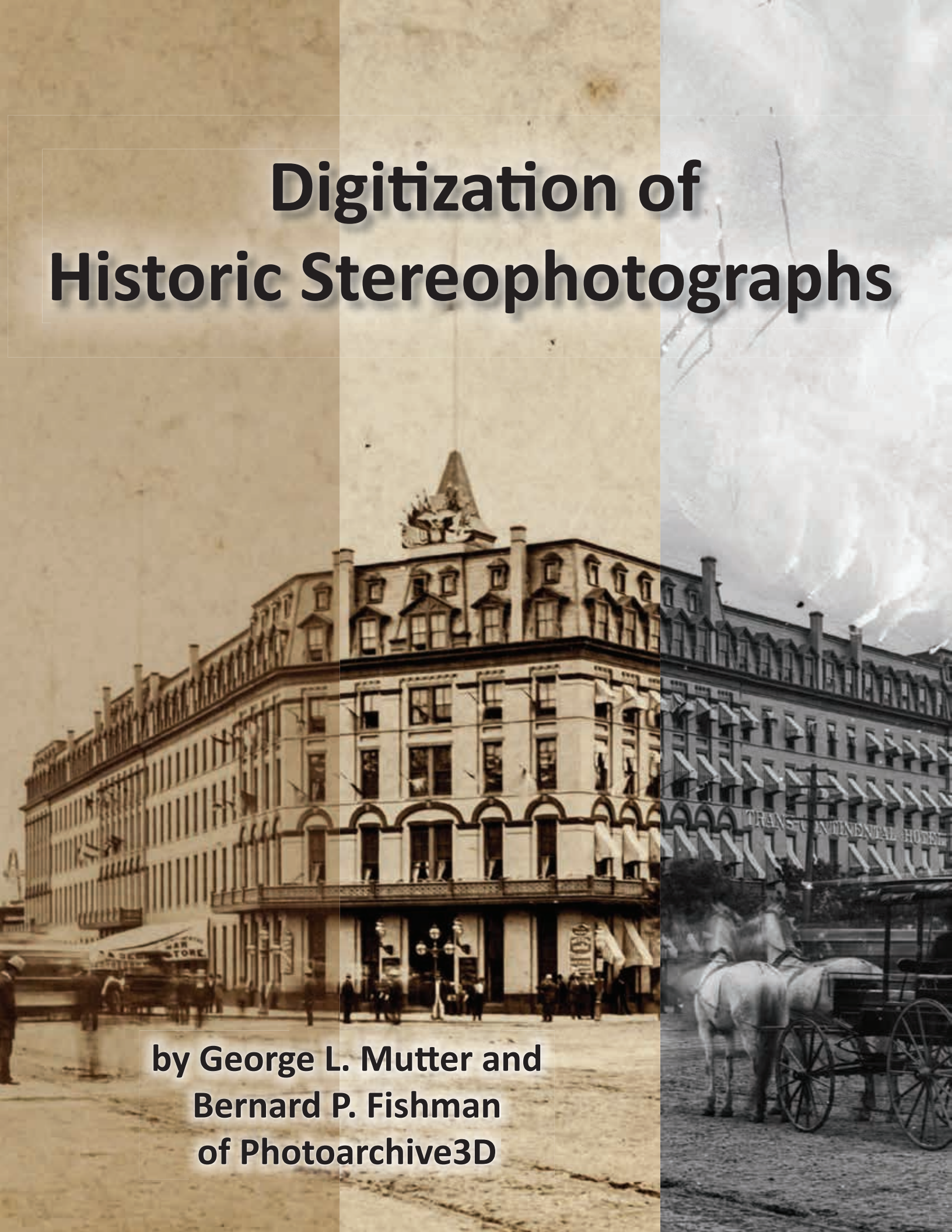
Digitization of Historic Stereophotographs

