conservation

perspectives
from the
heritage
conservation
centre

This book is published to mark the 10th Anniversary of the Heritage Conservation Centre, Singapore.

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contents

Breathing new life...


into our priceless artefacts.


Arresting the effects of time...

with new approaches to preservation.


Nikon
Capturing the past for posterity.

At the Heritage Conservation Centre,
preservation and conservation is
a labour of love – undertaken with
skilled hands, patience for complexity
and a passion for our shared past.

foreword

by michael koh
chief executive officer
national heritage board

I am pleased to pen a few words for this publication, which is launched on the occasion of the 10th Anniversary of the Heritage Conservation Centre.

Artefacts take centre stage in our exhibitions, conveying the stories that the NHB Museums want to share. Museum visitors are often awed and impressed by the beautiful artefacts. Yet, few know about the painstaking work that goes on behind the scenes to ensure that these precious historical and artistic treasures are carefully conserved and prepared for exhibitions. Others also wonder what happens to the artefacts that have been collected for posterity but are not on display.

The Heritage Conservation Centre, established in 2000, is tasked to manage, care for and facilitate access to NHB's museum collections. It has been playing a critical role ensuring that the collections are physically well preserved and housed in a good home, cared for by professionals who are equipped with the appropriate skills in preservation and conservation. With excellent facilities and a dedicated professional team, the Centre has given strong assurance to NHB's donors and lenders that their artefacts and artworks will be in safe and steady hands.

The Centre raises the bar for heritage materials management and conservation through active outreach and research programmes. It continues to focus on enhancing its staff's professional knowledge and skills in areas such as collections management and conservation. This has in turn elevated the overall standards in this field in Singapore and earned the Centre professional recognition from the region and beyond.

As the Centre embarks on its next decade of development, it is an opportune time to review its achievements and look forward to the future. The accumulated knowledge and experience within the Centre will no doubt bring it to the next level, but there are two areas that I hope it will further develop its strengths in: research and scholarship; and engagement of the domestic and international communities. I am thus most delighted that the Centre has decided to introduce this publication as a platform for professionals to contribute and share their findings, to add to the current body of conservation and collections management knowledge in this part of Asia.

On this note, I applaud the Centre on its development over the last 10 years. Going forward, I am sure, its team's energy and dedication will continue to give it the momentum to make its mark in the field.

introduction

by loh heng noi
director
heritage conservation centre

On Conservation is conceived as a flexible and open platform for professionals in the field of conservation and preservation to document their projects and publish their experiences. The publication of this biennial series is part of a larger effort of the Heritage Conservation Centre to bring together the wisdom of practitioners from Singapore and beyond. *On Conservation* differs from many other journals or books on conservation and preservation in that it is not a technical or scientific publication. Aimed at both experienced and new practitioners, it also welcomes them to come forth and share their knowledge. This series is our contribution to the wider body of conservation, preservation and collections management knowledge.

Materials conservation and preservation connote different meanings to different people. In the museum context, these processes often mean prolonging the lives of artefacts and artworks by slowing down their deterioration so that they can continue to serve as historical and cultural evidence for future generations. Conservation and preservation consist of a series of active and passive activities, including the careful management of external factors and the application of interventive measures, to ensure that artefacts can survive the passage of time.

The focus has for a long time rested on the tangible and physical qualities of artefacts, as the field was largely dominated by the need to preserve the creations of known and unknown artists and artisans who had passed on. Beginning largely as a craft, the field was elevated to a science only in the last century. Scientific principles and tools have and will continue to make significant impact on the techniques and processes that help to extend the existence of many heritage objects.

Over the recent decades, however, professionals around the world, including here at the Heritage Conservation Centre, have come to recognise and embrace the need to take into consideration the conceptual, contextual, relational and other non-physical values of artefacts and artworks when devising and implementing preservation and conservation treatments. In many cases, such as contemporary art, these values may be the only ones that make a work significant. These considerations often also necessitate a cross-disciplinary approach, which adds further challenge to the conservation process.

A number of the case studies featured in this inaugural issue of *On Conservation* reflect our broad-ranging considerations and cross-disciplinary approach. In some instances, they also offer insights into the decision-making process behind the creative solutions. Other than the eight case studies, this volume also includes one article on the transformation of the Centre's visual documentation process as well as an overview of our education and outreach efforts. These examples have been chosen because they show an interesting range of the work done at the Centre and illustrate how we have responded to the changing external environment.

Each of these featured projects is a joint effort by the author and other colleagues at the Centre. A number of very experienced international practitioners also took time amid their busy schedules to travel to Singapore to share their skills, knowledge and experience in some of them. We are grateful for their advice and guidance and are glad to be able to share their insights through this publication.

the art of suspension – **mounting and storing a contemporary artwork**

By Anthony Lau, Assistant Conservator (Paintings)

introduction

Conservation is often a multidisciplinary task involving both interventive and preventive approaches that address artworks' requirements. This article illustrates a series of measures that were developed to improve the physical condition as well as the display and storage of a large two-dimensional installation work, entitled *Born out of Fire*, by artist Salleh B. Japar.

The work comprises three large pieces of mixed media on canvas.[1] On the rear side of each canvas a series of cotton tapes had been sewn to hold the bamboo strips that were used for the work's display. When on display, the canvases were suspended at a forward tilted angle of approximately 30 degrees. This support method created tension in the canvases and posed risks to their structural stability. The practice of rolling up the canvases for storage also caused creasing and contributed to the surface deterioration.

conservation

An initial condition assessment raised several issues about the work's treatment, future display and long-term storage. Of immediate concern was the paper components' condition. Collaboration between the disciplines of painting and paper conservation was necessary in order to devise the most appropriate treatment.

The size of the canvases also posed several technical and logistical challenges for the project team. With the canvases measuring approximately 248cm (height) x 174cm (width) each, a large space was required for their conservation. In addition, as they were rolled up in storage, they had to be flattened before treatment could commence.

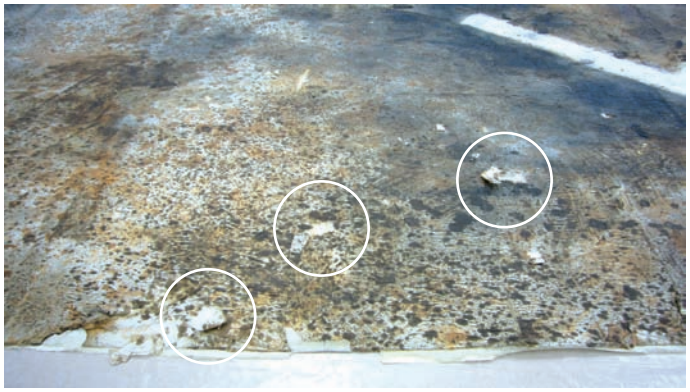


Figure 1. [1991-01631] Detail of a delaminated paper surface

The three canvases were buffered with blotting paper and weighed down with books for several weeks before their flat forms were regained. The canvas surfaces had suffered extensive delamination and losses, including some areas of paper which had lost adhesion to the canvas support (Figure 1). The delaminated paper was pasted down with wheat starch paste. This adhesion process was undertaken for both the front and the back of the canvases. Glass weights with blotters were used to apply pressure as the adhesive dried. Most of the losses were found when the canvases were unrolled and could be adhered back to the original positions.

Due to the fragility of the surfaces, an alternative mounting method that would reduce the stress to the surfaces and provide a rigid and stronger support was needed. It was also important to consider safer ways for handling and installing the canvases.

mounting system

The original mounting system relied on the series of cotton tapes that had been sewn on the rear sides of the canvases. The tapes were used to secure thin lengths of bamboos which supported the canvases when on display. The relative thinness and flexibility of the bamboo supports caused uneven tension in the canvases. The cotton tapes were also not strong enough to hold the canvases for long; this rendered the work unsafe for long-term display.

A new mounting system using aluminium tubes and wooden rods as hanging supports was designed. This could provide an even distribution of support and would be strong enough to suspend the work for extended periods. It could also address storage, handling, transport and installation concerns.

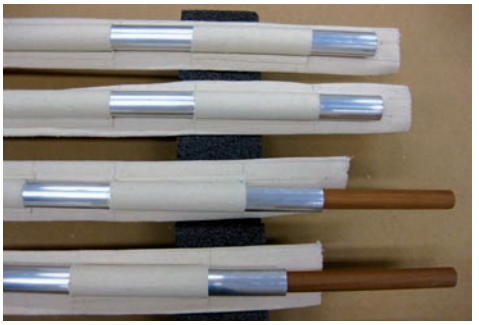


Figure 2. Adhesive-coated canvas strips with aluminium rods and wooden poles inserted

Figure 3. Attaching an adhesive-coated canvas strip with a heated iron to the centre top of the canvas support

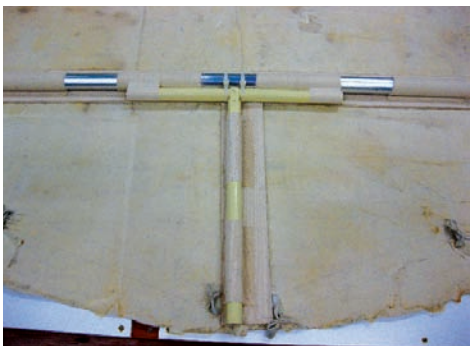


Figure 4. T-shaped support added at the top of each canvas

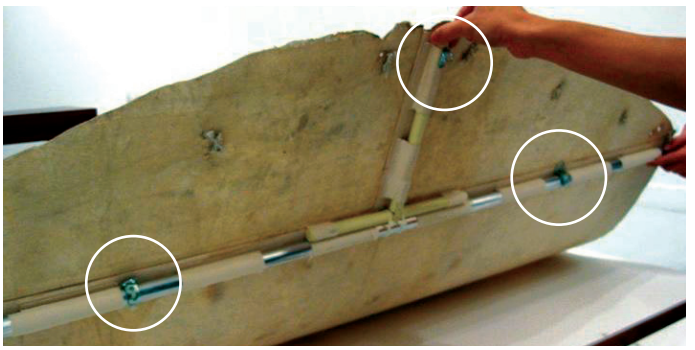


Figure 5. Positions of hanging hooks at the top of the canvas

The cotton tapes were first neatly tied to make space for the new mounting system. Long strips of canvas were then prepared with support sleeves sewn at intervals along their lengths. This provided tight-fitting sleeves for aluminium tubes to be slid in (Figure 2). The canvas strips were then coated with Lascaux 375, a heat-activated adhesive, and secured to the rear sides of the canvases at the top and bottom. The heat-activated adhesive was used to avoid penetration through the canvas supports, which would cause staining on the paper surfaces of the canvases (Figure 3).

For each canvas strip support, an aluminium tube was inserted through its canvas sleeves. A wooden rod was then put through each tube and secured with metal screws. The protruding lengths of the wooden rods would serve as temporary carrying handles, which could be held by handlers when installing the canvases. At the top of each canvas, a T-shaped support was added so that the canvas could be hung forward tilted at a 30-degree angle as intended by the artist (Figure 4).

A hanging test using a hoisting beam was done to assess the adhesive strength of the canvas strips and the new system. It also tested the weight and tension distribution within each canvas.

Once the canvases had been suspended, it was easier to identify the most suitable positions to attach a series of permanent hanging hooks. These were shaped and fixed to the aluminium rods and secured by aluminium ducting tape and cable ties for additional security (Figure 5).

storage

The next step of the project studied storage methods for the canvases. The most practical solution came in custom-made handling frames that could support the canvases in both horizontal and vertical positions. These frames could also accommodate the new mounting system with aluminium tubes (Figures 6 and 7). Foamcore boards were fastened with metal screws to the front sides of the frames. These flat Foamcore boards would provide lightweight support to the canvases. The metal screws were covered with small squares of transparent polyester film (Melinex®) to protect the rear sides of the canvases from any corrosion staining.

Figure 6. Drilling wooden strips into a handling frame

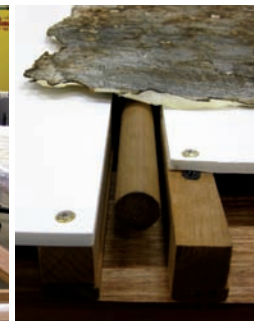


Figure 7. Detail of a handling frame's front side, with Foamcore and a recessed channel for the aluminium tube mounting system

To ensure that the canvases would be secure in the frames, a corresponding number of recessed channels were created to house the aluminium and wood supports (Figure 7). Brass brackets were used to fasten the wooden rods in position. This system would also help minimise the artwork's movement during transport.

The frames were colour-coded for their respective canvases. The specific accession number, artist's name, artwork title, medium and dimensions were stencilled at the bottom of each frame for easy reference.

Clear instructions on how to remove the canvases were attached to the sides of the frames. Two metal handles were also fixed to either side of each frame to facilitate handling (Figures 8 and 9). Wood "spacers" were added at the top left and top right of each frame so that the canvases could be stacked without compromising the canvas surfaces. Space is often limited in the store and the gallery; a stacking system to protect the canvases from damage was essential (Figures 10 and 11).

Figures 8 and 9. Detail of the handles attached to the sides of the frames to facilitate lifting of the canvases

Figures 10 and 11. Wooden spacer blocks fitted to the top of the handling frames protect the canvases when stacked

Figure 12. *Born Out of Fire* on display at the Singapore Art Museum

conclusion

The mounting, handling and storage of complex contemporary artworks can pose many challenges. Specific solutions are often needed to respond to the unique material composition, structure and display needs of such works. The design of a new mounting system for *Born Out of Fire* was an example of how a versatile and practical solution was devised for an unconventional artwork. The relative ease with which this artwork can now be handled and installed ensures that it can be stored, moved and displayed safely.

