Issues Relating to the Conservation of a 19th-Century Swell-body Sleigh

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The conservation of transport collections poses many challenges within a museum context. Visitors and enthusiasts often expect to see restored and "as new" vehicles on display, a standard which has been accepted for generations. It is increasingly difficult to find historic vehicles in unrestored condition, and it is the duty and responsibility of museums to preserve them when they are acquired. Conservation must not only treat the object, but must address the attitudes of museum staff, public programming, and the visiting public, and seek to foster an appreciation for the original materials and the history of use of the object. The treatment of an Albany Cutter swell-body sleigh described in this article covers a variety of materials and techniques common to horse-drawn vehicles. While the techniques are similar to those used in other branches of conservation, the challenge in a composite object like a sleigh, is in combining and adapting the techniques of painting conservator, textile conservator and metal conservator, to a single object. The treatment involved removal of discoloured varnish layers, consolidation of friable paint using Acryloid B72 and BEVA 371 Original Formula, and cleaning and support of fragile textiles. Equally challenging and interesting, is the discussion that must occur concurrent with conservation treatment, to help interpret the objectives of the treatment and to ensure that those fall within the ethics and guidelines of our profession.

La conservation-restauration des véhicules anciens dans un contexte muséal pose des défis de taille. Le public et les amateurs de ce type de collection s'attendent souvent à ce que les expositions montrent des véhicules restaurés 'à neuf', comme cela fut la norme pendant des générations. Il est de plus en plus difficile de trouver des véhicules historiques n'ayant subi aucune altération, et c'est le devoir et la responsabilité des musées de les préserver lorsqu'ils en font l'acquisition. Une restauration réussie comprend non seulement le traitement de l'objet, mais aussi la mise en valeur de l'objet ainsi préservé afin que le public et le personnel du musée (et notamment les éducateurs des programmes d' exposition) apprécient la présence des matériaux originaux authentiques, et qu'ils interprètent l'usure plutôt comme des traces pouvant révéler l'histoire et l'utilisation de l'objet. Le traitement d'une carriole hippomobile d'Albany de style bombé décrit dans cet article a fait appel à une variété de techniques et de matériaux communs aux traitements de véhicules hippomobiles anciens. Alors que les techniques sont semblables à celles utilisés dans d'autres champs de spécialisation de la restauration, le défi dans le cas d'un objet composite tel que cette carriole consiste à combiner et à adapter les techniques de restauration de peintures, de textiles et de métaux sur un seul objet. Le traitement consista à l'allègement du vernis jauni, la consolidation de la peinture à l'aide d'Acryloid B72 et de BEVA 371 Original Formula et le nettoyage et renfort des textiles endommagés. Un défi d'égal importance qui doit accompagner un tel traitement, est le suivant : comment inclure les buts de la restauration et ses principes déontologiques dans le contexte de la présentation et de l'interprétation de l'objet ainsi restauré.

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Introduction

The conservation of transport artefacts raises questions of expectations and ethics. By far the largest number of these artefacts are privately owned, and a long history of "restoration" by collectors has contributed to an aesthetic expectation, by the museum public, that is difficult to meet using our current conservation standards. Such "restoration" most often involves the complete re-finishing of decorative surfaces, repair of damaged structural elements (since many of these objects are used after restoration), and replacement of deteriorated trimmings. Conservation, in contrast, attempts to retain and stabilize original materials and finishes, though at times reversible and non-intrusive techniques may be used to minimize the visual effects of aging or damage. As will be seen in the following treatment, removal of a disfiguring varnish also falls within the conservation guidelines established at the Canada Science and Technology Museum (CSTM). Most enthusiasts have been exposed to examples of restored vehicles, through the media, in such venues as magazines and films, and although the conservation discipline has a long history in the field of archaeology and the visual arts, its influence in collection areas such as transport, is much more recent. Institutions with a long history of collecting and caring for transport artefacts often have a large proportion of that collection in restored condition. In the face of this pressure to restore to "new", it is increasingly imperative that museums today, adhere to conservation principles in order to preserve a dwindling number of vehicles with their original materials and finishes.

Description of the Sleigh

The swell-body sleigh described in this treatment is an example of an Albany Cutter. Although the exact date of manufacture of this horse-drawn sleigh is unknown, comparisons with vehicles in carriage trade literature combined with the style of decal, indicate that the vehicle was built sometime between 1875 and 1880 (**Figure 1**). This style of sleigh first appeared in 1816, introduced by James Gould of Albany, New York. Its distinctive curved body shape evolved over the next twenty years, achieving, by 1836, the classic style of this vehicle. Along with the Portland Cutter, this style of sleigh was the most popular form of winter passenger transportation in America and Upper Canada. The Albany sleigh