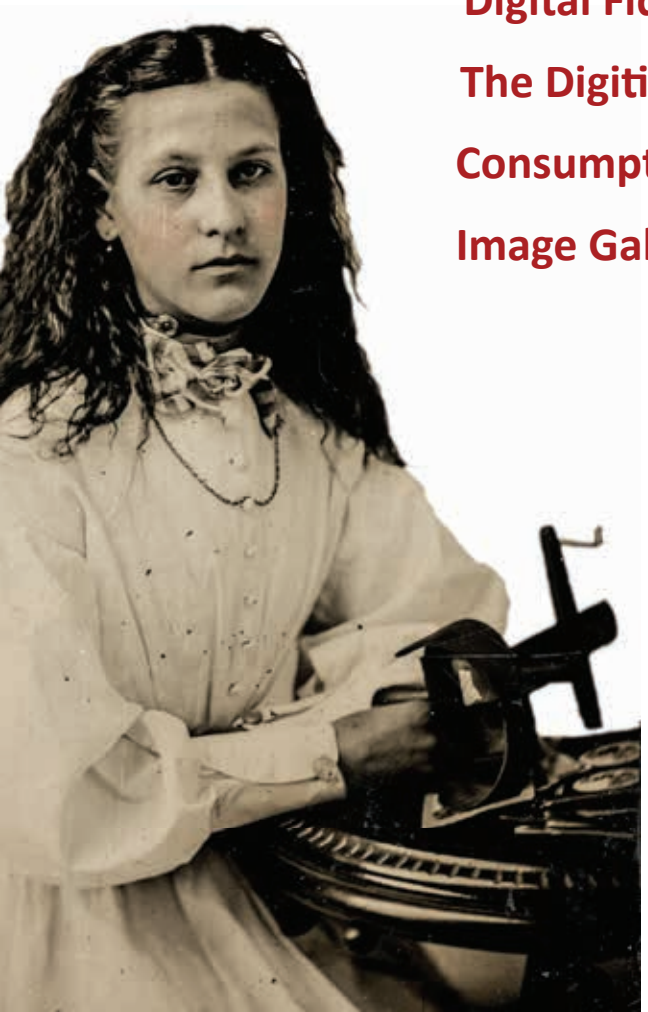


by George L. Mutter and
Bernard P. Fishman
of Photoarchive3D

Digitization of Historic Stereophotographs

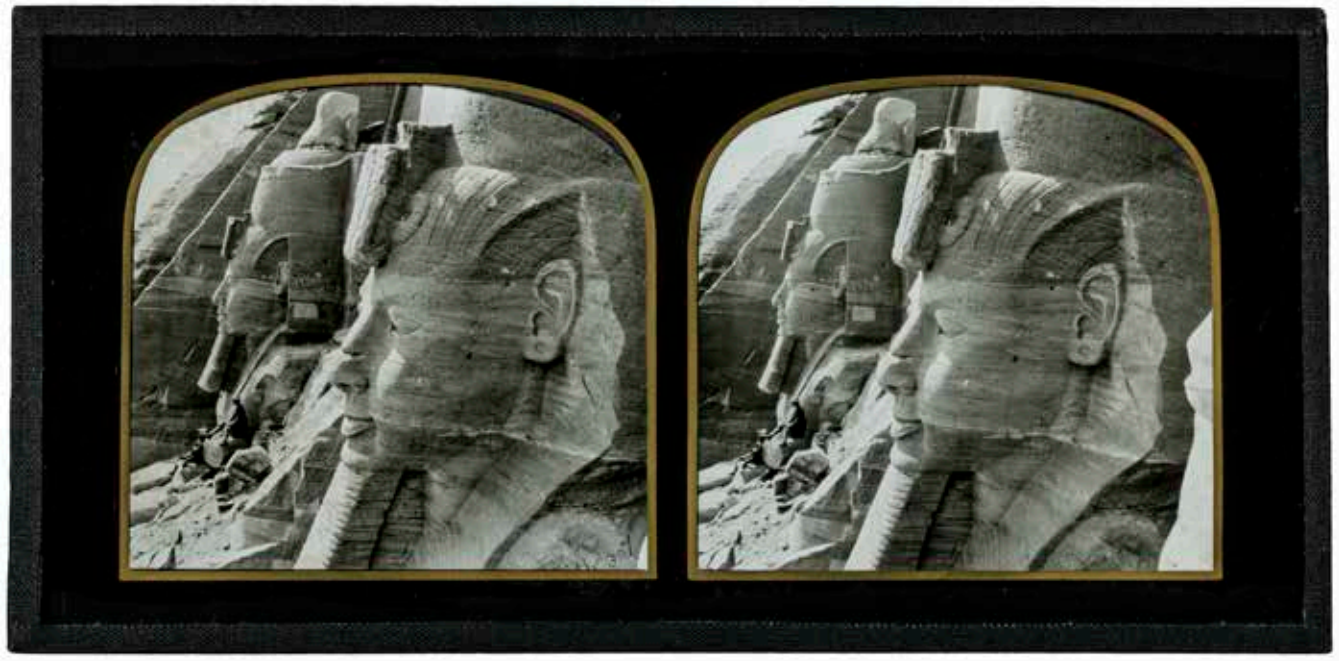
by George L. Mutter
and Bernard P. Fishman
of Photoarchive3D

