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PHOTOGRAPHIC MATERIALS

Rebuilding Holtermann's triumph: From plate to pixel

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ABSTRACT

In 1875 some of the world's largest ever wet-plate glass negatives were made in Sydney by photographer Charles Bayliss for Bernard Holtermann. Bayliss produced his panoramas from a purpose-built studio in the tower of Holtermann's residence. These glass plates form part of a collection donated in 1952 to the State Library of New South Wales. In 1982 one of the plates broke into hundreds of pieces. Although attempts were made to repair the plate, no satisfactory solution was found. This paper explores the collaborative efforts required to re-assemble and preserve the physical artefact, and recapture the image using best practice digital imaging.

HISTORICAL BACKGROUND

From 1872 to 1875, German-born Bernard Otto Holtermann, a successful gold miner, entrepreneur and merchant, initially commissioned Beaufoy Merlin and then Charles Bayliss of the American & Australasian Photographic Company (AAPC) to document towns in New South Wales and Victoria for the purpose of promoting the Australian colonies abroad and to encourage immigration (Figure 1).

The Holtermann Collection contains 3,500 glass plate negatives in various formats, from quarter to mammoth plate and even larger. They were found in 1951 in 83 original boxes in a garden shed belonging to a Holtermann descendant by a grandson of Holtermann and editorial staff of the *Australasian Photo-Review,* including Keast Burke and Vyvyan Curnow (Burke 1977, 2). This extraordinary find revealed significant images of Australian goldfield towns in New South Wales and Victoria dating from the early 1870s, at the height of the gold mining boom, and of streetscapes of Sydney and Melbourne. The rich detail captured in the plates chronicles every shop, house and mine in the surveyed areas, and often the people who lived in them.

Most astonishing of all was the discovery of some of the largest wet-plate glass negatives (1.6 m by 0.96 m), revealing panoramic views across Sydney Harbour (Burke 1977, 24). These panoramas were taken by Bayliss in 1875 from a purpose-built studio in the tower of Holtermann's North Sydney residence. Each sheet of plate glass weighed more than 30 kilograms and they were probably sourced from glass merchants in Sydney, who supplied plate glass for use in shop windows.

> He pur-chased a site of land at the North Shore (Blue's Point — the highest point in the locality), from whence he could command an uninterrupted view of the city harbour of Sydney... On the summit of the building is a tower 90 feet high, from whence the views are taken; and perhaps from no other spot in the colony, can such a magnificent view be obtained as from this elevation (*Illawarra Mercury* 1875, 4).

Bayliss used the collodion 'wet-plate' process, so called because the glass plate negative was coated with an emulsion of collodion, sensitised, exposed in the camera and developed whilst still wet (Davies 2013, 18).

The logistics of handling these large and heavy plates would have been considerable in a studio environment; carrying them almost 30 metres up the tower's spiral staircase added further complexity (Burke 1977, 24).

From contemporary newspapers it is known that four giant panoramic plates were made through this process. However, only three have a known location at the State Library of New South Wales (the Library), XR 45a and b and the broken plate XR 46.

Figure 1. Carte-de-visite of Holtermann standing beside one of the giant glass plates, Loescher & Petsch, Berlin, 1879 (National Parks & Wildlife Service, Hill End). Beyers' Family Album

CUSTODIANSHIP AND ACCESSING THE HOLTERMANN COLLECTION AT THE LIBRARY

Soon after the discovery in 1951, contact prints of a selection of the plates were produced and displayed at the Mitchell Library, the Public Library of Victoria and the Kodak Salon galleries in Melbourne and Sydney. This work was sponsored by Kodak Australasia Pty Ltd, which realised the importance of the collection and encouraged the Holtermann estate to offer the collection to the Library. The Library acquired the collection in 1952.