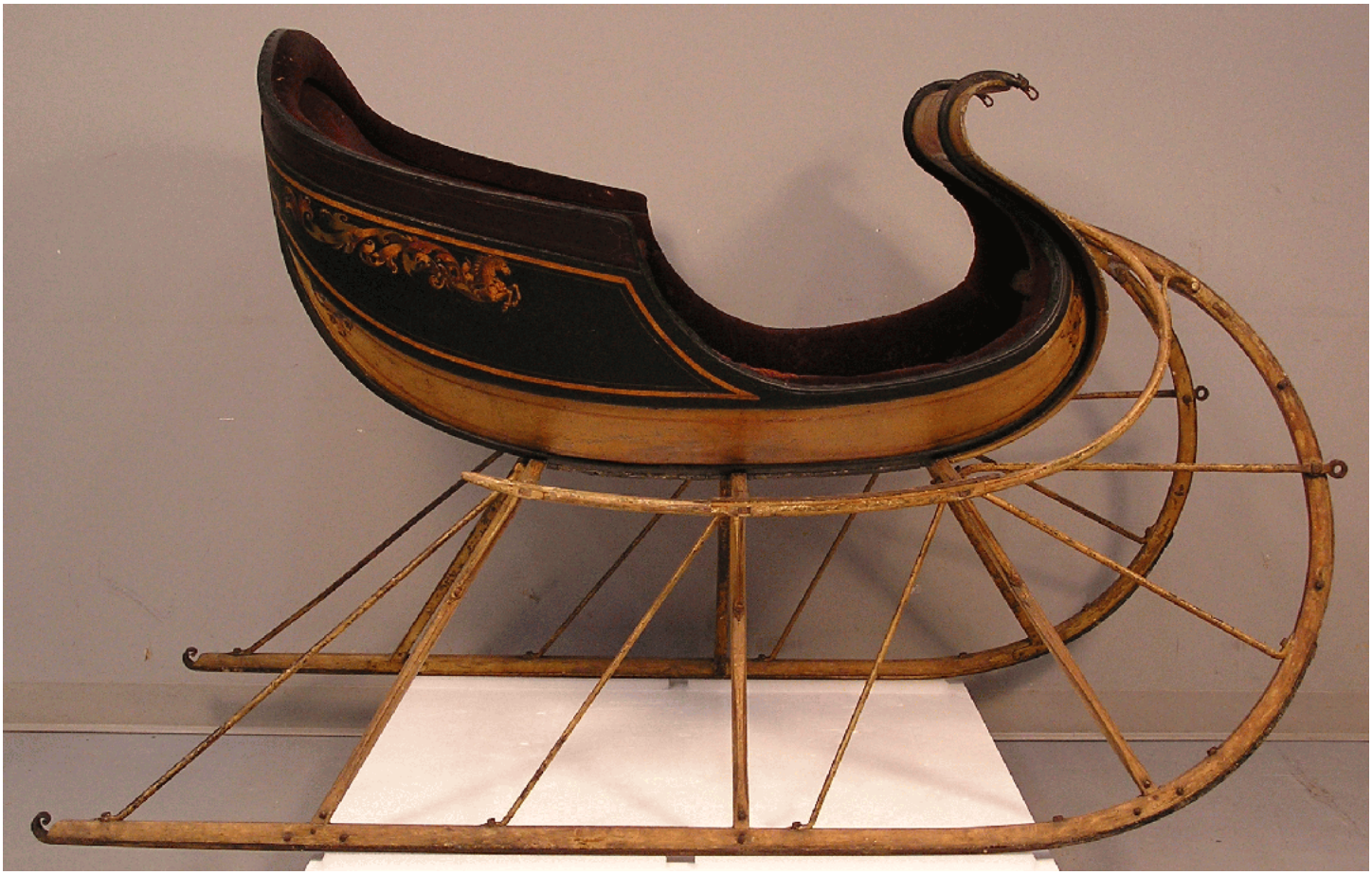


Figure 1. Sleigh after treatment. Photograph courtesy of the Canada Science & Technology Museum.

style was produced in smaller numbers than the Portland, due to the high level of workmanship and subsequent cost required for producing such a complex shape. Two-passenger sleighs, such as this one, were less popular than the larger four and six-seat sleighs, though all styles continued to be sold until the early 20th century.[1]

The sleigh was acquired by the Canada Science and Technology Museum (CSTM) in December, 2004. It was purchased from the great-granddaughter of William Woodward Miner who, in partnership with his brother Harlow Jr., founded the H. & W. Miner Carriage Company in 1868 at Granby, Quebec. William had apprenticed to a blacksmith in Granby, and then later to a carriage maker in Hoosick Falls, New York prior to establishing the company with his brother. The carriage works remained under the direction of the family until 1902, when it was sold and renamed the Granby Carriage Company. The Miner family continued to be influential figures in the business and industrial history of Quebec and Canada through lumber, rubber and mining enterprises.