1 The artwork comprises three individual canvas supports, whose front and back are adhered with paper. The paper surfaces have been scorched to create the work's mottled appearance. Charcoal drawings also adorn the front sides of the canvases. At the centre of the installation is a small acrylic vitrine containing a scorched book, illuminated from above by a suspended tungsten lightbulb (Figure 12).

fitting form – **treatment and supports for an installation artwork**

By Woo Mun Seng, Senior Conservation Officer (Objects)

introduction

Contemporary art poses unique and often complex challenges to those responsible for its acquisition, interpretation, display and long-term preservation. The range of materials used in contemporary art is almost infinite, as artists continually push the boundaries of experimental and unconventional expression. A unique approach to documentation, storage, conservation treatment and display is often required for each contemporary work. This article examines the conservation treatment of an installation work entitled *Missing,* following its selection for an exhibition at the Singapore Art Museum (SAM) in 2009. The work's successful conservation was attributed to the unique collaboration between the artist Amanda Heng Liang Ngim, the museum curator and the conservator.

description

The installation artwork is displayed in a simulated domestic, living-room setting. The four walls are painted black and the floor space is covered in black carpet. A black door with a black frame stands at a corner; the door is slightly open. At the other end of the room are a black sofa and a black table. Twenty-one stiffened white baby-girl dresses populate the room, suspended from the ceiling by monofilament nylon line (Figure 1). The floating dresses appear randomly arranged in small groups; some are on the sofa while others hover around the table. The heights at which the dresses are suspended vary, though the majority are hung at a low level. Black cards with various texts and messages are tied with red threads and attached to the ceiling, and the red threads hang down to create a cylindrical form. The viewer is encouraged to walk into, out of and around the installation, and may tug at the red threads to pull down the black cards.

Figure 1. [1996-00681] The installation artwork *Missing*

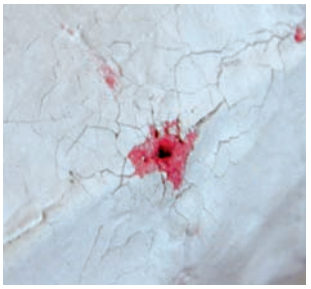


Figure 2. Paint loss caused by nylon line attachment

Figure 3. An area of cracked paint and surface loss, before conservation

Figure 4. An area of damage after facing treatment with fabric and acrylic paint

condition of the artwork

The baby-girl dresses are made of cotton and polyester fabric and coated with starch, fixative and white emulsion paint. Prior to its acquisition by SAM, the work had travelled to various international exhibition venues. Over the course of installation, display and transit, several of the dresses had suffered physical distortion and paint loss. A conservation assessment revealed that the work was inherently fragile due to the lack of internal structural support. All the dresses had suffered some general physical distortion. Minor cracks, over old creases, weakened areas and stressed joints and around holes where the hanging lines were previously secured, were observed (Figures 2 and 3). In areas with surface cracking, white emulsion paint had flaked off.

discussions between artist, curator and conservator

A series of dialogues were arranged between the various stakeholders to derive a more informed evaluation of the artwork and the potential consequences of any proposed conservation actions. Contemporary art possesses a unique advantage when it comes to conservation – its artists are often available and willing to discuss their works' conservation requirements. This is in marked contrast to the conservation of historical materials such as ancient sculptures, whose creators are unknown or dead. Following discussions, the stakeholders reached a consensus – any future conservation treatment of the dresses should not significantly alter their original appearance, which was viewed as critical to the work's meaning and interpretation. The artist also requested that the dresses remain white and be as stain-free as possible. The dresses' colour and shapes are to give the impression of children's souls without form or body. In addition, the artist highlighted that the dresses are the work's most important element, and therefore the materials used for treatment should not interfere with the work's visual concept. It was agreed that any conservation intervention should be visibly unobtrusive while providing the maximum level of structural stability to the work's weakened areas.

conservation treatment

The conservation treatment comprised two inter-related courses of action. Firstly, the cracks and flaking paint had to be stabilised so as to prevent further losses. Secondly, individual custom-made internal supports were needed to help prevent the dresses' further physical distortion.

To stabilise the cracked and flaked areas, the conservator devised a method of treatment that would impart strength to the fragile surfaces while endowing similar textural and visual characteristics as the dress fabric. A facing treatment was carried out using Reemay[1], a white non-woven polyester fabric, and Lascaux Tylose MH 50 Methyl Cellulose[2], a 5% adhesive solution, in deionised water. When dry, the thin polyester fabric was painted with white acrylic artist paint to match the work's colour and surface texture (Figure 4).

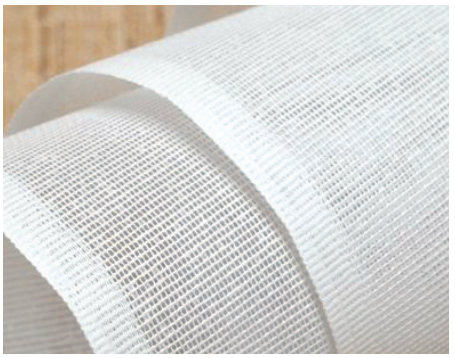


Figure 5. Buckram

Support mounts to prevent physical distortion were custom-made for each garment. Buckram[3] was selected as the material for the mounts because it could be easily shaped to fit within the variously sized dresses and yet provide firm support (Figure 5). To fit snugly, each mount had to be slightly smaller than its corresponding dress. Moulds were first fabricated using the inner measurements of the individual dresses. They were further padded and shaped with layers of polyester wadding before being covered with a tight layer of cling film, which provides a non-stick barrier against the gluey Buckram. Wet Buckram strips were applied, overlapping, on the moulds; this process is similar to that of making papier mâché. To ensure that the supports would be strong enough, several layers of Buckram strips were used on each mould (Figure 6). When dry, the newly cast support mounts were removed from the moulds with a sharp blade (Figure 7). The various parts of each mount were joined using a hot glue gun and trimmed to size (Figure 8). Polyester wadding was used to pad these hard-shelled supports and a final layer of calico fabric was used to cover them. Lastly, the interiors of the supports were lined with a layer of fabric known as Interfacing[4], using a heated spatula (Figure 9). The Interfacing protects the dresses' interiors from abrasion and also conceals the Buckram on the dresses with smaller shoulder straps for aesthetic purposes.

Figure 6. Wet Buckram applied on moulded form

Figure 7. Hardened Buckram shell

Figure 8. Joining the cut Buckram with a hot glue gun

Figure 9. Lining the interior with Interfacing using a heated spatula

Figure 10. A finished support mount (left) next to its baby-girl dress (right)

conclusion

Collaboration between stakeholders offers different perspectives that influence the outcomes of conservation treatments. In this case, the conservator's direct contact with the artist helped outline the significance and context of certain artistic elements. Although he worked separately from the artist, the latter's criterion of minimal and unobtrusive intervention was a paramount consideration in developing a workable treatment solution.

As the fabrication of the 21 support mounts was extensive, the services of an external textile-mounter were engaged. The mounter was meticulous in designing, sewing and making sure the supports fitted the dresses exactly. This new support system ensures that the dresses are always maintained in their original shape. It also allows easy handling during the installation and securing of the hanging lines. Furthermore, the hanging lines do not pass through the old holes in the dresses as in the original display but are secured directly to the new supports instead.

The new mounting and storage system provides ample structural support for the artwork's display and handling, without affecting the installation's integrity and intent. The new mounts act as additional padded support for the dresses for future storage (Figure 10). Nylon lines used for suspending the dresses can now be secured safely to the Buckram support without risk to the artwork's painted parts.

1 A spun, bonded, white, non-woven polyester fabric with continuous filament construction to minimise fibre migration and add strength. This material can be thermally and ultrasonically adhered.

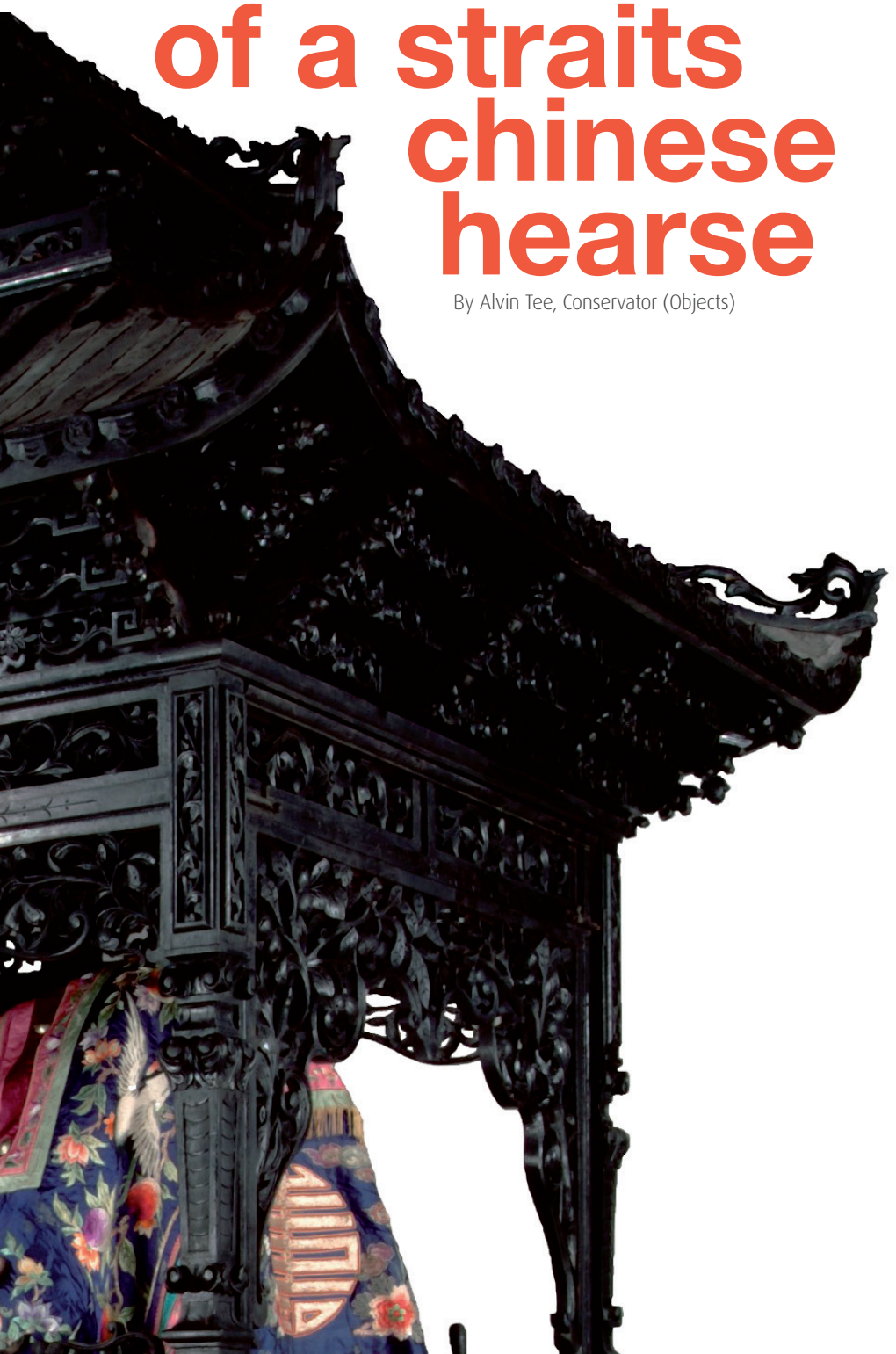
2 A powdery substance prepared synthetically by the methylation of natural cellulose. MH stands for methyl hydroxyl ethyl cellulose. Methyl Cellulose (MC) forms a gel when heated to 50–90°C, depending on the grade. It is a water-soluble and high-quality adhesive. Water-soluble MC (distribution of substituents 1.5–2.0) is used in paper conservation as an adhesive and consolidant, as a reversible facing on wall paintings, for pigment fixing, and as an adhesive for textiles.

3 A cotton or linen fabric impregnated with a starch-based size, which acts as both stiffener and glue. The material becomes sticky and easy to manipulate when wet. When dry, it hardens into a rigid shell. Buckram has many advantages; it is light, strong, rigid, easy to cut and can be stitched with a needle and thread. Its versatility allows it to be fashioned into shapes that can fit costumes of any dimensions. As figures made of this material are hollow and can be cut as desired, it is particularly suitable for making concealed costume supports.

4 Interfacing is essentially an extra layer of fabric that provides shape and support in detail areas. It is commonly used in collars, cuffs, lapels, necklines, pockets, waistbands, buttonholes, facings and opening edges. Interfacing acts to keep these areas of garments crisp even with repeated washing and wearing. Interfacing that has heat-activated adhesive coating on the back was used in this case. When steam, heat or pressure is applied, it fuses onto the fabric. This type of Interfacing is known as fusible Interfacing. Non-fusible Interfacings do not have adhesive and must be sewn by hand or machine.

from bits to form – **the conservation and reconstruction of a straits chinese hearse**

By Alvin Tee, Conservator (Objects)



introduction

In preparation for the reopening of the National Museum of Singapore in December 2006, a large-scale conservation project involving the partial reconstruction of an elaborate wooden carriage was carried out. Selected as a key exhibit in the museum's new Singapore History Gallery, the carriage was the hearse of Tan Jiak Kim, a Straits Chinese merchant and community leader. Several factors were critical to the project's success, including the conservators' careful consideration for the hearse's historical significance, their pragmatism and flexibility in approaching the complex issues encountered during conservation treatment, as well as their unique collaboration with specialist woodworkers.

