aesthetic aspects also come into consideration.

Leather, Japanese paper, silk and polyester fabric are all common repair materials in leather conservation. Leather is often the obvious choice being the most structurally and aesthetically compatible material. If to be used it should be of good archival quality, which often means it is first vegetable tanned followed by a chrome tanning. This ensures it will last for at least as long as the original leather. Good practice is further to pair down the edges of the repair leather before adhering to avoid visible contours under the original. In spite of the mentioned advantages of leather, it was not chosen as repair material for the targe. Since the hide on the targe is very thin and has an almost paper like texture to it, adding leather patches seemed a too bulky and imposing repair that would not come across as discreet as wanted. Although silk is a structurally compatible material for thin leather, it is more suitable for leather which is quite soft, very much unlike the hide on the targe. Furthermore, silk may react disadvantageous with the acid in the leather, and in this case it was also considered too flexible a material to provide the needed support. Japanese paper is another material suitable for repair of thin leather. It is not very strong and is often used as a sacrifice material in conservation since it tears quite easily (Kite, Thomson and Angus 2005: 126). When considering using Japanese paper for the targe, this characteristic

was relevant considering the hide will be subjected to stress if the underlying wooden planks expand and contract due to fluctuating relative humidity. In such a case it is preferable if the repair material splits before the hide does. Another option would be to choose a material that will stretch rather than split with movement. Reemay is a polyester fabric with a random fibre structure, similar to the fibre structure of leather, which makes it a strong but at the same time flexible material that seldom splits (Sturge 1999: 66). If the wooden planks should expand, a Reemay repair patch would most likely stretch with the expansion, taking the stress off the hide. Based on these characteristics, Reemay was chosen as repair material. It was furthermore decided to be used as several patches shaped after the individual damages rather than as a full lining. A single large patch would be nearly impossible to manoeuvre into position underneath the hide without removing the iron nails around the edge, a very imposing procedure that could cause damage to both the nails and wooden planks. Individual Reemay patches were therefore cut to the right size and shape based on a damage map drawn on a sheet of Melinex placed over the hide (Fig. 5).

Although the main priority with the conservation was to stabilize the hide; a second goal was to do this in a way that would visually reintegrate the damaged areas and make them look less obvious. Since the Reemay fabric is bright white it was decided to colour the patches to a shade that would make them visually blend into the remaining hide. Considering the hide and the Reemay have different surface textures it is still a visible repair, but with similar colours the eye should not immediately be drawn to the damages but rather to the object as a whole. Should the object at some point be displayed in a way that also shows it back side, it will still have most of its aesthetic integrity intact. Colour tests done both with dry pigments in water and with diluted acrylic paint demonstrated that the former failed to give the desired shade, whereas this was obtainable with diluted acrylic paint if applied generously. The colours used for the different shades of brown were yellow ochre, burnt sienna and burnt umbra.

Fig.5: Damage map on Melinex + coloured Reemay patches

Condition of hide and choice of adhesive

In the same way as there is different repair materials to choose from, there is also a range of adhesives suitable for leather conservation. In deciding what to use, both the characteristics and condition of the leather and the question of reversibility are important factors.

Among the most commonly used adhesives are Beva 371, acrylic dispersion adhesives like Lascaux and Evacon-R and to a certain extent wheat starch paste. When deciding on an adhesive for the hide on the targe, one of the main concerns was the reaction between the deteriorated and fragile leather and the adhesives in question. More specific, whether the shrinkage temperature of the hide would be as low as risking shrinkage or distortion when in contact with a water based adhesive. The shrinkage temperature of a specific leather can be measured to determine its hydrothermal stability which again is directly related to how deteriorated it is (Larsen, Vest and Nielsen 1993: 151). Acidic or alkaline deterioration will cause swelling of the collagen molecules. This increases the distance between the polypeptide chains which in turn decreases the amount of energy needed to break the intermolecular bonds (Wallace 1996: 145). The practical consequence is leather that will shrink in contact with moisture even at relatively low temperatures, depending on the tanning method. Considering the hide on the targe appears brittle and fragile, it can be

assumed it has a low shrinkage temperature. If the hide is semi-tanned rather than fully tanned it further increases this possibility.

It was considered relevant to establish whether and how the hide was tanned, not only to decide on adhesive, but also in relation to preventive conservation. Among the different tanning methods, vegetable tanned leather has shown to be most prone to chemical deterioration (Larsen and Rahme 1999: 71). Research has further concluded that the two main groups of vegetable tannins, the hydrolysable and condensed tannins, cause the leather to be susceptible to different kinds of deterioration. Leather tanned with hydrolysable tannins will mainly deteriorate by acid hydrolysis which means it should be kept away from a polluted store or display environment to avoid deterioration. Leather tanned with condensed tannins will deteriorate by oxidation, which means the preventive conservation focus should be to keep it away from excessive lighting, heat and ozone (Larsen and Rahme 1999: 71). Spot-tests were done on small fiber samples from the hide to check for the presence of vegetable tannins and furthermore for hydrolysable and condensed vegetable tannins. The spot-test for detection of vegetable tannins using iron (III) sulfate (0, 5 g Fe2 (SO4) added 25 ml deionised water) gave a weak but nonetheless positive indication for vegetable tannins. For unknown reasons the spot-tests for hydrolysable and condensed tannins were unable to give a positive indication for either. Although the interpretation of these results must be considered uncertain, it is a possibility that the hide is vegetable tanned but not thoroughly enough to give clear results from the tests. Unfortunately the tests did not determine the main deterioration risk to the hide, but establishing that the hide is indeed vegetable tanned is relevant in itself since it means the hide is less sensitive to moisture than what would be the case if it was semi-tanned.