The sleigh had belonged to William Harlow Miner, son of the carriage maker, but it is not yet clear how or when he acquired it. Family memories link it with the inheritance of the Granby family home in 1929, indicating, that in all likelihood, it was previously owned by the carriage maker himself. The vehicle had been stored in a barn on the estate of the donor's mother since the 1960s, and part of the reason for its good condition was undoubtedly the more stable relative humidity of such protected "outdoor" storage. The importance to the CSTM was not only the condition of the artefact, but also the documented provenance, and the significance of the donor's family in the commercial life of Granby and the manufacturing and industrial history of Canada.

Background and Acquisition

The sleigh was first inspected in the fall of 2005 by the author and Suzanne Beauvais, Assistant Curator for Transport Collections. Remarkably, the original materials were all present and, although fragile, were relatively stable. Photographs of the vehicle were taken at this time as part of the acquisition proposal, and an appraisal was completed by William Robbins of Historical Research Services Inc. The sleigh was collected in December of 2005.

Vehicles like this one, with a documented history and intact original materials, are increasingly rare. The market for purchasing historic vehicles is competitive owing to public interest in owning and restoring them, and this often means that inflated costs are too high for many museum acquisition budgets.

Any survey of auction sales in the U.S. substantiates the interest in, and high value of, horse-drawn vehicles. William Robbins, in his evaluation and assessment of the sleigh, identified one thousand six hundred and sixty-two vehicles sold or offered for sale between May 2002 and October 2004 by one auction company alone; of these, forty were comparable to the Albany sleigh under consideration, and only ten were described as "original", while four were reproductions and twenty-six were highly restored.[2]

For owners of objects like this, an awareness of the importance of conservation can influence their decision to donate or to sell privately to a museum rather than through an auction house. Other factors influencing such a decision can include: condition and prestige of the collection at the institution, and an interest in preserving the history of the object rather than just the piece itself. The donor of our vehicle had some knowledge of conservation, and wished to see her object preserved and displayed in a museum rather than in a private collection. Preservation of her family history was also a motivation, and to this end she has very kindly provided family papers to the CSTM curatorial department with which to document the vehicle.

The only disappointment during the acquisition process, was the fact that the donor had arranged to have the sleigh "cleaned" by some local workmen before it was collected by museum personnel. The cleaning, unfortunately, resulted in the loss of approximately one-third of the weakened carpet, and the entire original seat cushion which had been inhabited by numerous generations of mice and was, admittedly, in poor condition. From the CSTM perspective, this was a disappointing loss since original trimmings are rare in vehicles of this age. On the positive side, it served as a valuable learning experience; the museum now requests that an object be donated "as is".

Materials and Construction

The swell-body sleigh is an example of highly skilled craftsmanship. It has one of the most complex shapes of any horse-drawn vehicle, and was made to withstand the harshest of climates and operating conditions. A testament to the quality of this specific artefact is that its materials and structure had remained intact for over one hundred and twenty-five years, in less than ideal storage conditions, before being acquired by the Canada Science & Technology Museum.

The body of the sleigh is constructed of thin curved wooden panels that "float" in the framework: the panels are fitted into grooves in the structure, and are not restrained by adhesives or fasteners. The gear is painted iron and wood, the wood being curved into the elaborate swooping profile characteristic of the style of sleigh. The mohair plush fabric, used in the trimmings, is tacked onto the frame of the sleigh over a padding of horsehair and kapok (for the seat and footwell liners). The floor was entirely covered with a short-pile woven carpet with a backing of burlap. Although no testing of finish materials was undertaken, there is extensive literature to indicate that the upper panels are glazed carmine over a cadmium red base. The upper panels are further painted in a dark "hunter" green while the lower panels are cream-coloured. The gear is painted a dark yellow, with double striping lines in red and green. The chromolithographic decals match those in the catalogue of Palm and Fechteler of 1875-1880.[3]

Paints on carriages and sleighs built in Canada and America were linseed oil-based until the early twentieth century. Varnishes were what is referred to in the carriage trade as "spirit varnish", the most commonly used being composed of linseed oil as the binder, copal as the resin, and turpentine as the solvent.[4] Exact formulations were trade secrets and are not published in the literature. The behaviour of the varnish layer over time remains consistent: it yellows, but remains soluble in alcohol.

Decals were printed, using a lithographic process, with lithographic inks and pigments. At the date of manufacture of the sleigh, the composition of the ink was a linseed oil-base with mineral pigments.[5,6] Most decals of this type (i.e. Simplex) were applied using varnish, then coated with the same varnish. The Canada Science and Technology Museum has a significant collection of industrial transfers, and has done some excellent research into the history and manufacture of this technology.[7]

Management of Environmental and Infestation Risks

The sleigh was in very good condition, and entirely complete with the exception of the missing cushion and damaged carpet. Acquired in December, 2005, the primary concern was the change of environment from barn to the museum warehouse, and the catastrophic effects this could have on the organic materials and structure. Winter is the worst time to bring historic organic materials inside in Canada, since the relative humidity in uncontrolled but heated warehouses can be as low as 10% between December and March. There was no option of changing the date of acquisition, so steps had to be taken to minimize the risks.