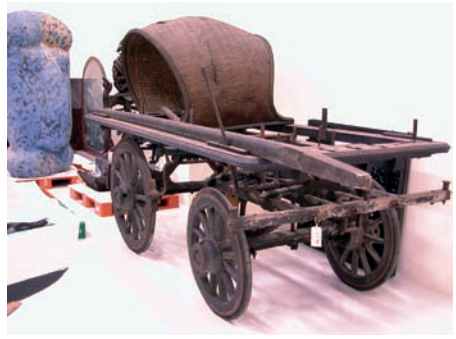


Figure 1. [W-0860] The carriage in early 2005

Figure 2. A section of the upper-tier roof, showing structural loss

history

Tan Jiak Kim (1859–1917) was a wealthy merchant and philanthropist who ran a family business, Kim Seng & Co, in Singapore. He died on 22 October 1917, and his funeral, attended by many including British government officials and prominent businessmen, followed one week later.[1] The funeral procession travelled from his home in River Valley Road to the family graveyard in Alexandra Road.[2] The hearse's grand scale and design were testament to Tan's wealth and status. Custom-made for Tan's family, it features elaborate carvings that combine Chinese, European and Malay design elements, which reflect the eclectic tastes of the Straits Chinese community.

condition assessment

An initial condition assessment of the hearse identified 17 component parts and a large selection of broken woodcarvings. At the start of the project, there were no obvious clues to how the various sections of ornate woodwork and the roof fitted together (Figures 1 and 2). A review of the artefact's acquisition record yielded little information on how it was originally assembled. Neither could historical photographs of Tan Jiak Kim's funeral procession be traced. A detailed technical study of the various structural joinery methods and points of attachment was thus carried out. Fortunately, evidence of a numbering system, in the form of markings, was discovered on the carriage bed and other component parts. Gradually, section by section, a structural outline of the various parts became increasingly clear.

Figure 3. Detail of the wooden cross rail, showing termite damage

Figure 4. The areas of loss in the cross rail filled

During examination and sorting, several notable areas of structural deterioration were also identified. A particularly visible area of loss was one of the carriage wheels, whose hub and three spokes were all that remained. A temporary support jack provided some relief to the carriage suspension, but the support of a new wheel was required to enable the carriage to be mobile again and be suitable for permanent display. Most of the structural losses of wood and metalwork were not immediately apparent until during the course of conservation treatment, when the conservators became more familiar with the artefact's structure and the layout of its carved ornamentation.

conservation treatment

phase 1: surface cleaning

An intensive programme of conservation treatment began in earnest in June 2005. The treatment was carried out in a series of phases, involving six objects conservators and a part-time staff member who was specially hired to assist with the more routine surface cleaning. The surface-cleaning process proved to be difficult and tedious, as a thick, stubborn layer of dirt had accumulated and bonded to the painted wooden surfaces. The hearse's size also contributed to the lengthiness of the process.

Samples from a cross-section of the hearse's wooden and metal surfaces were taken for a material study of the surface coating. The analysis of these samples revealed two decorative layers: a ground layer of oil-based black paint, topped by a coating of clear varnish. While the varnish was embrittled with age and suffered extensive loss, the oil-based black paint on the wooden surfaces was surprisingly in good condition, thus requiring minimal conservation treatment. The same black paint on the sheet metal roof, however, had almost completely vanished due to a combination of weathering and corrosion of the metal support.

phase 2: structural repairs

A wooden cross rail above a small fifth wheel at the front of the carriage, which served to stabilise the hearse and prevent it from toppling while in motion, had suffered more than 40% structural loss from termite infestation (Figure 3). The termites caused a multi-tunnel network in the wood that connected to other surrounding timber components. Treatment was carried out in situ. A liquid consolidant was injected into the cavities to harden the damaged wood before a lightweight pigmented micro-balloon and resin fill was applied to the areas of loss (Figure 4). Other similar structural losses were repaired in the same manner or replaced with new wood.

phase 3: reassembly

The first stage of conservation treatment was completed in September 2005 and the hearse was judged to be ready for reassembly. Without documentary evidence of the hearse's former appearance, the conservation team undertook a series of educated guesses for its partial reassembly. This phase was critical for the identification of key missing parts (Figure 5). The extent of both structural and decorative losses, particularly to the roof's lower and upper tiers, was the most visible and required a significant rethink of the project objectives and conservation approach.

Figure 5. Missing parts in the lower and upper tiers of the roof were identified after the hearse's original sections were reassembled

At this point, with its substantial structural losses and inherent weaknesses, the hearse was still unstable and unsuitable for display.

phase 4: reconstruction

For the significant structural and decorative losses, the conservators took a pragmatic approach as well. Their objective was not to fully restore the hearse, but to provide it with enough stability through reconstruction, so that it could safely support its own structural weight when fully assembled.

The conservation team reached their decision on the desirable level and methods of reconstruction following considerable consultation with other project stakeholders such as the museum curators. The conservators also took special care to understand the complex interplay of the decorative design elements.

Fabricating the missing lengths of elaborately carved woodwork and sections of sheet metal roof was beyond the conservation team's technical capabilities. A specialised woodworking contractor was therefore roped in to undertake this scope of the work. The conservators closely monitored and collaborated with the contractor to ensure that the project's objectives were met within a mutually agreed set of conservation guidelines and construction specifications.

About 35% of the hearse was reconstructed with new teakwood or metal components. The reconstruction phase started with the fabrication of the missing carriage wheel. The shape, dimensions and construction methods of an existing rear wheel were replicated, as were the teakwood spokes, rim, outer metal rim and rubber treads. Most of the original spokes had been severely damaged by termite infestation and were judged to be too weak to be incorporated into the new wheel. A water-based, matte black paint similar to the colour of the original carriage parts was then applied to the teakwood and metal components of the reconstructed wheel.

Figure 6. Detail of the reconstructed section of the upper-tier roof framework

The middle section of the lower-tier roof posed a larger-scale reconstruction challenge. Only fragmentary evidence – about 5% – of the original structure had survived. Like working on a jigsaw puzzle, the conservators pieced together the remaining fragments so as to speculate on the hearse's original construction and design. The sections where the tiers adjoined provided sufficient technical information on the structural joints and decorative detailing and served as a guiding template. New panels of galvanised zinc were attached to the framework and rendered with water-based paint which simulated the oxidised roof's patinated look.

Finally, the missing section of the upper-tier roof was replicated, based on the design and materials of the adjoining tier (Figure 6). All the reconstructed wooden parts were painted with a water-based black paint to match the appearance of the original weathered surface.

The full assembly of the hearse took place for the first time during its installation in the museum gallery (Figure 7). Supported by specially engineered axle stands, the hearse measures 330cm (length) x 170cm (width) x 417cm (height).

conclusion

Encountering numerous technical and logistical challenges during conservation treatment and installation, the conservation team required a flexible approach to ensure the hearse's long-term structural stability for permanent display. Their objective was not to fully restore the hearse to its original condition, but to revive its visual integrity and vitality by retaining its imposing architectural structure and flowing woodcarvings.

1 *The Strait Times*, "Death of Mr. Tan Jiak Kim, C.M.G.," 22 October 1917, p. 10.
2 *The Strait Times*, "The Late Mr. Tan Jiak Kim," 24 October, 1917, sec. Social and Personal, p. 8.

Figure 7. Tan Jiak Kim's hearse assembled, now on display at the National Museum of Singapore

safe to hang – **conserving a set of yao hill tribe paintings**

By Phyllis Koh, Assistant Conservator (Paper)

introduction

A set of 17 ceremonial paintings of the Yao hill tribe were treated as part of a paper conservation project in 2008.[1] The project provided its conservators with the opportunity to undertake investigative research into the paintings' materials as well as the techniques to keep the paintings' multi-layered structure intact. The conservation team also devised a mounting system for the paintings' future display.

The Yao, also known as the Mien, is one of the six major hill tribes in northern Thailand. Originating in China 2,000 years ago, the Yao had migrated southwards to neighbouring countries; they are today found in China, Laos, Myanmar and Thailand.[2] The Yao practise two principal faiths, namely ancestral worship and Chinese Daoism. For the latter, the Yao believe in a celestial hierarchy, also known as the Daoist Pantheon.

The deities of the Daoist Pantheon are illustrated in Yao ceremonial paintings known as Mien Fang.[3] Commonly displayed during religious ceremonies, these paintings are hung vertically in a sacred place. A complete set comprises 17 paintings, a long 'bridge' scroll, four or five small paintings, four or five paper masks, and a ceremonial crown.[4] When not in use, the paintings are carefully rolled in red or white cloth and placed in a special cylindrical rattan basket next to the house altar.[5]

Chinese or Yao painters may take two or more months to complete a full set of paintings. The painter first outlines the figures in black ink, using a master stencil. He then places the stencilled outlines under a piece of handmade bamboo or mulberry bark paper. Guided by the outlines, the painter paints the figures on the top layer with natural or synthetic dyes. When the painting is completed, a third piece of bamboo or mulberry bark paper is added to the back. The top and bottom edges of the painting are each folded around a wooden stick.[6]

Figure 1. [1999-00124] Front and rear views of a Yao hill tribe painting before conservation

condition assessment

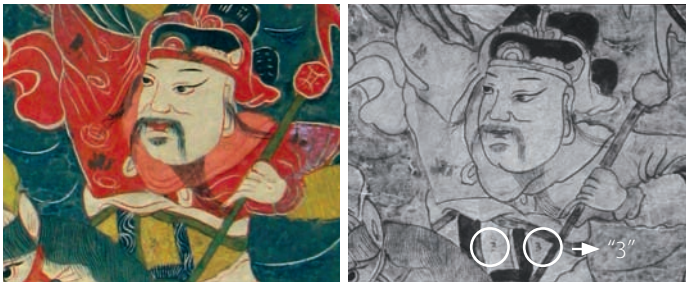
All the 17 pieces were in similar condition, varying only in the extent of damage to the support (Figure 1). Structurally, each painting comprises three layers of paper, each made of two shorter sheets of paper pieced together with a thin overlap of 1–2cm. The three layers are folded to the back and glued down on four sides, with the top and bottom flaps each wrapping around a bamboo stick. This stick was missing from some of the paintings. The frayed cotton cords attached to the sticks on top with knots were also judged to be too weak to support the paintings. Therefore, a new method to hang the paintings without straining or causing stress to the original cords had to be devised.

The surface of the paintings had received treatment to stabilise areas of flaking paint media in an earlier campaign. The paintings' paper support had multiple creases and tears, especially along folded edges, which were the result of frequent use and the practice of rolling and unrolling the paintings for ceremonial occasions (Figures 2 and 3). These were weak points that required stabilisation.

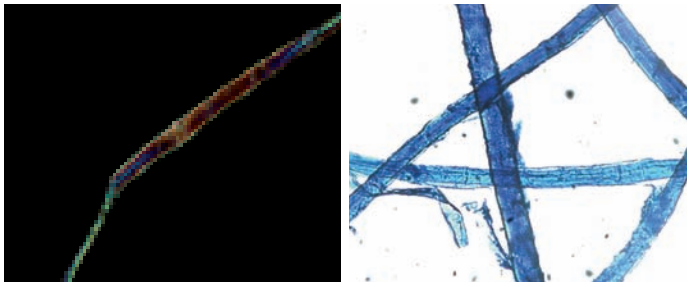
Figures 2 and 3. Typical forms of damage found at the top of the paintings

technical investigation

A variety of analytical methods were used to obtain technical information about the construction of the paintings. Infrared imaging, using a MuSIS MS camera at a spectral range of 1000nm, revealed that in some paintings, parts of the under-drawings (outlines) differ from their corresponding areas on the painted layers. In addition, there are number notations on the under-drawings, which correspond to the application of specific colours (Figures 4 and 5). This suggests that the artists who executed the under-drawings and applied the paint were two different persons.



Figures 4 and 5. Reflected light image (left) and infrared image (right)



Figures 6 and 7. Fibre under polarised light (left) and Toluidine Blue stained fibre (right) under transmitted light

Figure 8. Detail of flattened and repaired flap of the top edge

Polarised light microscopy[7] and micro-chemical testing were used to analyse small loose flakes of the red media. Vermilion as well as a lead-containing substance, such as lead white or red lead, were detected. The type of fibre used for making the paper was found to be bast fibres from the mulberry tree (Figures 6 and 7).

conservation treatment

The first step of the treatment involved surface cleaning the white-painted layer and the back of the painting. This was done by stroking a soft sponge in a single direction on the paper surface, to prevent the paper fibres from ruffling up.

The heavily creased layers at the top and bottom had to be flattened before any mending of tears could be undertaken. A small brush daubed with deionised water introduced small amounts of moisture into the folds to prevent the paper from disintegrating. Paper blotters were placed between the layers as they were unfolded from the bottom up, in order to prevent dirt from transferring to the other paper layers.