During the 1950s, plate XR 46 was moved to the Museum of Applied Arts and Sciences by Vyvyan Curnow and a group of photographic enthusiasts for large-format copy printing. A silver gelatine contact print was created and sepia toned to replicate an albumen print. This print (ML 849) has now been established as the only intact full-scale image of the broken plate.

During the 1970s and 80s, images from the Holtermann Collection were batch-scanned from second generation 35-mm film copies. Unfortunately, these digitised images lost much of the fine detail of the original negatives. In 1980 the three giant plates were photographed at a commercial photographic bureaux, producing three 5 × 4" photographic acetate negatives, now stored in the Library's cold storage facility. Until recent years, these were the only large format copies of the glass plates. In 1982, one of the three glass plates (XR 46) broke into large pieces, small shards and powdered splinters.

In 2008, after considerable improvements in digitisation, the Holtermann Collection Digitisation Project was established to enable each plate to be scanned at high resolution, capturing the incredible detail of the collodion wet plates. Access to the collection was then enabled and enhanced through the Library's website and the incorporation of Zoomify software. The digitisation included the two largest plates, which required the construction of framework, light box and the hiring of specialised photographic equipment.

INVESTIGATIONS

In attempting to reconstruct the broken plate XR 46, an historical investigation of previous attempts to repair it was undertaken. Retired Library staff were consulted and were willing to discuss what for most was an unfortunately memorable incident. Staff recalled how the plate was stored prior to the break (Pryke 2016). The three plates had been wrapped in brown paper and positioned vertically against a cabinet, a consequence of the compromised storage options available for large items at the Library during the 1980s.

Figure 2. Sorting and counting the glass fragments

It is thought that XR 46 had progressively slipped away from the cabinet, until it fell to the floor. The breakage pattern revealed during the assembly of the fragments reflects this theory, with fractures radiating out from a point of impact along one edge. The modern day equivalent for this is dropping a mobile phone and the screen shatters from the single point of impact.

Staff carefully collected all of the broken glass fragments, shards and glass dust. It is a reflection of the thoroughness and care taken by those staff members that so much of the plate has now been able to be reconstituted. The information provided from Library files created at the time of the break – correspondence with insurers, conservators and experts in the field, as well as oral histories of those involved – revealed the Library's concerted efforts to solve the challenges of the broken plate.

During the 1980s, the Library commissioned a private conservator to investigate a suitable method of repairing the negative. In developing a proposal for treatment, the private conservator floated a small portion of the collodion emulsion off one of the glass fragments. The subsequent treatment proposal presented to the Library was to remove all the emulsion in this manner and float these pieces onto a new glass substrate. Thirty years ago the conservation profession took a more interventive approach than we do today. The Library considered the risk to the image layer and the expense of such a difficult and irreversible treatment, and opted not to proceed, and instead to wait for improvements in photographic conservation. The glass fragments were boxed and returned to the Library for storage.

In 2012 the two undamaged large collodion wet plates XR 45a and b were digitised in high resolution. Unfortunately, the broken plate could not be digitised due to its state and it remained an unanswered question as to what was still possible to capture from the fragments.

DESCRIPTION OF CONDITION

The broken plate consists of 291 identifiable fragments of 8-mm-thick glass varying in size and condition (Figure 2). As the plate did not break cleanly, some fragments have just the collodion emulsion holding pieces of glass together and other portions are fragments of glass with almost no emulsion evident. The largest fragment measures 780 mm in height and 550 mm in width.

At the commencement of this project the fragments were stored flat in an arbitrary arrangement in 12 archive boxes. The boxes included layers of acid-free tissue over bubble-wrap padding. Fragments were free to move about within the boxes. Opening and closing of the cabinet drawers led to physical damage from glass fragments rubbing against each other and the loss of the fragile collodion. Prior boxed storage from the 1980s had also included padding out with cotton wool and small filaments of this remained attached to the broken shards in places.