While the CSTM does have some environmentally controlled storage areas, the high cost of building and maintaining these spaces means that large transportation objects and machinery are generally stored in buildings with only temperature control. While this may be acceptable for some automobiles and most machinery, it risks being disastrous for horse-drawn vehicles that are largely composed of organic materials such as wood, leather and textiles, many of which are under tension and stress. The temperature in these buildings is kept as low as possible during the winter months (15-18 degrees Celsius) to help moderate the low relative humidity. However, the warehouses are occasionally used as working spaces for staff, and as such must be heated.

Any new acquisition with composite materials previously stored in outdoor or questionable conditions is fumigated in our portable carbon dioxide chamber. In this case, there was no obvious sign of insect infestation; however storage in a barn would presuppose that possibility, especially since the fabric and padding material in carriage upholstery are highly susceptible to clothes moth infestation. Careful documentation was undertaken

at joints and body panels, to monitor movement of the wood and to note any splits that might develop with the change in environment or during the fumigation procedure.

Fumigation with carbon dioxide can be problematic due to the low relative humidity mechanism of anoxic treatment.[8] To balance the drying effects of the process, and in this case to provide a slower transition between outdoor relative humidity levels and those of our warehouse, the Museum uses an ultrasonic humidifier when fumigating horse-drawn vehicles. Whereas the density of materials in other types of objects and "batch" fumigations can counteract the drying effect on artefacts, on carriages and sleighs there is a great deal of surface area with comparatively little volume of material to buffer the air. We have been successful with the integration of the humidification and fumigation system for over 15 years now, maintaining the relative humidity between 30 and 40% during the cycle, all the while increasing the peak CO_2 exposure time to twenty-one days.

The sleigh was placed in the chamber immediately upon arrival, and kept in the enclosure for six weeks. For three weeks of this time, the environment was maintained at above 60% carbon dioxide. The remaining time served as an adjustment period for lowering the relative humidity slowly to the level in the warehouse. Due to the high quality of construction of the sleigh, the 'floating' panels in the body were free to move without causing any splits. The side panels demonstrated movement at the edges of 6 mm, but no damage resulted (**Figure 2**). A more complete description of the carbon dioxide fumigation process at the Canada Science & Technology Museum, and its effects on the Carriage Collection has been published.[9]

Treatment Goals

The four major problems requiring treatment were: poor adhesion of paint to the wooden substrate; discolouration of paint over corroded iron-work; discoloured and reticulated varnish layers and decals; and fragile textiles. The sleigh's surface decoration is assumed to be original and unaltered based on two factors: examination of paint samples revealed only one paint layer and two varnish layers; and the presence of a deteriorating historic decal within the multiple varnish layers.

Figure 2. Gaps at the edges of the lower "floating panel", illustrating the extent of wood movement following fumigation and exposure to the low relative humidity in storage. Photograph courtesy of the Canada Science & Technology Museum.

The aesthetic goal was to preserve the original materials and paint finishes, and present the sleigh as an historical artefact rather than an "as new" example of the technology. To do this in a uniform and consistent manner required compromises and concessions. It was obvious that some materials were more deteriorated than others, and that the treatment options for some areas would be defined or limited by the fragility of the surfaces.

Treatment

Consolidation of Paint

The wood movement due to humidity changes after acquisition (as described previously above) did increase the cupping, tenting and rate of paint loss; so treatment to consolidate the paint layers in the most fragile areas was undertaken immediately after fumigation. Due to the differences in condition of the various painted surfaces, different elements were treated separately and in their entirety; for example the gear was cleaned and consolidated prior to work on the body panels, and the upper panels were completed prior to consolidating the lower panels. The procedure for each area was essentially the same, though with some adaptation, as required. The order of the treatment was determined by the fragility of the paint layer and the need to stabilize those elements most at risk of irreversible damage.

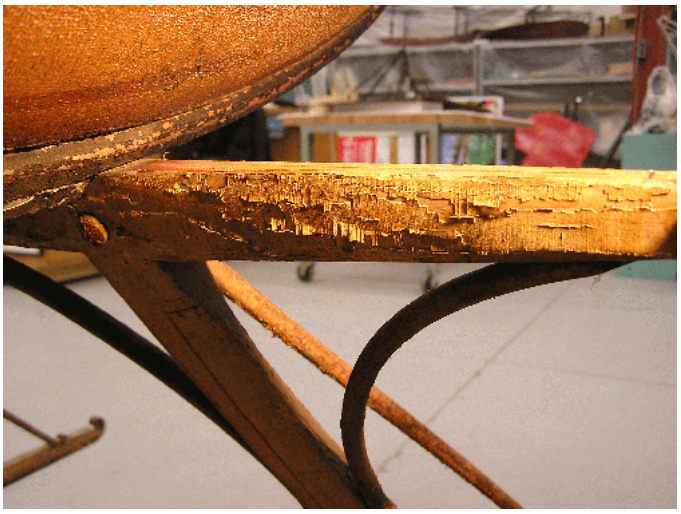
Paint on the wooden gear was curling and flaking in large fragments, while body paint and varnish was crumbling and tenting on a much finer scale. The method which worked best on the curling paint flakes of the gear, was to wick BEVA 371 (Original Formula), diluted to a thin consistency with toluene, behind the flakes, and gently lay them flat with a warm tacking iron. BEVA 371 (Original Formula) was used in all consolidation treatments on the sleigh, and was diluted to the consistency required depending on the specific problem: for example, with smaller paint flakes and tenting, a more dilute adhesive was required to penetrate behind paint flakes. Larger paint chips needed a thicker adhesive.