Subsequently, weights were used to flatten the unrolled areas. Once the layers had been flattened, the holes and tears were repaired with wheat starch paste and toned Japanese paper. This technique was used to reduce any visual discrepancy due to juxtaposing Japanese paper with the original paper support (Figure 8).

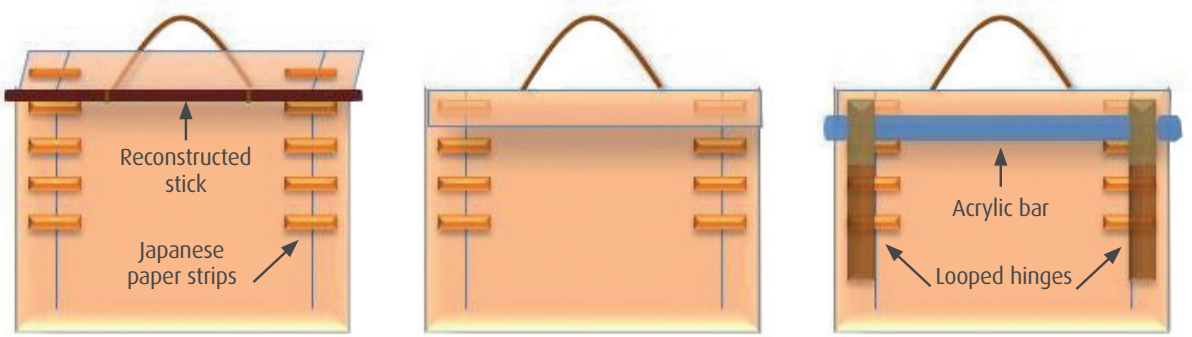
For paintings that were missing an upper or lower bamboo stick, new sticks were constructed using archival-grade conservation materials. Japanese paper was wrapped around a 2mm-thick conservation matt board, adhered with wheat starch paste, until the desired thickness, similar to that of the original stick, was achieved. For the cord, Japanese paper of a similar colour was mixed with wheat starch paste and twisted. Once ready, the cord was threaded through the original holes, looped around a stick and tied with a square knot at the top of the fold.

mounting

The development of a mounting system for hanging the paintings without stressing the frayed cord and paper support proved to be the most challenging part of the project. Several methods were evaluated before a suitable system was successfully tested and approved.

A mounting system, comprising two looped hinges placed on the top left and right folded edges of the painting, was devised. This system involves slotting an acrylic bar through the loops. As the bar can be mounted separately onto a wall or suspended within a showcase, the system also effectively transfers the weight of the painting from the original cord to a physically stronger area of support. The cord simply rests on a small pin, providing the illusion that it is supporting the painting.

Strips of Japanese tissue paper were applied to the upper right and left edges to reinforce the folded edges. Once the reinforcement strips were adhered (Figures 9 and 10), the top flap was folded down to cover the stick. Japanese paper strips and wheat starch paste were used to hold the flap down.



Figures 9 and 10. The photographs show the back of the painting with the reconstructed stick, Japanese paper strips and looped hinges

Figures 11 and 12. Diagrams of the construction of the looped hinges

Figures 13 and 14. [1999-00130] Front and rear views of a Yao hill tribe painting after conservation

To ensure the looped hinges were strong enough, they were constructed with two layers of material. A thin linen fabric was pasted on Japanese paper using wheat starch paste. Strips of this double-layered material, with the paper side facing outwards, were looped and secured with adhesive. The looped hinges were then pasted on the left and right edges on the backs of the paintings (Figures 11 and 12).

conclusion

Having undergone the conservation treatment, the Yao hill tribe ceremonial paintings have received a new lease of life. They are now aesthetically pleasing, and, strengthened with better support and mounting, they are also ready for future display (Figures 13 and 14). The conservation project also highlighted the value of analytical research on the manufacturing techniques of such a unique group of artefacts.

1 Konstanze Bachmann, Senior Conservator, and Erin Jue, Intern, were instrumental to the research, technical analysis and conservation treatment in this project.
2 Edward F. Anderson, *Plants and People of the Golden Triangle: Ethnobotany of the Hill Tribes of Northern Thailand* (Oregon: Dioscorides Press, 1993), 29; Paul and Elaine Lewis, *Peoples of the Golden Triangle: Six Tribes in Thailand* (London: Thames and Hudson, 1984), 9; Technical Service Club: Tribal Museum, *The Hill Tribes of Thailand* (Chiang Mai: Tribal Research Institute, 2004), 25.
3 Jess G. Pourret, *The Yao: The Mien and Mun Yao in China, Vietnam, Laos and Thailand* (London: Thames and Hudson, 2002), 215; Lewis, *Peoples of the Golden Triangle*, 159.
4 Pourret, *The Yao*, 215–17.
5 Ibid., 215.
6 Ibid., 215–17.
7 Polarised microscopy is usually used by geologists to examine crystal structures. The microscope is fitted with a polariser that alters the light to travel in only one direction.

binding to last – **conserving *the people of india***

By Tay Jam Meng, Senior Conservation Officer (Paper)

introduction

The People of India Vol. 8 (Figure 1) was acquired by the National Museum of Singapore in 2001. Originally part of an eight-volume set, the publication was inspired by the photographic interest of Lord and Lady Canning[1], "who wished to make a collection of photographic illustrations, which might recall to their memories the peculiarities of Indian life..."[2]. *The People of India* began as a personal project, but as the volumes of albumen prints increased, Lord Canning "felt that its importance was sufficient to warrant official sanction and development"[3]. The volumes were consequently published in book form between 1868 and 1875 for the India Museum in London, which is now part of the Victoria and Albert Museum. The majority of the photographs were taken by military photographers who were stationed in India during the British Raj.

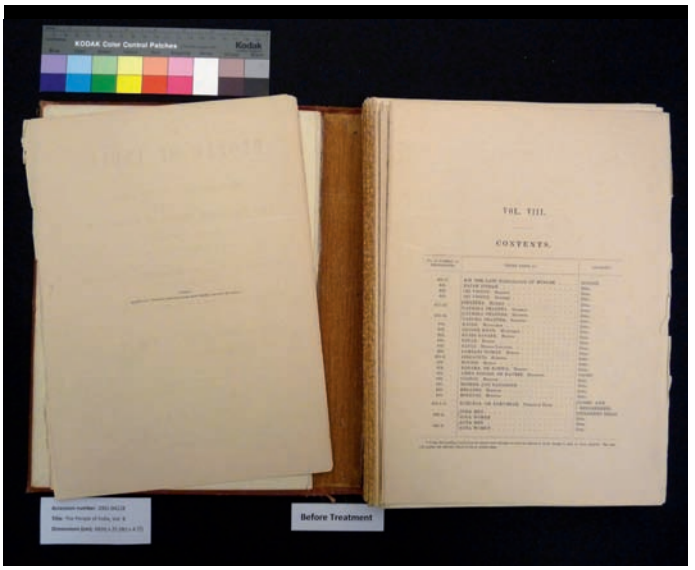


Figure 1. [2001-04428] The front cover and text block of *The People of India Vol.8,* before treatment

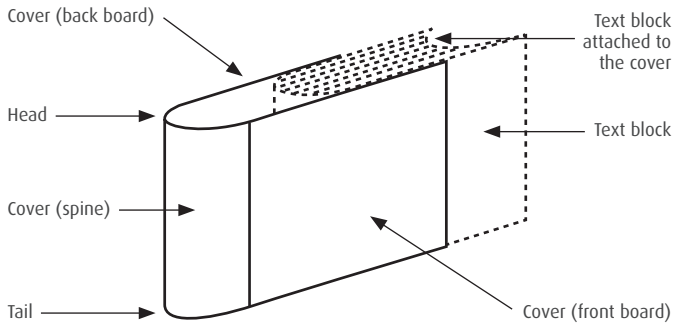


Figure 2. A diagram showing the cover and its text block

technical description

Invented by Louis Desire Blanquart-Evrard in 1850, albumen prints[4] were a very popular source of photographic illustration during the second half of the 19th century. The paper support of an albumen print is very thin and has a tendency to curl along its edges. Therefore, it is normally mounted on a piece of heavier-weight paper or cardboard. The text block of *The People of India* contains papers of two different thickness. The pages on which the albumen prints are adhered are thicker than those that are printed with text. The text block [34cm (length) x 25cm (width) x 4cm (height)] contains 63 albumen prints numbered from plate 406 to 468. The prints are published in a dome, oval or rectangular format.


Figures 3 and 4. Albumen prints with faded and yellowish edges

The book is made up of two parts: the book cover and the text block (Figure 2). The cover is a case comprising a front board, back board, spine and book cloth. The decorative motif on the book cloth cover is gold- and blind-stamped. The text block is the main block, including the end sheets and spine linings, which are bound together and attached to the cover.[5] The pages of the text block are made of wood pulp fibres that have been attached to the case with a protein-based adhesive. This type of adhesive binding method, called cased-in, was introduced to book binding between 1825 and 1830.

general condition

The text block was completely detached from the cover, and individual pages within the block were also separated (Figure 1). This was due to the structural failure of the book's adhesive binding and years of handling. Evidence of physical abrasion, fraying, losses and stains was also found on the cloth cover. The title page of the text block had tears and losses along its edges, while foxing spots were noted on some of the other pages. Some of the edges of the albumen prints were observed to have faded and yellowed (Figures 3 and 4). This type of chemical degradation was a result of moisture migration from the exposed edges of the text block to the albumen prints.

Figure 5. Consolidating the spine in the book press

conservation treatment

text block

Consultation between curatorial and conservation colleagues identified a series of treatment priorities to restore the book's structural stability against the rigours of handling and display. Firstly, the detached text-block pages were checked to ensure their correct sequence. They were then carefully aligned as a text block and securely sandwiched within a book press. The front and back end papers, which are the sheets of paper pasted onto the inner covers to join the text block to the front and back covers[6], were attached to the main text block with Japanese paper and wheat starch paste. When the end papers had dried, the text block's entire spine was consolidated with a mixture of two adhesives: wheat starch paste and polyvinyl acetate, applied with a brush (Figure 5). Each of the adhesives – wheat starch paste; polyvinyl acetate; and a mixture of wheat starch paste and polyvinyl acetate in equal proportions – had been tested to determine its suitability for use in terms of strength and viscosity.

An adhesive was previously used to attach the spine to its case; there was no evidence of a sewn binding. Despite doubts about its long-term durability, an adhesive system was proposed as part of the book's conservation treatment so as to retain the material integrity of the original binding method. Two options were evaluated:

- The use of an appropriate adhesive to reattach the text block to the cover, replicating the book's original method of construction. This option would rely on a uniform distribution of adhesive between the text block spine and the case. However, it was not certain whether there was sufficient contact coverage between the two elements to form an adequate adhesive bond, especially if the binding was flexed or frequently opened.
- The addition of a flexible cord material to act as a connecting bridge across the spine to supplement the adhesive treatment outlined in the first option. This was viewed to be the most satisfactory method to meet the book's long-term preservation requirements.

A series of small grooves were created across the spine with a file (Figure 6). Into each of the grooves a length of cord was inserted, flush with the spine's curved surface. After the cords were attached (Figure 7), Japanese paper was applied on the spine along the text block's length.

Figure 6. Sawing the groove

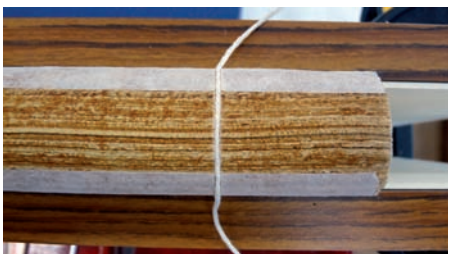


Figure 7. The cotton cord fitted into the groove

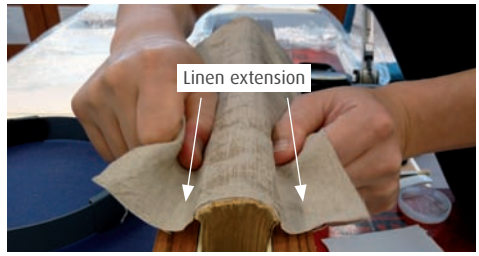


Figure 8. Linen extension adhered on the spine

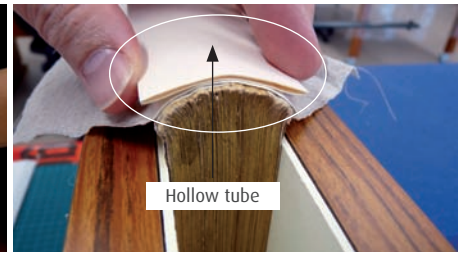


Figure 9. Adhering the hollow tube

An extension material of washed linen fabric was then applied on the spine (Figure 8), followed by a 'hollow tube' on top (Figure 9). Providing flexibility to the spine, the hollow tube would allow the book to be opened more easily. The tube was made of European handmade paper that had been folded twice to the same width as the spine. After adhering the hollow tube to the spine, the text block was ready to be reattached to the cover.

cover

The book cloth was surface cleaned with a soft and finely textured latex sponge. The areas of gold stamping were avoided as much as possible because of their delicate surface. The head and tail (Figures 2 and 10) had suffered minor structural losses and were generally in a weak condition. They were lifted open with a scalpel knife and repaired with toned Japanese paper. A cotton cord was adhered along their edges (Figure 11), and the head and tail were folded back (Figure 12). After this treatment, the structure of the head and tail improved significantly. They were also in-painted with chalk pastel that matched the book cloth's colour.