Without the necessary equipment available to determine shrinkage temperature of fibres from the hide, it was still possible to take precautions to make sure the adhesive chosen or the application method would not cause shrinkage or damage. To investigate the moisture sensitivity of the hide, a piece of Sympatex, a material resembling Gore-Tex, was lightly sprayed with deionised water and placed over a small loose piece of the hide. Leaving the Sympatex on for about ten minutes left the test piece damp but not thoroughly wet. Dimensions were measured both before it was moistened and after it was allowed to dry, and no changes could be observed.
Even though the test demonstrated it was safe to use a water-based adhesive, further testing of the most relevant adhesives was carried out to decide on the most suitable one. Small patches of Reemay were bonded to pieces of leather with approximately

the same thickness and character as the hide using Lascaux, Evacon-R and Beva 371. Wheat starch paste was left out on the basis of previous experience on leather were it was considered too inflexible and brittle to be an optimal choice. Both Lascaux and Evacon-R are acrylic water dispersion adhesives that are known to have good bonding properties while at the same time, as they are dispersions, not actually being absorbed in to the leather (Sturge 1999: 65). This latter characteristic being relevant since it increases the possibility of reversing the bond. Both Lascaux and Evacon-R made a good bond between the leather test pieces and the Reemay patches even though Lascaux remained slightly tacky and seemed to have lesser tensile strength than Evacon-R. None of the two adhesives caused any staining of the leather or Reemay. Beva 371 is a heat-seal adhesive with an activation temperature of 65-70°C which means it can be applied cold and therefore has the advantage of a controlled positioning prior to activation with a heated spatula. It is also arguably the most easily reversible of the adhesives in question since it can be remelted at any time. In spite of these apparent positive characteristics it did not give as good a test result as the dispersion adhesives. Both the Reemay and leather were slightly stained, the adhesive was not distributed evenly and the heat needed to activate the adhesive also caused some misshaping of the leather (Fig 6). Taking this into consideration in combination with the poor condition of the hide made Beva 371 a less than optimal choice. Even if the hide had proven to tolerate moisture without shrinking, it was considered too much of a risk adding high temperatures as well, considering it is primarily the combination of moisture and heat that causes shrinkage (Thomson 2005: 2).

Fig.6: Adhesive tests. Evaon-R and Beva 371

Based on the tests, the adhesive chosen was Evacon-R due to its strong bond, relatively fast curing time and clean and stain-free appearance. It can be argued that Evacon-R is not the most reversible alternative, it can be reversed with acetone but this may be increasingly difficult over time, but in this case the safety of the hide and the overall aesthetic presentation of the targe were prioritized over easy reversibility. The adhesive was applied with a small spatula on both the Reemay and the underside of the hide after the Reemay patch had been positioned in the right place with tweezers (Fig. 7). Also prior to the application of adhesive, the hide was relaxed locally by placing a piece of Sympatex moistened with deionised water over the relevant area for about ten minutes. This made the leather temporarily less stiff and brittle and easier to handle without risking any damage. This kind of relaxing involving water is not necessarily a recommendable approach for deteriorated leather, but was considered safe in this case since the hides' water sensitivity was already established. By adhering one damaged area at a time, the final result was a hide stabilized and secured where necessary to underlying Reemay and a targe with a reinstated aesthetic integrity (Fig. 8 & 9).

Fig.7: Positioning of Reemay patch
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Fig.8: Back side of targe after conservation
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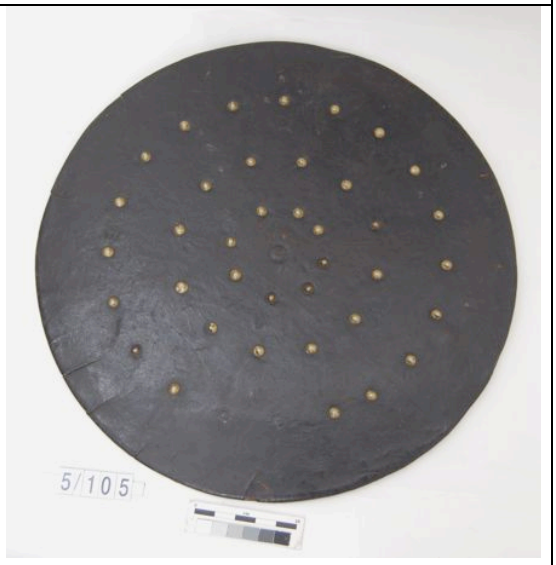

Fig.9: Front side of targe after conservation
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Fig.10: Back side of targe at an angle after conservation
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Conclusion

When deciding on a treatment approach for leather objects like the targe from the Royal Armouries, the main priority should be stabilizing to prevent further damage and loss. The case study has aimed to demonstrate how this can be done in a way that will also take into account the aesthetic integrity of the object. By using a structurally compatible repair material like Reemay and colouring it in to match the hide, it is possible to visually reintegrate the damaged areas so the object can be appreciated as a whole.

An important aspect of the decision making process when choosing a suitable adhesive, was to let the condition of the hide be the decisive factor and to do simple tests on similar leather samples in order to find the best solution. When the tests demonstrated that the most suitable adhesive was Evacon-R, it was used in spite of not being the easiest reversible one. The decision was made on the basis that it would not put the hide at risk as opposed to the application method for Beva 371. The final result was a stabilized hide and a targe fit for display.

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