Excess BEVA was removed before it had completely dried, by swabbing with isopropanol. Isopropanol was preferred over toluene for this process due to its decreased likelihood of dislodging the consolidated flakes of paint. The disfigured varnish layer was still in place at this point, so the isopropanol did not contact the original paint layer. **Figure 3** illustrates the process on the wooden runner structure.

Cupping and tenting of paint on the body panels was wide-spread, but not to the point of loss. A similar process was employed for the consolidation of tenting paint on the body, as for the wooden elements of the gear.

Removal of Corrosion Stains from Paint

As is often the case, corrosion of the iron-work had caused discolouration and loss of paint on all of the gear. Most of the corrosion was inactive at the time of acquisition. The paint that remained was secure, but rust-stained, and covered in layers of barn debris. Once the water-soluble grime had been removed from the gear by washing with Orvus WA Paste and deionised water and rinsing, the iron-stained paint was cleaned by applying a gel poultice of 5% citric acid in methyl cellulose. The gel poultice was covered with clear food wrap to contain it, to slow the drying, and also to ensure that the gel had a good contact with the entire surface, as maintaining long-term wet contact is necessary to ensure that the stain is drawn out. If the treatment was not completely successful after one application, the area was treated a second time, with the gel never remaining on the surface for longer than 20 minutes at each application. The surface was rinsed with deionised water after treatment, and the varnish cleaned with swabs and ethanol (**Figure 4**).



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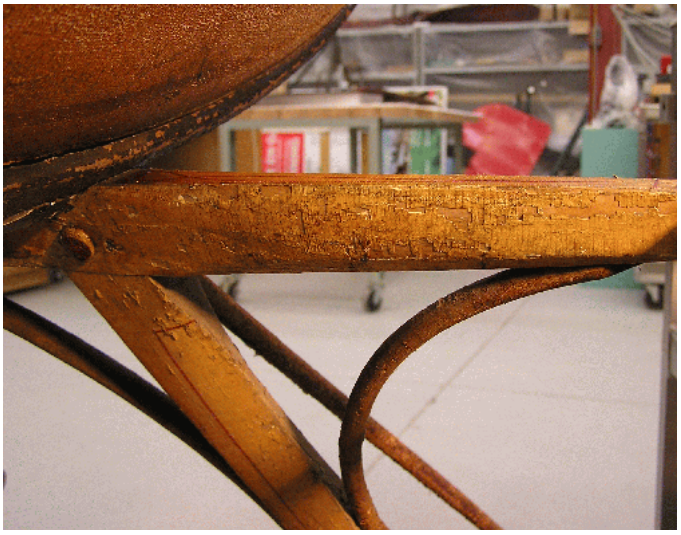

(**b**)

Figure 3. Curling paint flakes on wooden gear elements, (a) before and (b) after treatment. Photographs courtesy of the Canada Science & Technology Museum.

Previously invisible striping was revealed during this treatment: fine red and green stripes were painted on all elements of the gear structure. Although stabilisation with tannic acid is a standard treatment on corroded iron and often used by the author, in this case it was not undertaken, since the yellow paint was susceptible to staining and the metal was stable after rinsing, with no sign of active corrosion in pits or on the surface. Following treatment, all surfaces were coated with a layer of 10% Acryloid B72 in toluene to seal the surfaces, saturate the colours, and protect the paint. No inpainting was carried out on the gear, since the losses were extensive but not disfiguring in the overall context of the sleigh.