DIAGNOSIS AND TREATMENT

The aim of the project was to use conservation best practice and leading digital expertise to stitch together – both physically and virtually – a

large-scale image of Sydney Harbour, and reintegrate it into the Holtermann Collection. An equally important aim was to improve the preservation of the glass fragments, and halt further damage from inadequate storage.

The approach

A range of options were explored, from physically rebuilding the entire plate to photographing each fragment and stitching it together. In consultation with the Library's Digitisation and Imaging (D&I) team, reassembling the whole plate and photographing it in its entirety was discounted due to its weight and fragility. The logistics of manoeuvring 30 kilograms of broken glass horizontally for both the assembly and photography were insurmountable.

Another option, to photograph each fragment and digitally stitch the image together, was also not practicable. Many shard-like fragments could not sit independently and consequently could not be photographed. A combined approach was considered to be the most practical solution. This involved reconstructing the plate in six separate sections that would be more manageable to assemble and transport for photography. These six sections could then be photographed and digitally stitched together.

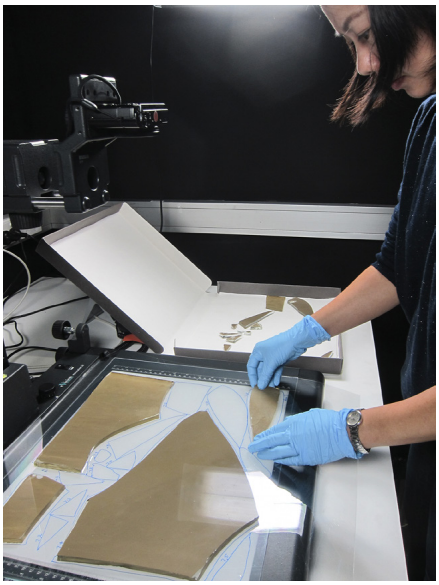

Figure 3. Registering fragments for photography

Solving the Holtermann puzzle

The sheer scale and fragility of the broken plate posed many problems. To avoid excessive handling of the pieces and lengthy assembly sessions over a light box, low-resolution snapshots of groups of fragments on a light box were taken using a copy stand and camera. These images were printed at the same scale and the fragments cut out to produce a paper jigsaw puzzle of the plate.

Registration of each fragment was critical to the success of this process. The fragments were relocated into 17 temporary boxes, to provide more space around each piece. A tracing of each fragment's location within the box was made on a polyester film that was supported by a sheet of Perspex on top of the temporary box. Each fragment tracing was labelled with a permanent marker, referencing the box number and its individual number within the box. The polyester film was photocopied to create a paper registration sheet recording the fragment layout. The film was then placed onto a light box with a copy stand, with an additional film sheet placed on top to prevent any transfer of the ink. The fragments were transferred from the box to their matching numbered outline on the light box, illuminated and photographed (Figure 3). The paper registration sheet was then placed in the base of the box and the fragments returned to their correct numbered positions.

Sixteen boxes of fragments were photographed in this manner, capturing 235 of the 291 fragments (56 were unsuitable for photography). The height of the camera was maintained at the same distance for each box and each image printed onto A3 paper to ensure the images of the fragments remained in proportion with each other. A rule captured within each image was used to confirm the correct scale was achieved (1:1.38). The label for each fragment was transferred to the verso as each paper puzzle piece

was cut. The paper fragments were assembled together and pinned onto a cork board (Figure 4).

The impact pattern was evident in the paper jigsaw, with the lower right quadrant the most complicated, with 135 fragments. The paper jigsaw proved invaluable in planning the sections of the plate to be assembled and the sequence in which they were digitised. In addition, the paper jigsaw revealed two substantial missing portions of the plate – one along the top edge in the right corner, and a larger portion missing in the centre of the lower right quadrant. Unfortunately, there is no documentation indicating the whereabouts of these lost portions.