CONTENTS



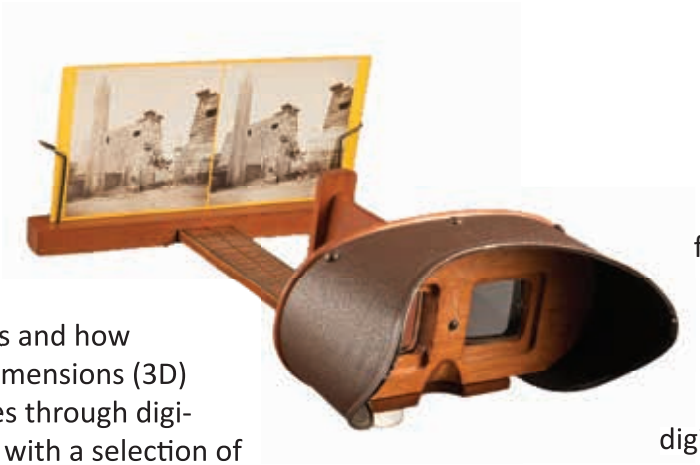
Published by Photoarchive3D.
1st Ed, September, 2018
www.Photoarchive3D.org

By the mid 1850s visitors to the rebuilt Crystal Palace outside London could gaze directly upon life sized (65 feet tall) reconstructions of two of the Colossi at Abu Simbel, Egypt. Glass stereoview, anonymous photographer and publisher, but possibly by Philip Henry Delamotte, London, c. 1857.



It was the remarkable 1850s stereophotographs of Egypt by the Englishman Francis Frith that did more than anything else to make the stereoview a resoundingly popular part of the Victorian imagination. Frith went on to publish some 400 stereoviews of Egypt and of Palestine, bringing the direct reality of the Biblical landscape into innumerable homes.