Discoloured and Reticulated Varnish and Decals

During the lifetime of the vehicle, varnish layers were intended to be replaced regularly; every few years at the least. By the time these vehicles are acquired by collectors or museums, the varnish is often dark, resistant to removal, and usually has decades of embedded grime. The varnish is disfiguring and often conceals colours and decorative details. For these reasons, some degree of removal of discoloured varnish is usually carried out during conservation treatments of horse drawn vehicles.[10]

In keeping with the previously stated goal of achieving consistency in the final results, varnish on areas of dark paint was reduced using ethanol. While some of the darkened varnish was removed in this process, revealing deep red and dark green

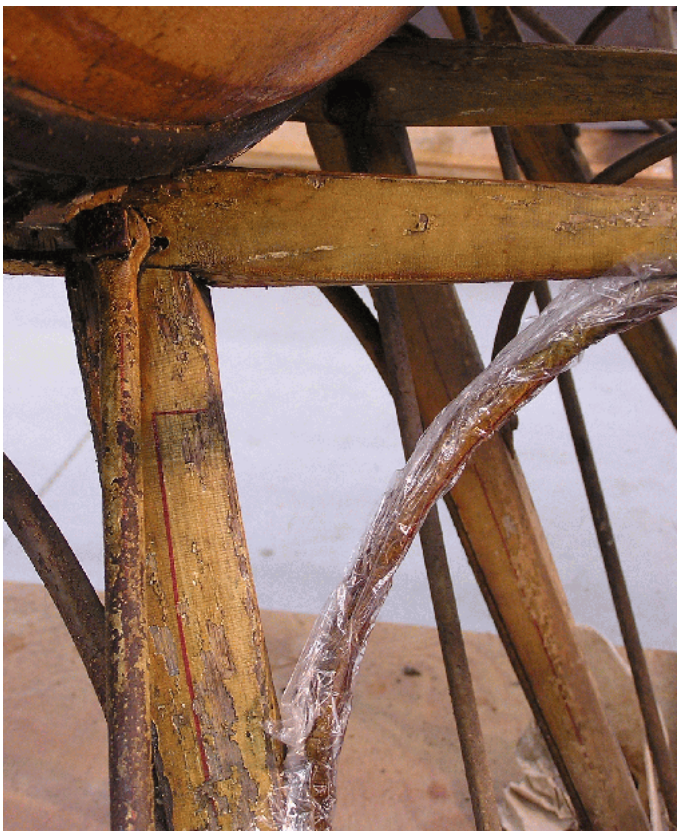

Figure 4. Painted iron component during cleaning with a poultice of 5% citric acid in methyl cellulose. Photograph courtesy of the Canada Science & Technology Museum.

(**a**)

(**b**)

Figure 5. Eagle head detail on dash, (a) before and (b) after cleaning and removal of darkened varnish. Photographs courtesy of the Canada Science & Technology Museum.

(**a**)

(**b**)

Figure 6. Detail of decal, (a) before and (b) after consolidation. Photographs courtesy of the Canada Science & Technology Museum.

painted panels, it is important to note that not all of the varnish was removed so that the resulting colours are visible, but darker than original. Yellowed varnish on the lower body panels was not removed for two reasons: first, the back and side panels are the same colour, and varnish removal could not be carried out on the back panel, for reasons described below; and secondly, the lower panel on the proper right side was severely stained with mouse urine from the nest inside the arm padding. The paint and wood were darkened over a large area, and the stain would have been more visible without the yellowed varnish. All painted surfaces were coated with 10% B72 in toluene after cleaning, to help to consolidate any minor flaking missed during the initial consolidation and to protect them.

In this treatment, the varnish on painted surfaces with no decals was cleaned using ethanol and mineral spirits to reveal the original carmine red and dark green paint. The mineral spirits were added to the ethanol as a means of controlling the rate of varnish removal so that a uniform appearance could be achieved slowly. Pure ethanol was aggressive and in test spots was difficult to control. Visible differences after treatment were most noticeable in areas such as the decorative eagle heads on the dash, where surprising colour details were revealed (**Figure 5**).

Varnish reduction was not undertaken on light coloured body panels with decals (lower and back), since the decals were so intrinsically bonded with the varnish that they had reticulated with it. Over time the layers become indistinguishable, and the solvents that will remove discoloured varnish from the surface can also dissolve the bond between decal and underlying paint or solubilise the decal.

The varnish and decal on the back panel was in worse condition than those on the sides. This is due, in large part, to the deteriorated condition of the underlying cream coloured paint that had been more weathered by exposure. It appeared to have lost

Figure 7. Condition of rear panel before treatment. Photograph courtesy of the Canada Science & Technology Museum.

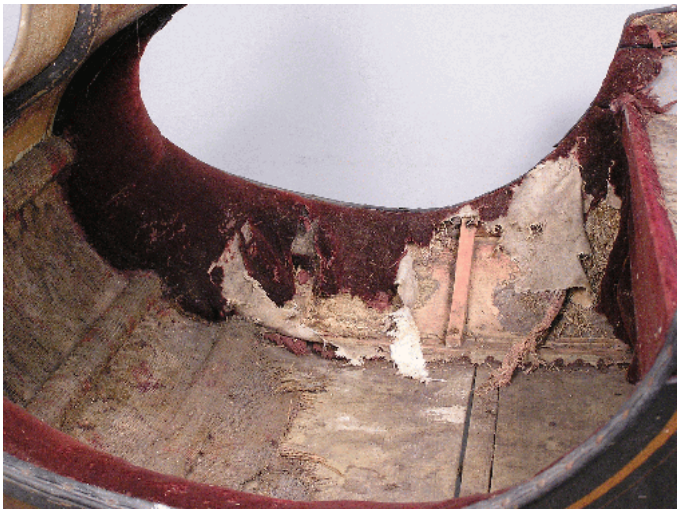

Figure 9. Carpet and plush fabric body-liner before treatment, showing damage from mouse infestation. Photograph courtesy of the Canada Science & Technology Museum.