Figure 4. Holtermann paper jigsaw

The pilot

Due to the complexity of assembly and the size of the fragments, reconstruction in situ on the large light box in D&I proved challenging. Sections with many smaller fragments would be time consuming and problematic for the conservators to assemble due to the intense illumination from the light box. To this end, an acrylic tray was fabricated to enable reconstruction of the plate away from the D&I lab.

The first pilot of this proved unsuccessful as the weight of the fragments on the 10-mm-thick acrylic tray caused bowing of the acrylic, contacting the light box. This caused an interference pattern which was unacceptable for digital capture. A second tray was fabricated in 15-mm-thick acrylic, with a 10-mm lip to stand off the surface of the light box. Although heavy, the tray did not flex under the weight of the fragments, resolving the issue of interference patterns. Considerable time was required to physically reconstruct the more complex portions of the broken plate. Three identical trays were made which enabled the team to reconstruct the fragments away from the D&I lab and transport them to the shoot.

The plate was reconstructed in six large sections guided by the paper jigsaw. In dividing up the fragments into the six trays, at least one outer

edge was included to assist in registration and provide a reference point for both digitisers and conservators.

DIGITISATION OF THE GLASS PLATE

The fragments were digitised (emulsion side up) on the acrylic trays on an oversize light box, illuminated with daylight-balanced fluorescent lights (Figure 5). A medium format Hasselblad H4D 50MS camera was used with the height of the camera maintained at the same distance throughout the whole process to ensure size relation between fragments. Each tray was photographed separately and the six sections were stitched together in Adobe Photoshop CC to form a final completed image, measuring 18,876 by 12,117 px.

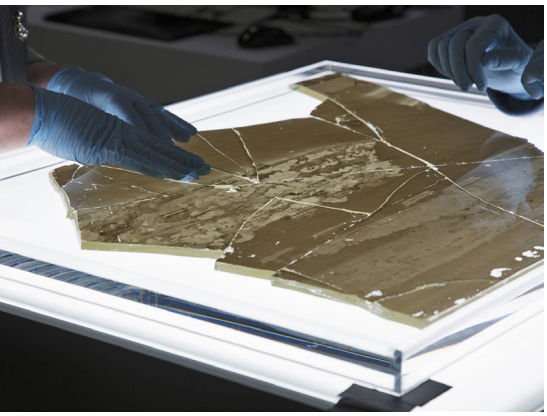

Figure 5. Adjusting fragments in tray for photography

The master files were created according to Library standards as Adobe RGB (1998) 16-bit uncompressed .tif files and retained as negatives to represent the original object. Viewing files were produced as de-saturated (black and white) co-masters to represent a positive final image.

At the same time, the 1950s contact print (ML 849) was conserved[1] and then photographed in 12 parts using the Hasselblad H4D 50MS at the same final resolution as the stitched image from the broken fragments. The missing portions of the glass plate could then be supplemented with images from the contact print.

STORAGE OF FRAGMENTS

At the start of this project the fragments were stored in 12 archival board boxes with insufficient padding and no separation from each broken piece. This meant any movement such as opening and closing of the storage drawers could result in physical damage from the glass pieces rubbing against each other and the loss of the fragile emulsion layer.

Figure 6. Rehousing system using bumpers

Following digitisation and the assembly of the fragments, it was decided to store the fragments where possible in the correct arrangement. Drop-front storage boxes were constructed using a Gunnar 601-RS matt cutting machine to established sizes. Sink mats with a hinged board cover were made to house the fragments. Blue-grey single corrugated board, 8 ply Alpharag Art Core mount board, Rising Photomount, Gummed linen tape, 3M double-sided tape and Evasol adhesive were used to construct the boxes and sink mount trays. All supplies were acid-free and have passed the Photographic Activity Test (PAT). The fragments in sink mount trays are separated by mount board bumpers to prevent further damage from handling (Figure 6). This is a common approach to storing broken glass plate negatives as exemplified at the Smithsonian Institute Archives (Batkin 2012).