Figure 10. Close-up of the tail

Figure 11. A cotton cord adhered along the edge

Figures 12 and 13. After drying, the tail was folded back

reattachment

For the reattachment, the end papers of the case (front and back boards) were opened with a lifting knife and lifted to a depth of about 3cm to provide sufficient space for the insertion of the linen extension. The text block was aligned with the case, and its linen extension was applied with wheat starch paste, inserted and pasted on the cover board (Figure 14). Once dried, the lifted end papers were also pasted down to complete the conservation treatment.

conclusion

With the book's functionality restored, it can now lend itself to museum display or be handled by a researcher (Figures 15 and 16). Preventive conservation, with an improved storage method which minimises the risk of physical or surface damage caused by handling, also plays an important role. A custom-made clam-shell box has thus been fabricated for the book's storage, ensuring that it can continue illustrating the life and times of 19th-century India.

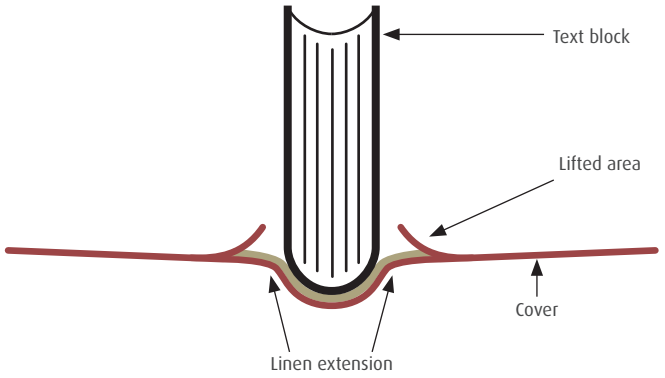


Figure 14. A diagram showing the reattachment

Figure 15. The book partly open (after treatment)

Figure 16. Side view of the book cover (after treatment)

1 Lord Charles John Canning was the Governor-General of India from 1855 to 1862. Lady Canning was the patron of the Photographic Society of Bengal.
2 John Falconer, *India: Pioneering Photographers 1850–1900* (London: The British Library, 2001), 23.
3 Ibid., 23.
4 An albumen print (1850–1920) was made by coating a solution of egg white on a piece of thin and fine Western-made paper. The albumen bound the photographic chemicals to the paper and was a major photography form from 1855 to 1895.
5 University of Florida George A. Smathers Libraries, "Glossary of Binding Terms," http://www.uflib.ufl.edu/preserve/binding/glossary.htm
6 The National Preservation Office, "Preservation Policies: Glossary," http://www.bl.uk/blpac/pdf/glossary.pdf

beads and threads – conserving a flores ikat tube skirt

By Miki Komatsu, Conservator (Textiles)

introduction

This article describes the conservation treatment and mounting of a rare Flores ikat tube skirt known as a *lawo butu* (Figure 1). Dated from between the late 18th and early 19th centuries, the textile originates from the Ngadha people of Flores, Indonesia. The skirts were worn by women during important ceremonial occasions, such as the consecration of a recently felled tree for the building of a clan house. The antique beads used to decorate these cloths were often treasured heirlooms, and only wealthy individuals could afford to have such a textile woven. Individual textiles were named after the person who had made the commission; the skirts are thus also known as *lawo ngaza* or 'named sarong'.

The skirts are generally considered to be extremely rare and the most important examples of Flores textiles.[1]

Figure 1. [2006-00205] The Flores ikat tube skirt before treatment [78cm (width) x 162cm (length)]

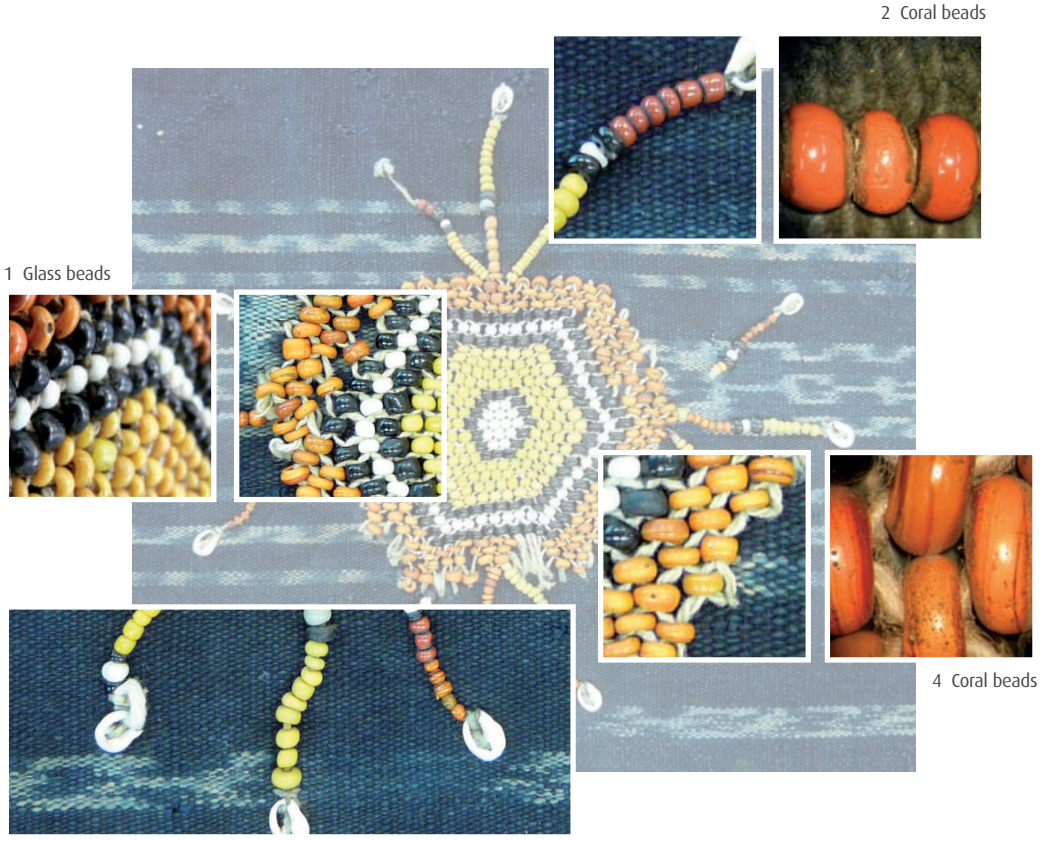


Figure 2. Various types of beads used

The tube skirt consists of two pieces of a full-width navy warp ikat. The pieces are joined together at the selvedge horizontally and made into a tube with hand-stitching down the centre of the rear side. The textile is made with handspun cotton and natural dyes, most probably indigo. The navy cotton is warp-faced plain weave, whose weft units pass alternately over and under successive warp units. The warp units outnumber the weft units; therefore the fabric can be described as having a predominant warp, and the white band pattern was created with a pre-designed warp. The lower front half of the skirt is embellished with imported glass and locally made coral beads and shells (Figure 2).

condition

Overall the textile was structurally quite poor. The ground fabric (navy warp ikat) had evidence of soiling throughout its weave and areas of staining at both the top and bottom ends of the tube construction. A number of creases were noted and small holes had probably resulted from insect damage. There were also losses at the top and bottom edges, and the right side of the skirt showed evidence of fading. There were some beads missing from the beadwork, which was also detached from the ground fabric and had loose threads and deteriorated glass beads (notably the yellow, black and pale green ones). There was also evidence of a previous repair with navy thread, used to stitch loose beads to the ground fabric.

Figure 3. Detail of glass beads before cleaning

Figure 4. Detail of glass beads after cleaning

conservation treatment

After documentation, the skirt was surface cleaned with a low-powered museum vacuum with a nylon net screen and soft brushes. The accumulation of dust and insects from previous storage and display environments was not considered to have any social or historical value. Therefore, it was mechanically removed, so as to reduce the likelihood of acidification and minor structural abrasion to the textile.

The surfaces of the coloured glass beads were disfigured by an unidentified surface deposit. A pH test on these surfaces revealed a high level of alkalinity (pH9). This alkaline condition suggested that alkali, a major component of the glass, had leached out and caused a cloudy appearance to form. The condition posed the risk of causing damage to the cotton ground fabric and the beadwork's core thread, as cotton is vulnerable to alkaline. Therefore, a decision was taken to clean the beads with deionised water and cotton buds. The gentle aqueous treatment lowered the pH value of the glass to a neutral level and removed unsightly dirt accumulation (Figures 3 and 4).

The beadwork contained a number of loose threads, which made it vulnerable to handling and further loss of beads (Figure 5). Each thread was stitched back into its original location with pulled polyester Stabiltex™ thread (Figure 6). The treatment greatly enhanced the aesthetic integrity of the textile and the iconography of its beadwork.

Figure 5. Loose beadwork before treatment. The original design of the beadwork could not be recognised

Figure 6. Beadwork after stitching to reconstruct the original design. This represents the octopus (*kubi*), an important symbol for Flores people

The fragile and frayed edges of the textile required protection from further structural deterioration (Figure 7). An overlay of polyester Stabiltex™ fabric was used to neatly encase the vulnerable edges (Figure 8).

The areas of the textile that had suffered structural deterioration with the formation of holes (Figure 9) were treated with a supporting colour-matched cotton underlay (Figure 10).

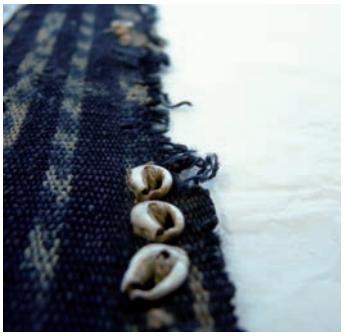


Figure 7. Close-up of bottom edge showing areas of fraying and loss (before treatment)

Figure 8. Close-up of bottom with with Stabiltex™ polyester fabric (after treatment)

full support

After the completion of a series of patch supports, the tube skirt was lined with Stabiltex™. Two layers of the polyester fabric were joined to make a tubular support. The two edges of the fabric were stitched with Skala™, a polyester thread, and then hot-melt cut together, producing a fused seam[2] (Figure 11). The polyester support was then inserted into the skirt, using the seam lines on both sides as a guide for alignment (Figure 12). Two rollers wrapped with polyester film Melinex® were used to support the folds and give a shape to the skirt. The tube-shaped polyester lining was supported along the length of the roller during the process of herringbone stitching (Figure 13). The use of the roller as a support and barrier beneath the textile helped to prevent any accidental stitching through to the layer below. After the attachment of the full lining, small holes and minor areas of loss were secured to the polyester fabric by laid-couching stitches, which gave additional support to these potentially vulnerable areas.

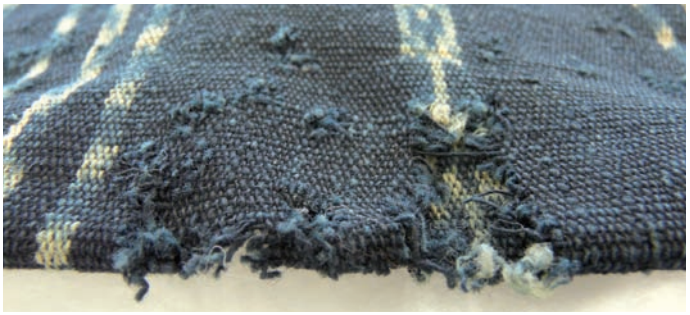


Figure 9. Holes and losses probably due to insect damage (before treatment)

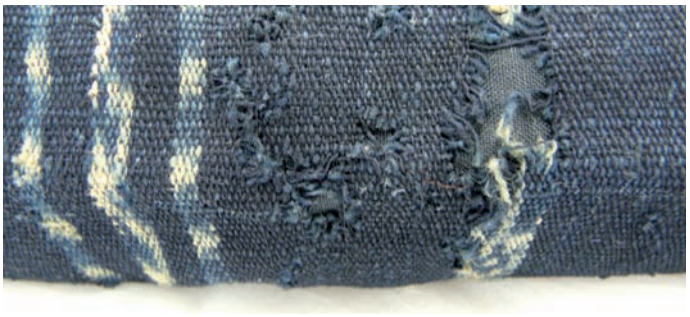
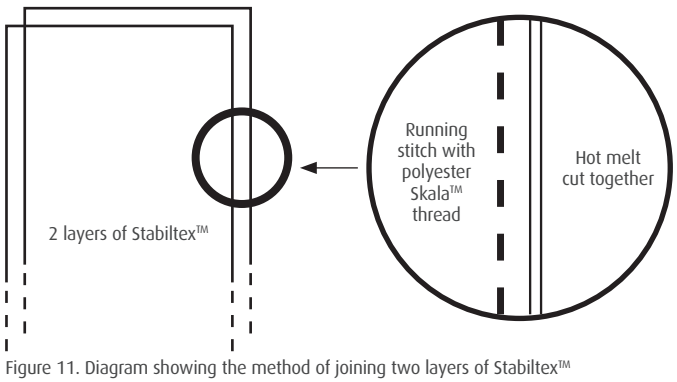


Figure 10. Patch support – underlay was stitched with laid couching (after treatment)