Figure 8. Close-up of decal on rear panel, after consolidation and some inpainting. Photograph courtesy of the Canada Science & Technology Museum.

Figure 10. Carpet and body-liner after treatment, following cleaning and reconstruction with new padding materials and replica plush fabric. Photograph courtesy of the Canada Science & Technology Museum.

much of its binder and had a chalky consistency. The reticulated varnish and decal layers were precariously bound on this powdery substrate, and were easily damaged by abrasion and movement of the wood. After an aqueous surface cleaning to remove barn debris (where the surface condition permitted), the varnish was "reformed" by applying ethanol with a soft brush, and allowing the spirit varnish to flow and reattach to the chalky surface. This stabilised both the varnish and the substrate, and improved the appearance by reducing the gaps in the reticulated varnish. These gaps were further minimised by applying moderate heat with a tacking iron to mobilise the varnish and manually spread it over gaps (**Figure 6**). The entire surface was then consolidated with 10% B72 in toluene. Large areas of loss and gaps in reticulated varnish, were then in-painted with acrylic paint to reduce the visual impact of the losses to the varnish and decal. A portion of the rear decal was recreated by tracing the pattern from the remaining image, and transferring it to the missing area. This was undertaken in order to reduce the very distracting impact of the damage. Inpainting was done using acrylic paints, over the B72 isolating layer. **Figure 7** shows the condition of the rear panel before treatment, and **Figure 8** shows a close-up after consolidation and some inpainting.

Textiles

The carpet, made of a coarse woven burlap fabric with looped pile, was severely worn and embrittled. Almost all of the original material from the centre of the footwell was missing due to the previous cleaning, but the remaining fabric was firmly held in place by tacks. As is invariably the case, the fibres of the carpet were severely abraded by grit and debris deposited throughout a lifetime of use. Treatment of the carpet involved removal of tacks

on the lower section in order to lift the fabric and clean underneath. It was also wet-cleaned in-situ by sponging a solution of 1% Orvus in deionised water through the fibres onto a pad of blotting paper. After cleaning, the verso of the carpet was backed with Reemay and BEVA 371 Film, applied with a hot air gun to ensure complete support of the warp and weft threads. A thin border of Nylon Gossamer and BEVA Film was applied around the fragile edges, and wrapped over onto the recto to prevent the ends of the carpet fibres from being further damaged.

Losses to the plush body-liner fabric were replaced using a mohair plush fabric of similar weight and colour.[11] The replacement fabric used was a close approximation of the original, but variances in colour and pile height result in a visible difference. The new fabric was toned down slightly by rubbing in a very dilute acrylic paint mixture to simulate age and wear. Losses in horsehair and cotton 'kapok' fibre padding were filled with carved Ethafoam blocks, covered with polyester quilting padding. This enabled the silhouette of the original to be reproduced, and minimised the visual impact of the damaged areas. **Figures 9 and 10** show the inside of the body before treatment, and after. Missing carpet was not replaced since the loss was not as visually distracting as the loss of the red plush fabric.

The fabric around the seat back was severely damaged in the lower right corner, due to the mouse infestation. There was some loss of horse-hair stuffing in this corner also, but surprisingly the losses were minor. Some of the very heavily soiled stuffing was removed and washed, and then put back in place; but the majority of the seat structure was cleaned in-situ, by sponging Orvus detergent and water through the fabric onto a blotting paper pad, and rinsing with deionised water using the same technique. The fragile lower edges of the fabric were backed with Nylon Gossamer and BEVA 371 Film, applied with a tacking iron. The lower edges of the backing fabric were then tacked into the seat frame using the existing tacks and tack holes. There is no discernible odour remaining in the seat materials.

Based on the photographs taken at the initial inspection of the sleigh, a replica cushion was fabricated using the replacement mohair plush fabric. The cushion was made by a local firm, using what they referred to as "traditional" techniques of padding with horsehair and cotton rather than foam.[12] The intent of the cushion was for display purposes only, and it is clearly identified as a replica. It was not aged in any way.

Results and Discussion

Research on comparable vehicles in the trade literature as well as through microscopic inspection of paint samples, shows that the original paint scheme was bright red and green upper panels over cream-coloured lower and back panels. The conserved appearance of the vehicle does not correspond exactly to this colour scheme largely because of the yellowed varnish on the light coloured panels, and the darkening of the remaining varnish on the other panels. The overall darkening of all of the paint surfaces has created a more muted appearance than the original; but a balance has been achieved between the deteriorated trimmings and the various degrees of deteriorated finish on the wood and metal.