CONSEQUENCES OF TREATMENT

This project has reunited the three giant panoramic images of Sydney Harbour from 1875 as originally intended through the physical and digital reconstruction of the broken plate. For three decades the plate had been considered unsalvageable and the information contained within it lost. This

work involved a multidisciplinary team of past and present staff which looked into the reconstruction of an object from many angles.

The registration solution utilised by the team had a twofold effect: it enabled a low-tech jigsaw puzzle reconstruction, which informed digital capture, and a numbering system which could then be adapted to the storage solution. The rehousing of the plate provides best preservation practice for storage of broken photographic plates, and also acknowledges the importance of the object as artefact. It is also anticipated that through the reconstruction and digital capture further intervention and handling of the fragments will be kept to a minimum. Finally, the size of the plate has been confirmed as 1517 × 965 mm.

Prior to this treatment the 1875 image of XR46 was only available in poor quality versions which lost the brilliant detail and clarity of the original (Figure 7). The treatment has ensured the physical artefact is preserved and the high quality imaging has recovered the detailed view of Sydney Harbour.

Apart from the size of the pictures, they are splendid specimens of the photographers' art, the outlines being sharp and clear, and the various objects shown coming out prominently before the eye... (*Ovens and Murray Advertiser* 1875, 3)

Figure 7. Detail from 5 × 4″ negative, contact print ML 849 and XR 46, comparing sharpness and resolution

CONCLUSION

Linking the past to the future

This has been a collaborative effort of a team of conservators, photographers and curators to piece together the story of this plate. In addition, by finally digitising the broken plate, it has reunited and reconnected this image into the Holtermann Collection. The Holtermann Collection was inscribed to the UNESCO Australian Memory of the World Register (#43) in May 2013.

In 1875 Charles Bayliss, in the employ of Bernard Holtermann, used what was then cutting-edge photographic technology to make huge glass plate panoramas to showcase the growing city of Sydney to the world. In 2016, some 141 years later we have used the latest digital technology to recapture the same view from a broken plate and make it accessible online to an audience he could not have imagined (Figure 8).

Figure 8. Assembled fragments of XR 46

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NOTES

[1] Contact print conservation: the contact print was unframed and surface cleaned using a soft brush avoiding areas with friable emulsion. A solution of ethanol and water (50/50 v/v) was then used with cotton wool swabs to clean any dirt sitting on the surface. Friable and loose emulsion areas were consolidated using a 1% (w/v) solution of Bermocoll E 230 FQ (ethyl hydroxyethyl cellulose) in deionised water. Areas of lifting support were adhered down to the Masonite backing using dilute wheat starch paste. The contact print has been framed in a custom-built wooden frame with Perspex glazing.

MATERIALS LIST

3M #415 Polyester double-sided tape 25 mm × 32.9 m
Conservation Resources
www.conservationresources.com.au/html/home/

Archival polyester 100 micron
Conservation Resources
www.conservationresources.com.au/html/home/

Bermocoll E 230 FQ
AzkoNobel
www.akzonobel.com/ic/

Blue-grey corrugated board 1160 × 960 mm single wall blue/grey
Archival Survival
www.archivalsurvival.com.au/

Evasol adhesive
Conservation Resources
www.conservationresources.com.au/html/home/

Lineco 533.2020 Gummed linen tape 51 mm × 91 m
Conservation Resources
www.conservationresources.com.au/html/home/

Nielsen Bainbridge Alpharag® Artcare™ 8-ply white mount board
Megawood Larsen-Juhl
www.megawoodlarsonjuhl.com.au

Plexiglas™ 15 mm clear – tray fabrication
Australian Plastic Fabricators PTY LTD
www.ausplasfab.com.au

Rising Photomount board 4-ply white
Archival Survival
www.archivalsurvival.com.au/

Wheat starch
Conservation Resources
www.conservationresources.com.au/html/home/

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