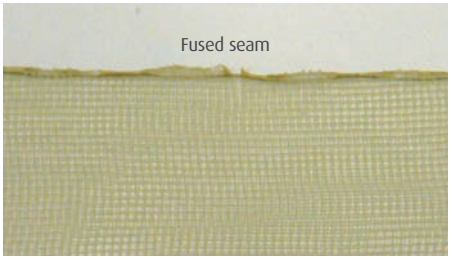


Figure 11. Diagram showing the method of joining two layers of Stabiltex™

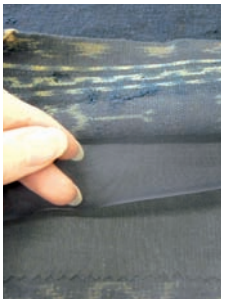


Figure 12. Tubular Stabiltex™ support inserted in the skirt

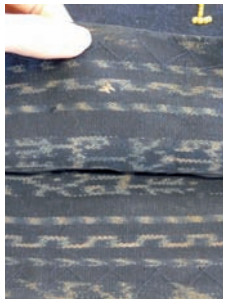


Figure 13. Top and bottom sides of the lining were attached by herringbone stitch

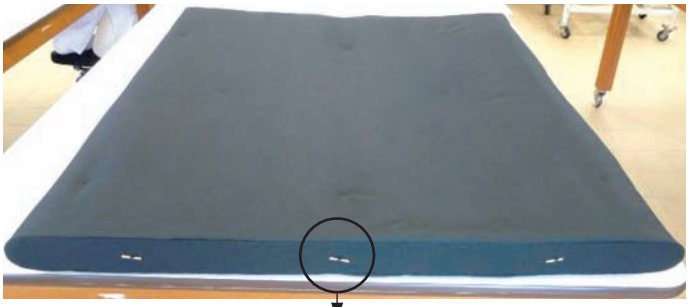


Figure 14. Mount for the tube skirt

Close-up: a fabric-made loop for suspension point

mounting

A soft sculpture made of polyester wadding and wrapped with cotton calico fabric, with a rigid board at the top, was prepared for hanging display. This soft sculpture was made to fit to the internal dimensions of the tube skirt so that it could provide soft cushioning to the textile as well as a shaped form. Three loops were attached as suspension points (Figure 14). The tube skirt was then mounted on the soft sculpture with three rows of stitches. The stitching also helped to distribute the weight of the beadwork at the lower part of the skirt and provided an even contact between the support and the skirt.

conclusion

The conservation treatment and the method of mounting achieved the goals of structural stabilisation and support. This has enabled the tube skirt to be displayed in a hung position that is more contextual to its form (Figures 15 and 16). The treatment process also helped to chemically stabilise the glass beads, and a series of stitching repairs sharpened their unique designs.

Figure 15. Overall (obverse): The tube skirt is mounted on soft sculpture after treatment

Figure 16. Overall (reverse): After treatment

1 Roy W. Hamilton, ed., *Gift of the Cotton Maiden: Textiles of the Flores and Solor Islands* (Los Angeles: University of California Los Angeles, Fowler, 1994), 108–9.

2 Fonda G. Thomsen, "Hot Melting Cutting of Stabiltex", *Journal of the American Institute for Conservation* 27, no. 1 (spring 1998): 32–37.

weighing the risks – textile wet-cleaning techniques for *wayang golek* puppets

By Miki Komatsu, Conservator (Textiles)[1]

introduction

Wayang, the Indonesian word for "theatre" – literally "shadow" – is also commonly used to refer to puppet performance. *Wayang golek* are wooden doll puppets, each operated from below, with rods connected to the puppet's hands as well as a central control rod that runs through the body to the head.[2] The five Balinese puppets illustrated and described in this article date from the early 20th century. They were selected for an exhibition and each required a series of interventive conservation treatments to stabilise the condition of its textile parts in preparation for museum display (Figures 1–5).

Figure 1. [XXXX-5628] Draupadi (before treatment)

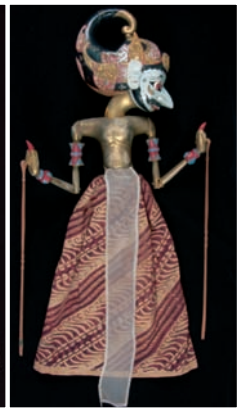


Figure 2. [XXXX-5630] Bima (before treatment)

Figure 3. [XXXX-5627] Samiadji (before treatment)

Figure 4. [XXXX-5634] Arjuna (before treatment)

Figure 5. [XXXX-5631] Abimanyu (before treatment)

description

Each of the five *wayang* puppets features a traditional carved wooden head, which can be detached from its body. The torso and arms are joined together with cotton cord at the shoulders and elbows to facilitate movement. Visible areas of the wooden puppet parts are decorated with colour paints, most notably gold and white. The puppets are dressed in skirts made of block-printed cotton that are tubular in shape (Figure 6) and waistbands with golden metal thread stitched at the front (Figure 7). In addition, the puppet Draupadi wears a black top (Figures 1, 8 and 9) while the other four puppets are each fitted with a narrow white apron (Figure 6).

The overall condition of the block-printed cotton skirts was found to be poor. There was evidence of discolouration on all the skirts, in the form of soiling stains, general yellowing and a random scattering of small white stains. Large areas of couched repair stitching were also present (Figures 10 and 11). The narrow white aprons suffered similar surface disfigurement with areas of ingrained grey or brown soiling. The stitching on the waistbands had also been replaced and enlarged with a beige repair thread.

Figure 6. Tubular skirt and white apron

Figure 7. Waistband with metal thread, stitched at centre front

Figure 8. Black top on Draupadi

Figure 9. Waistband on Draupadi

Figure 10. Previous repair with laid couching on Bima

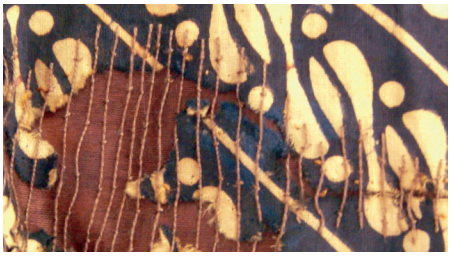


Figure 11. Previous patch repair with laid couching on Arjuna

conservation treatment

Photographic and written documentation was undertaken to record the puppets' conditions, before commencing on a series of physical and chemical interventions, which were devised to restore the textiles' former colouration and flexibility.

Firstly, the skirts, waistbands and the black top on Draupadi were surface cleaned with low-powered vacuum suction and a soft brush. The textile parts were then removed for easier access to the puppets' various component parts and more detailed examination of the gathered waist areas (Figures 12 and 13). The stitching in this area was identified to be from a previous repair and thus was not considered to be of significant historical value to warrant its preservation, as compared to the benefits from their removal and subsequent treatment of the deteriorated textile parts.

The puppet Abimanyu (Figure 5) was the only one whose original method and materials of construction were retained. Therefore, a decision was taken, in consultation with curatorial colleagues, not to disassemble this puppet and to carry out only minimum interventive treatment.

Figure 12. Skirt and apron that are removed from Samiadji (Figure 3)

Figure 13. Draupadi's black top removed, revealing the skirt and gathering thread

Figure 14. Removed skirts placed in plastic trays

Figure 15. Wet cleaning with 2% Hostapon anionic surfactant and sodium carboxymethyl cellulose

Figure 16. First washing solution: pH5.5–6.0

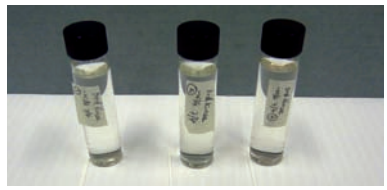


Figure 17. Last rinsing solution: pH6.5–7.0

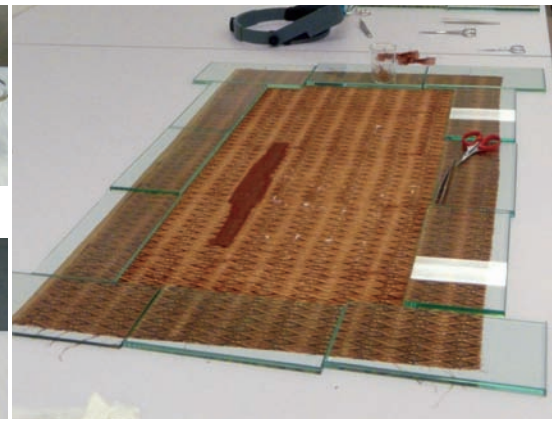


Figure 18. Drying on the table with glass weights

wet cleaning

The aesthetic appearance of the skirts and aprons was considerably impaired by a yellow discolouration caused by soiling. The presence of acidic material had resulted in chemical oxidation and structural deterioration, including fibre degradation. The combination of soiling and acidity had also stiffened and embrittled the textiles, a condition that restricted certain physical interventions such as stitching.

In this instance, the accumulation of dirt and degradation products was evaluated as being of no historical significance. A programme of wet cleaning was undertaken to reduce and remove the acidic contaminants for the the puppets' long-term preservation. Areas of loose soiling were removed through standard vacuum-cleaning techniques. However, this form of mechanical surface cleaning did not remove the soils deeply ingrained in the weave structure between the dry fibres. A critical advantage of wet cleaning is that it penetrates the structure of the textile, reducing the level of acidity and brightening the overall appearance by removing water-soluble substances. It can also enhance the pliability of the textile fibres, thus enabling a safer treatment. A potential risk of water-based cleaning systems is that they can cause water-soluble dyes within the textiles to bleed. Therefore, a wash-fastness test was conducted to determine the safety of the treatment on each of the different colourants.

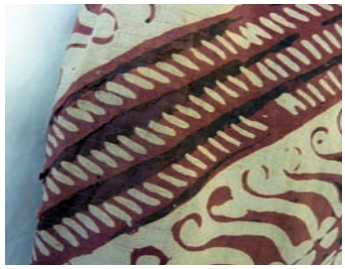


Figure 19. Laid-couching stitches on the areas of loss on Bima

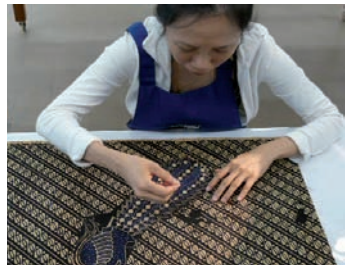


Figure 20. Patch support on Arjuna

The skirts and aprons, supported with Myler sheets, were spread out and wet cleaned in appropriately sized plastic trays (Figure 14). Each item was washed twice with a 2% solution of Hostapon (anionic surfactant, CMC: 0.04383%) and 0.5g/l sodium carboxymethyl cellulose (CMC: soil suspension agent) before being rinsed three or four times with water (Figure 15). The first wash coloured the water brown-grey, resulting in an acidity of pH5.5–6, which highlighted the release of soluble acid from the textiles (Figure 16). The final rinse recorded a higher pH of 6.5–7 (Figure 17). After treatment the skirts and aprons were blotted with towels and then weighted to dry, face down (Figure 18).

Figure 21. Draupadi
(after treatment)

Figure 22. Bima
(after treatment)

Figure 23. Samiadji
(after treatment)

Figure 24. Abimanyu
(after treatment)

full support

The seams of the skirts were unpicked after wet cleaning and previous repairs with crude stitches were removed to minimise any potential risk of structural tension between the textile fibres. The decision to replace the crude stitches was also influenced by aesthetic considerations. The skirts were then lined with a dyed cotton fabric and couch stitching was applied to support areas of structural weakness (Figure 19). An additional system of grid stitching also provided structural support to the textile. Arjuna was given a patch support instead of a full support, as there was only a small area that required treatment (Figure 20).

reassembly

With full support provided to most of the skirts, they could now be reassembled. The seams were first rejoined by stitches threaded through the original stitch holes. Thereafter, the skirt waists were gathered, also with stitches running through the existing holes. The skirts were then put on their respective puppets, held by thread wrapped around the waist twice and secured by stitching. The seam of each skirt was positioned centrally on the rear side of the puppet, whilst the narrow aprons were stitched on the reverse side of the front waist gathering. Waistbands were also stitched at the centre front.

conclusion

The conditions of the skirts, waistbands and the black top on Draupadi were improved and stabilised considerably (Figures 21–24). Wet cleaning has removed water-soluble dirt and reduced the level of acidity in the textiles. The skirts have also become softer with the partial return of the fibres' natural flexible properties.

Such intervention, however, is not always appropriate for all categories of textiles because of the potential risk of removing historical evidence in the form of ingrained soils and stains (e.g. blood). The decision to use this interventive method is one that requires both conservation and curatorial inputs so as to assess the risks and aesthetic outcomes of such a course of action.

1 The conservation treatment for this project was undertaken by Jacinta Loh Boon Nee, Conservator (Textiles); Elsie Wong, Conservator (Textiles); and Poppy Singer and Louise Squire (HCC Fellows).

2 Keith Rawlings, "Scenic Shades," in *Observation on the Historical Development of Puppetry*, http://www.sagecraft.com/puppetry/definitions/historical/chapter2.html.

safe materials save – an alternative 3-in-1 methodology for accelerated corrosion testing for materials

By Jacinta Loh Boon Nee, Conservator (Textiles)

introduction

The use of safe materials for storage and display is important, for they can prevent or minimise pollution damage and thus reduce the risk of artefact deterioration.