An appreciation for the beauty and importance of the "original" in transport collections needs to be fostered and promoted within the museum context. Collections of transportation artefacts in unrestored condition are in the minority in North America; with by far the greatest number containing restored objects. Although the Canada Science and Technology Museum today adheres to conservation principles as set out in the Canadian Code of Ethics[13], many of our transport objects have been previously restored and there is, therefore, little opportunity to showcase the "conserved" objects without throwing them into a sometimes unflattering contrast with restored pieces.

The use of an artefact, such as this one, to illustrate the process and principles of conservation, can do much to promote the conservation profession's objectives to the general public and change aesthetic expectations. In an age of cut-backs to funding, where attracting the paying visitor is a major goal, museums cannot afford to have a public that is unhappy with what it finds on display. Visitor feedback plays an important role in exhibit planning and artefact selection, and pressure from the public can influence the decisions of curators and exhibit designers. A conserved vehicle can appear shabby and ill-cared for; but an interpreted comparison between a restored vehicle and a conserved vehicle can illustrate the differences in workmanship and quality of materials; and the importance of preserving the living history of the object through wear patterns and alterations. By incorporating the conservation element into public programming, and explaining the role of science and conservation in the preservation of historic objects, museums can give visitors a deeper understanding of the artefacts; while at the same time increase awareness of the conservation profession.

With these goals in mind, the Canada Science & Technology Museum has started a training program that explains conservation to Public Programming personnel, the primary contact with visitors. The Museum also hosts public tours throughout the year, which include the warehouses and conservation areas. As part of a new initiatives some artefacts on display will soon be accompanied by information panels describing the care and conservation of the piece.

Conclusion

The challenge of preserving an object such as the sleigh is in choosing and adapting treatment strategies from other areas of conservation. The painted wood and metal surfaces were highly decorative, yet created for harsh outdoor conditions. The trimmings, though as luxurious as any interior furnishings, were subjected to storage in barns, stables and carriage houses. Treatment methodologies from the fields of painting, textile, furniture and industrial technology conservation are all relevant and necessary, and must be applied in a co-ordinated approach. Conservation treatments have, as their goal, the preservation of original material and technology; some are also able to preserve

the original purpose and function. For transport artefacts in a museum context, the form and technology takes precedence over function; for while the sleigh will never again provide transportation, it will continue to exist as a historic reference and example of the craft of sleigh-making.

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Materials

Acrylic Emulsion Paints: Liquitex Professional Acrylic Artist Color, Liquitex Artist Materials, NJ, USA. Purchased from local art supply store.

Acryloid B72 (methyl acrylate / ethyl methacrylate copolymer): International Gilders' Supplies, 12-1541 StarTop Rd., Ottawa, Ont. K1B 5P2. Tel: (613) 744-4282; fax: (613) 744-0949; www.gilding-supplies.com .

BEVA 371 Film (ethyl vinyl acetate copolymer): Conservators Products Co., P.O. Box 601, Flanders NJ 07836. Tel: (973) 927-4855; www.conservators-products.com .

BEVA 371 Original Formula (ethyl vinyl acetate copolymer): International Gilders' Supplies (for contact info, see Acryloid B72).

Citric acid: Fisher Scientific, 112 Colonnade Rd., Ottawa, Ont. K2E 7L6. Tel: 1-800-234-7437 or (613) 226-3273; fax: (613) 226-7658; www.fisherscientific.ca .

Ethafoam (polyethylene foam): Hansler Smith Limited, 830 Industrial Avenue, Ottawa, Ont. Tel: (613) 736-8855.

Methyl cellulose paste powder: Carr McLean, 461 Horner Avenue, Toronto, Ont. M8W 4X2. Tel. 1-800-268-2123; www.carrmclean.ca .

Nylon Gossamer: Talas, 20 West 20th Street, 5th Floor, New York, NY 10011. Tel: (212) 219-0770; fax: (212) 219-0735; www.talasonline.com .

Orvus WA Paste (Canpac 645 anionic detergent): International Gilders' Supplies (for contact info, see Acryloid B72).

Reemay (spun-bonded polyester): University Products, 517 Main Street, P.O. Box 101, Holyoke, Mass. 01040-0101. Tel: 800-628-1912; fax: 800-532-9281; www.universityproducts.com .

Replacement fabric: Hirsch Automotive Supplies, 396 Littleton Avenue, Newark, NJ 07103. Tel: 800-828-2061 or 973-642-2404; fax: 973-642-6161.

Solvents (Ethanol, Mineral Spirits, Toluene, Isopropanol): Fisher Scientific (for contact info, see Citric acid).

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11. Green, Susan, “Plush Fabrics in Horse-Drawn Vehicles”, *Driving Digest*, No. 107, 2004, pp. 50-57.

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