In 1997, the British Museum's methodology of accelerated corrosion testing (ACT) for materials[1] (Figure 1) was set up at the Heritage Conservation Centre (HCC). It then became one of a series of essential preventive conservation measures that were routinely carried out. Other measures include integrated pest management and environmental monitoring. In the ACT protocol, the material that is being tested is put in three sealed glass tubes, each with a different metal coupon, namely copper, lead and silver, and incubated at 60°C and 100% relative humidity for 28 days. At the end of the incubation period, the extent of corrosion on these metals is then used for assessing the suitability of the tested material (Figure 2).

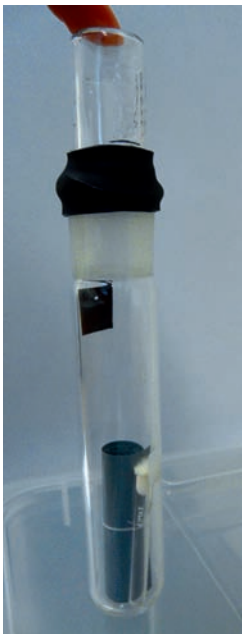


Figure 1. British Museum's ACT with one metal coupon per test tube

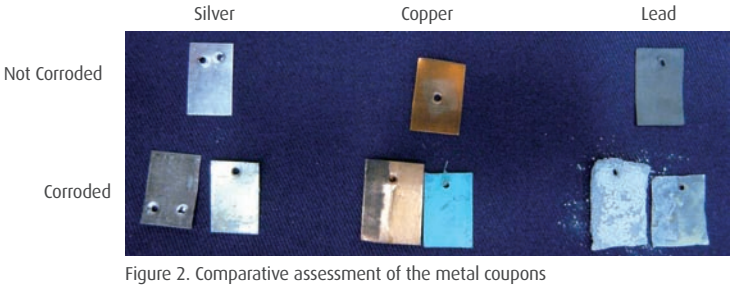


Figure 2. Comparative assessment of the metal coupons

Figure 3. Preparation of the metal coupons in a fume cupboard

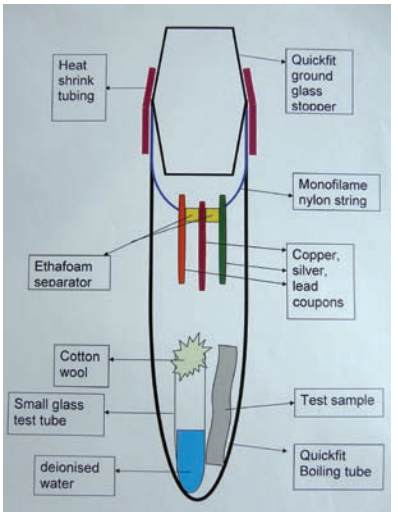


Figure 4. HCC's 3-in-1 set-up

A wide range of materials that form the primary components of displays and/or storage enclosures are tested. The material could be a paint, coating, adhesive, textile fabric, wood or polymer. It may also be a new material that is being considered for use in a conservation treatment. Each material is tested because of the potentially damaging volatile organic compounds (VOCs) that they may contain. VOCs corrode metal artefacts, weaken textiles and paper fibres, and change the colours of artefacts.

Selecting a material that is safe for artefacts is a norm in the museum world. However, the process of materials testing can be both costly and time-consuming. The test can take at least five days to be set up. It is also manually intensive (Figure 3), with each material requiring three set-ups and the results being known only after a long period of 28 days. The number of tests that can fit into the incubator is also limited.

accelerated corrosion testing (ACT)

Although ACT has undergone several improvements since it was first introduced[2], it was the development of a streamlined 3-in-1 method at HCC that prompted a reappraisal of its protocol.

HCC's version features a two-phase test. The first phase is a selective introductory phase that prioritises suitable materials for testing. It effectively filters out inherently unstable materials by means of a dual-function spot test, which determines the materials' pH level and water fastness, both of which are important criteria not provided by ACT.

Materials that pass Phase 1 are put through Phase 2, which uses the 3-in-1 method. This method differs from the protocols of other types of ACTs in two main aspects. Firstly, the three metal coupons of copper, silver and lead are strung in the same test tube on a nylon line, separated by small pieces of archival Ethafoam (Figure 4). This creates a 3-in-1 system, that is, three metal coupons in one test tube. The other difference is that the test tubes stand upright in autoclavable tube racks in the incubation oven. This essentially keeps the metal coupons away from the test tube's glass walls and eliminates the risk of accidental corrosion caused by condensation on the glass on the metal coupons.

Figure 5. Sample result sheet distributed to NHB Museums

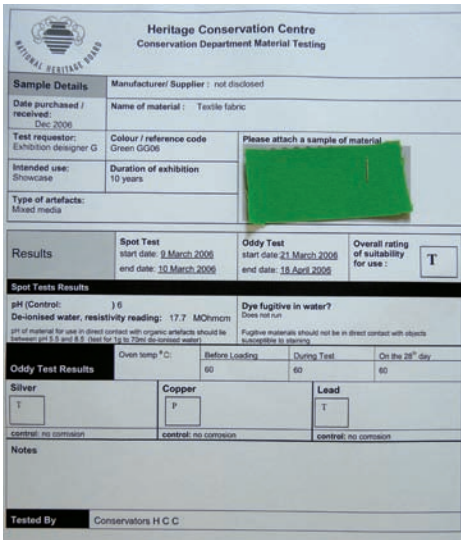


Figure 6. Data record of material testing

conclusion

This was a rewarding project on several fronts. With the new ACT protocol, conservators are now able to test three times as many materials as before. This maximises the conservators' time and the expended utilities. For example, the incubator that runs for the 28 days can now house three times more samples. The new protocol has also helped reduce manpower and energy demands, thus ultimately improving work efficiency and promoting greener practices.

Previously, there was a dependence on expensive imported materials from overseas. Since the improved ACT protocol was established in 2006, HCC has tested over 300 locally available fabrics and paints, thus increasing the availability and range of local materials for conservators, museum designers and curators (Figure 5 and 6). This method has expanded the material resource library considerably in a short period of time.

1 Lorna R. Lee and David Thickett, *Selection of Materials for the Storage or Display of Museum Objects*, British Museum Occasional Paper 111 (London: British Museum Press, 1996), 24–26.

2 Joseph Bamberger, "The Oddy Test Improved," *Met Objectives* 4, no. 2 (spring 2003), http://www.metmuseum.org/Works_of_Art/objects_conservation/spring_2003/oddy.asp; Laurianne Robinet and David Thickett, "A New Methodology for Accelerated Corrosion Testing," *Studies in Conservation* 48, no. 4 (2003): 263–68; Gregory Dale Smith and Colleen Snyder, "Something Odd about the Oddy Test" (poster presented at the International Council of Museums – Committee for Conservation 15th Triennial Conference, New Delhi, 2008).

from analogue to digital – **adopting technology for artefact imaging**

By Chong Yu Ting, Manager (Visual Resources)

introduction

In 2000, the Heritage Conservation Centre (HCC) embarked on a project to transform its visual documentation process for artefacts. Advances in technology and a timely provision of funds enabled the Centre to adopt digital photography and replace an antiquated system with one that could meet new needs. The majority of the museums' collections had been centralised at HCC, which is located a considerable physical distance from the museums. To enable the museum curators to access the artefact images and records easily, a more accessible system was necessary. The project's primary objectives were to devise a faster and more efficient method of capturing, processing and housing images of the collections as well as to facilitate virtual access to them.

There is no change to how the artefacts are set up, whether for film or digital photography. A collections officer continues to arrange for the retrieval and handling of the artefacts while a skilled photographer is to set up proper lighting for the photography. The differences are in the equipment used and the subsequent work processes.

pre-digitisation: analogue photography workflow

For the film photography method, up to three analogue cameras would be loaded with different types of film. The first was loaded with 35mm colour slide film; the second with 35mm black and white negative film; and if the artefact was part of the Asian Civilisations Museum's (ACM) collection, a third camera was loaded with 35mm colour negative film.

The three types of films each served a different purpose. The slides were used for publication, colour photo printing and presentations. The black and white films were used to make prints to be affixed to object record forms as the artefacts' primary photo identification. The colour negative films were used to make 4R-sized prints as reference material for ACM's curators.

The slide and colour negative films were sent to external vendors to be processed and printed. The collections officer who arranged for the photo shoot would painstakingly sort the processed slides and prints and label them with the artefacts' accession numbers. There were two sets of slides – one master and one spare. The labelled slides were then stored in archival sleeves and housed in dry cabinets.

The photographer manually processed and printed the black and white films in-house. After numbering the negatives and writing a reference number on the back of each print, he would file the negatives and store them in dry cabinets. The collections officer would then paste the prints on the hard copies of the object record forms.

This method of processing and managing the various formats of film was cumbersome. It entailed tedious manual work for staff after actual photography and a prolonged production time for the images. Very often, there was also a time lag before the images were made available as the films had to be processed and catalogued by both external and HCC staff. The photographer also had to carry out the photography as well as develop the black and white prints. Access to the images and records was restricted as the slides and object record forms could not be widely distributed. If the museum staff needed to refer to the images or records, they would have to make their way to HCC or arrange for copies to be sent from HCC. Records also suffered wear and tear as a result of handling.

Figure 1. Photographer reviewing artefact images on a PC monitor

digitisation: digital capture

With digital capture, instead of two or three analogue film cameras, only one digital SLR camera and a computer are used. The photographer reviews the images immediately on a colour-calibrated computer monitor after the shutter is triggered (Figure 1). The computer monitor needs to be colour calibrated because the photographer depends on it to judge all aspects of the images, including colours. If colours are calibrated according to a reproducible standard, another similarly calibrated monitor will be able to display the images with the same colours. More importantly, for publishing purposes, this will help ensure that the colours of the printed digital images can be as close to those of the original artefacts as possible.

Another advantage of digital capture is the easier white balancing of images. If proper white balancing is achieved, there will be no colour shifts in the images; something that is white will appear white in the image without any other colour cast. With analogue photography, the film type has to be balanced with the colour temperature of the light sources and any variations have to be adjusted for with the use of colour filters or gels, either over the light sources or the camera lens. The results cannot be seen instantly; this means that if a miscalculation is made, the artefact will have to be photographed again.

Once a proper digital image of the artefact is made, it is immediately saved with its accession number as its filename. This ensures there is no subsequent confusion over the artefact's identification. At the end of the photography session, the images are batch-processed to TIFF and JPEG formats. The TIFF images are uncompressed and open format, serving as archival master copies. Derivatives for distribution, like JPEGs, are created from these master copies. The JPEGs can also be printed directly on object record forms.

digitisation: conversion of analogue colour slides to digital format

The project also included the conversion of artefact images that were already on colour slides to digital format. Even though this was not the most ideal digitisation method, it was carried out so as to speed up digitisation and facilitate image and data access quickly without the need for additional artefact retrieval and photography. Better images, if captured subsequently, would be added.

The colour slides were sent in batches to an external vendor to be scanned and their digitised forms were recorded in CDs. Initially scanned as Kodak Photo CD format, the images were eventually scanned to TIFF format when the vendor could provide this service. In total, over 30,000 slides were scanned.

digitisation: digital distribution

HCC's digitisation efforts did not just stop at digital capture and conversion. How these digital images could be distributed quickly was also a major consideration and one of the main reasons why the digitisation took place.

A server with the cataloguing and distribution software Cumulus was set up and installed at HCC. At the end of a photography session, staff can immediately tag each artefact image with key data using the Cumulus client software and upload it to the server. A similar process is applied to images that have been scanned from slides to TIFF format. The server in turn publishes the images and data on the NHB Intranet, which can be accessed by all museum staff.

Museum staff can browse or search for artefact images on the Artefact Image Library (AIL), the web front end of the Cumulus server on the NHB Intranet (Figure 2). They can also download the images for reference, presentations and publication. An artefact image is available for access immediately after it has been uploaded to the server. The turnaround time from photography to the availability of images is significantly shorter, compared to that during the analogue days.

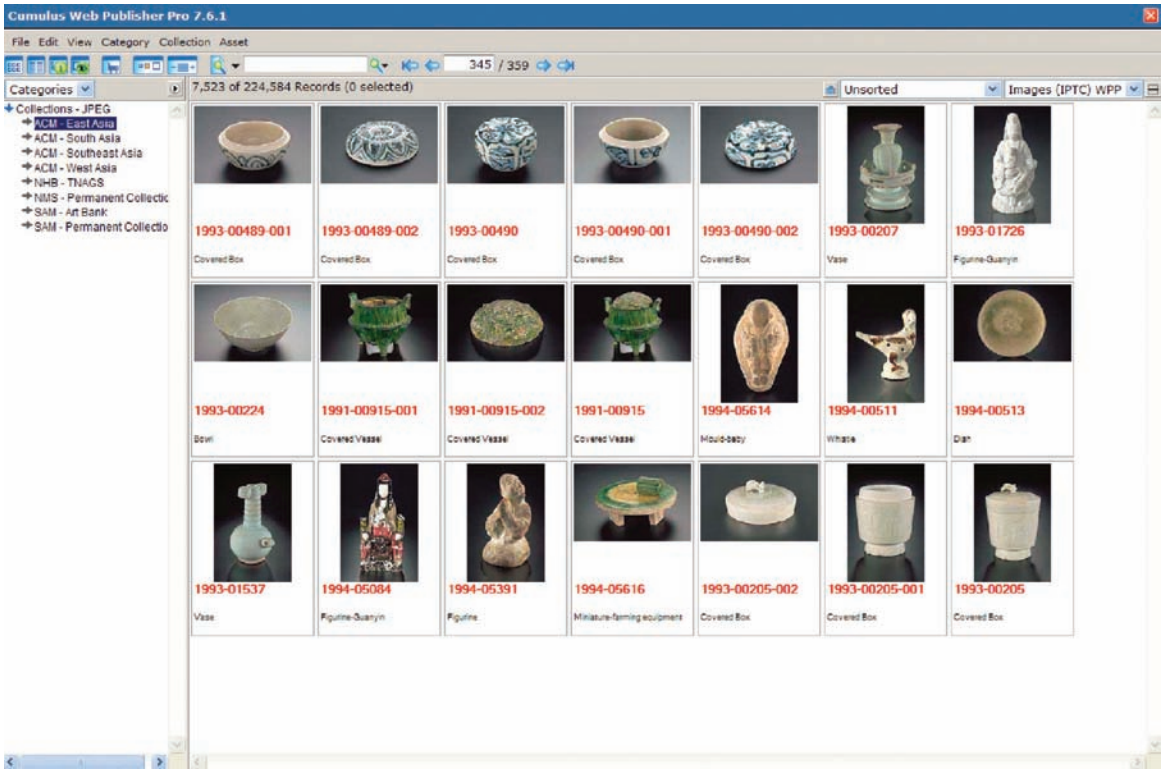


Figure 2. Screenshot of the Artefact Image Library

Following the creation of the Integrated Museum Collections Management System (IMCMS), images from the Cumulus server can also be ported easily to populate the IMCMS database with images. Through the IMCMS's public Internet front end, SGCOOL, the general public can access the images. Hence, the artefact images can now reach a much larger audience.

other issues: retrospective digital capture

The digital imaging system has been in place for the past nine years. The focus now is to complete the retrospective digital image capture of artefacts that have not been photographed previously on any film. Additional manpower is engaged to ensure that this backlog of work continues even as new additions to the collections are photographed promptly. As of August 2010, a total of 225,000 artefact images have been digitally captured. The backlog is projected to be completed by 2012.

The storage and backup of the digital artefact images is the other area that is being reviewed in order to ensure that the investment is safeguarded. The images are important records of the collections and valuable resources that can be deployed for other purposes.

conclusion

Technology has helped facilitate access to the images and records of the collections and achieve greater efficiency in the processing and housing of the artefact images. Although digitisation requires regular future migration and upgrades, continual technological advances will ensure even greater cost savings in the future. The investment in digital technology continues to be an attractive and sustainable option for a growing national collection.

reaching out – **sharing our heritage**

By Robin Liu, Assistant Director (Conservation Services)[1]

introduction

Outreach is the effort an organisation makes to connect its beliefs, values, mission and ideas with other organisations, interest groups and the general public. It is a significant mission for the programmes of heritage institutions worldwide. Similarly, the Heritage Conservation Centre (HCC) views outreach initiatives as an important and integral part of its work. Its outreach programme incorporates various activities run by its Collections and Conservation Services Departments. The programme aims to generate and promote awareness and appreciation for heritage preservation and conservation practices and to raise the standards of care for heritage and cultural materials. Its audience include schools, the general public and heritage professionals. From 2000 to 2007, HCC reached out to approximately 10,000 people from the public and specific target groups (Figure 1).

generating awareness the HCC way

In earlier years, HCC's outreach programme was targeted at as wide an audience as possible. This included groups that were identified to have direct or indirect related interests in heritage preservation and conservation. Security was an additional consideration that shaped HCC's outreach activities then; access to the Centre was thus managed.

One of the first outreach initiatives following HCC's opening in 2001 was the partnership with the Singapore Ministry of Education's Learning Journeys programme. Under this initiative, special programmes such as tours and workshops were offered to upper secondary school students (aged above 14). A group of students from Pioneer Junior College were also chosen to be attached to HCC's Conservation Science Laboratory, where they learnt about materials testing and pests, in 2001 and 2002 respectively. During the attachment, the students gained a better understanding of conservation within a broader scientific context; science was also brought alive in a real-world setting. Then, encouraged by the success of the attachment programme, HCC took a step further to work with institutions of higher learning on similar projects. The Singapore Polytechnic Student Internship Programme at HCC, for example, was developed. In this programme, science-based duties, such as accelerated materials testing and remedial conservation treatment, matched specific parts of the students' curriculum.

Figure 1. A group of students taking a closer look at artefacts

Figure 2. Volunteer guide Sue Hixson in action

HCC also reached out to student volunteer guides through the Community Involvement Project (CIP). The first student volunteer guides, selected and trained by HCC to help guide student tours, were from Pioneer Junior College and River Valley High School. Through this programme, students were given the opportunities to learn about heritage preservation and conservation as well as to live the spirit of volunteerism.

HCC also made a conscious effort to rope in adult enthusiasts to join its outreach initiatives. One important group that have contributed their time to the Centre are adult volunteer guides, who are recruited from Friends of the Museums (FOM), the volunteer organisation that supports the National Heritage Board (NHB) and its museums, and from the public through open recruitment (Figure 2). These HCC-trained volunteer guides are the core group who help bring HCC's key messages to a wide range of organisations, upper secondary school students, potential lenders and donors, members of the public, overseas visitors as well as other interest groups. HCC views volunteer guides as a valuable resource for facilitating weekly tours and promoting community involvement and ownership of Singapore's cultural heritage.

On the guided tours, visitors are able to view the facility and interact directly with collection officers, conservators and registrars. They learn how artworks and historical artefacts are preserved using environmental control methods, good physical storage and museum display techniques, as well as about preventive conservation measures that could avert deterioration. A total of about 10,000 people visited HCC over the seven years before the Centre was closed for expansion work in 2008.

Tours and attachments are not the only avenues through which HCC generates awareness on heritage preservation and conservation. Hands-on workshops are designed for secondary school students. The Do-It-Yourself (DIY) Treasure Care Workshops, targeted at specific interest groups, have also proved to be very popular with those who are tasked to look after their organisations' heritage galleries. Providing participants with a sound introduction to the fundamental principles of collection care and basic preservation processes and storage methods, these workshops help them bridge the gap between conservation theories and practices. Despite the popularity of the workshops, HCC has not been able to provide these programmes on a regular basis due to manpower constraints. On average, two to three workshops are conducted every year.

HCC has also collaborated with institutions of higher learning, such as the National Institute of Education (Singapore's national teacher-training institution), LaSalle College of the Arts and Nanyang Academy of Fine Arts, on organising talks and workshops on a broad range of topics to raise awareness among students on the importance of preserving heritage materials, collections management and other conservation-related subjects.

To reach a wider audience, HCC has participated in NHB's collaborative outreach efforts, such as Museum Fest and Singapore Heritage Fest, since 2001. The HCC website has also been created and enhanced over the years to provide information on the Centre as well as on the care of heritage materials through research papers and journal articles written by collections managers, registrars and conservators.

international connections

HCC recognises that it cannot work in isolation and needs to be connected with regional and global colleagues. It has actively exchanged professional expertise with esteemed institutions like the Canadian Conservation Institute and invited individuals like Mr Stephen Koob (objects conservator), Ms Konstanze Bachmann (paper conservator), Ms Deborah Meyer (paper conservator) and Ms Alison Lister (textiles conservator) to work alongside, train and give lectures to both HCC and participants from special interest groups (Figure 3). Although the training and development of HCC staff is the key reason for such international connections, overseas colleagues also benefit from the opportunities to learn about conservation development in Singapore and this part of the world.

HCC strives to share and exchange knowledge with representation at various conferences and proceedings. Since its official opening, its staff has presented conference papers at relevant international gatherings. In more recent years, papers have been presented at conferences and meetings organised by the International Council of Museums – Conservation Committee (ICOM-CC), Institute of Conservation (ICON), and the Asian Pacific Twentieth Century Conservation Art Research Network (APTCCARN). Active participation at such events has helped HCC remain connected to the international body of knowledge and build on its professional network and reputation.

Figure 3. HCC staff participating in the Glass Workshop conducted by Mr Stephen Koob, Conservator, Corning Museum of Glass

Figure 4. HCC conservator Anthony Lau (foreground) working with a Balai Konservasi conservator

To reach out and contribute to the professional community, HCC takes in local and overseas conservation interns yearly. Interns from the USA, Scotland, Macau, Hong Kong, Taiwan, South Korea, Germany, Denmark, the Philippines and Indonesia as well as local aspiring conservators have passed through HCC's doors. Since 2008, HCC has improved its internship application process and introduced a more structured internship programme to meet the increasing demand for attachments in Singapore. These opportunities attract many applications, even though all interns are self-funded. HCC offers the unique and rare exposure to conservation in Asia and more specifically in the tropics. HCC has benefited from this experience through the mutual sharing of specialised knowledge between interns and staff.

HCC has also been reaching out beyond Singapore through international partnerships. The first successful collaboration on an international conservation project, funded by Tropenmuseum (Amsterdam), was between HCC painting conservators and conservation staff of Balai Konservasi in 2008, in Jakarta, Indonesia (Figure 4). HCC conservators shared conservation knowledge with their Indonesian colleagues in the survey and treatment of selected works and an important painting, *The Battle of Sultan Agung and Jan Pieterszoon Coen*, by S. Sudjojono, in the Museum Serajah Jakarta's collection. This project led to a new collaboration with a Balinese gallery in 2010.

exhibitions

HCC took a bold step to hold its first exhibition, entitled *Seeing the Invisible: An Insight to Conservation*, at the Shaw Foyer Gallery, Asian Civilisations Museum, from 25 July to 13 December 2009 (Figure 5). The exhibition was viewed by some 98,000 visitors. For the first time through a dedicated exhibition, the Centre offered the public a glimpse of its work and expertise as well as insights into the lesser-known profession of heritage conservation in Singapore. Using specific cases, the exhibition introduced visitors to the conservator's work, which combines the specialised fields of science, art and history.

Figure 5. One of the showcases in the exhibition *Seeing the Invisible*

Visitors took the opportunity to engage with the exhibition and study the series of themed displays. The exhibition conveyed a broad message about the various technical aspects of conservation, including the process of interventive treatment, deterioration factors and the decision-making processes that conservators undertake when deciding on the most appropriate treatment methods.

A supporting programme of events was also provided during the exhibition. The Paper Conservation Section organised several workshops on conservation framing and mounting, while an objects conservator gave a public lecture on ceramics care together with an external ceramics collector, who spoke on his experience in collecting Yixing teapots. In an attempt to bring conservation alive for visitors, conservators conducted a total of seven 'conservatours', during which they shared insights into preventive and interventive conservation, using the actual artefacts in the galleries of the Asian Civilisations Museum as examples.

The exhibition was extended as a website <http://hccsti.wordpress.com> (Figure 6), which has attracted a total of 3,218 views since December 2009.

Riding on the success of its first exhibition, HCC then collaborated with The National Arts Gallery, Singapore (TNAGS) on a conservation component in the exhibition *The Story of Yeh Chi Wei*, held from 27 May to 12 September 2010 at the Singapore Art Museum. The Paintings Conservation Section presented case studies on the conservation treatment of selected works on display in the exhibition and produced a series of videos that demonstrated some of the conservation treatment techniques. The conservation corner also added a unique behind-the-scenes look at the exhibition preparation. The case studies and videos were uploaded onto a blog <http://nationalartgallery.sg/exhibition-events/yeh-chi-wei/blog> as part of the TNAGS website, reaching out to a wider audience.

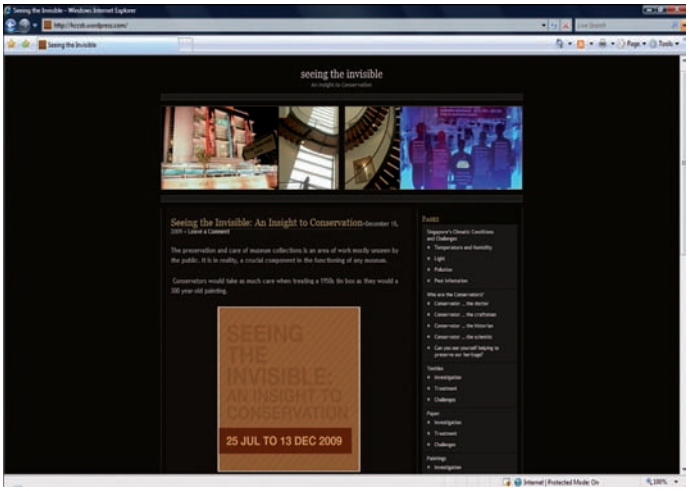


Figure 6. A screenshot of the *Seeing the Invisible* website

from strength to strength

It has been a challenging and exciting experience designing and executing HCC's outreach programmes over the last 10 years. As part of its continual efforts to renew itself and stay relevant, HCC has formulated a three-year strategic plan for the review and redesign of its outreach programmes. The newly renovated facility will offer a brand-new tour route with updated exhibition panels and information brochures to engage visitors. There will also be a dedicated outreach room, which will accommodate more workshops for a wider audience.

In the years ahead, HCC will endeavour to collaborate more actively with partners to provide programmes that will create and strengthen the awareness on conservation and collections management at various levels. The Centre will continue to provide opportunities for more in-depth engagement with its current audience while also striving to introduce conservation and preservation to new ones, so as to share its knowledge and expertise with as many people as possible.

1 This article was written with contributions from Low Jyue Tyan, Registrar, and Wee Ann Jee, Manager (Management and Outreach).

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