Preface

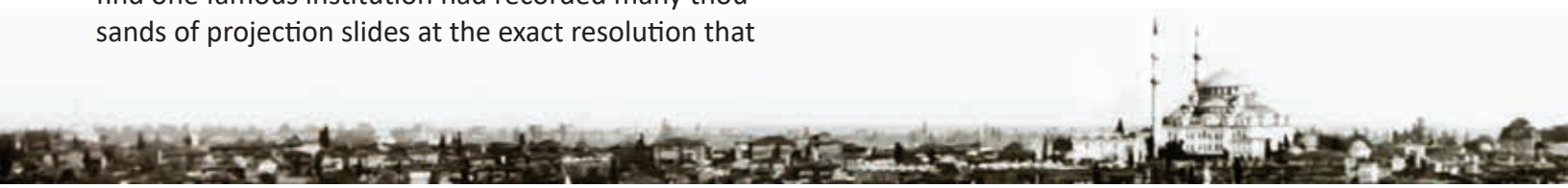


The present work is an overview of historic stereophotographs and how to deliver them in three dimensions (3D) to contemporary audiences through digital technology. Illustrated with a selection of vintage photographic images from the Photoarchive3D Collection, it reflects years of experience by the authors, who have amassed 33,000 vintage images over a period of decades. The prospect of bringing these to a broad audience through digitization launched what has become a fruitful collaboration under the banner of Photoarchive3D. We digitized it all at high resolution to produce durable, separate left-right aligned pairs of high resolution source files easily reformatted for any of a large number of current and future display technologies. Since 2011 we have walked into many rooms outfitted with a standard digital projector, handed out silly looking cheap paper glasses suited to a 1950s horror movie (our inaugural 3D projection format was red-cyan anaglyph), and heard gasps from an intensely engaged audience shown images that had not been seen for over a century. We were "in the game," sharing our passion for history, great images, and the immediacy of three dimensional immersion that had previously been constrained to our personal armchairs.

The digital world, and possibilities of virtual reality, has re-energized interest in historic material created originally in 3D up to 150 years ago. Our initial goal of archival digital documentation was quickly expanded to include another purpose: optimizing the image content for display in contemporary settings. The manner in which we have efficiently achieved both of these goals is detailed in the Technical Appendices. Early on, one of us (GLM) visited several organizations which were early adopters of digital methods, only to find one famous institution had recorded many thousands of projection slides at the exact resolution that filled their screens at the start of the project (720 x 540 pixels, extended CGA). The lesson was not lost on us, and we immediately scrapped our own first digital archive of jpg files shot with a 10 megapixel camera. Two cameras later, and with better insight regarding file format characteristics, we relaunched the entire project with what at the time was an optimistic vision: get the highest resolution quality camera we could afford (21MP), and use the latest flexible file storage format that promised to have some prospective durability (DNG). Now, all objects in the Photoarchive3D Collection can be zoomed to a resolution that exceeds what was visible from legacy optical systems. With a few clicks any can be calibrated to a real world color standard, or restored for viewers who are more interested in knowing what Dresden looked like in 1870, rather than how the image has aged since.

Our purpose in this booklet is practical, and several fold. First, we will present the various formats of stereophotography as seen through its material remains, including the reissue of single negatives as variants. Second, digital strategies compatible with the dual perspectives of preservation and content revitalization are detailed. Third, as curious acquisitors incorporating all topical and geographical boundaries, our collections are broadly representative of what has been available in the marketplace between 1980 and today. We include full-sized examples of some of these images to provide a sense of what has been available.

George L. Mutter, Boston, Massachusetts
Bernard P. Fishman, Augusta, Maine
September 2018

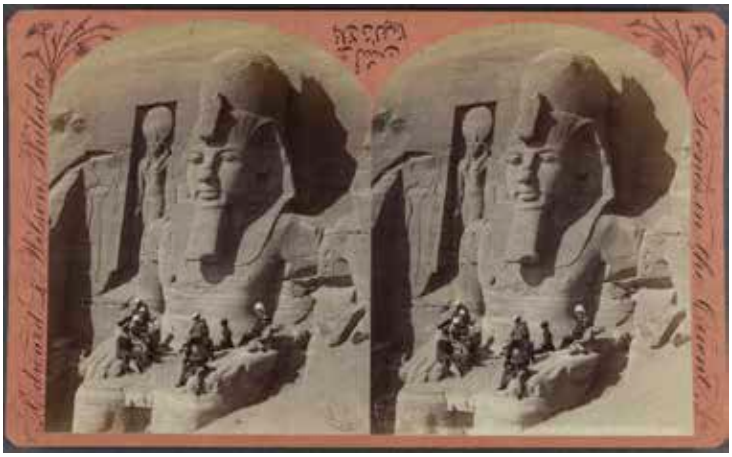


Physical Formats of Stereophotographs

19th century stereophotographs were created as paired right and left photographs taken from a position separated approximately by the distance between a typical pair of human eyes. For 3D viewing it was necessary for each eye to be able to simultaneously see only one image. Most commonly images were produced on photographic paper and mounted cardboard stock approximately 3.5 inches high by 7 inches wide. Hooded viewers with prismatic lenses were the most common type of stereoscopic apparatus. Handheld, photographic cards were placed in the sliding mount of a hooded viewer that permitted focusing by moving the image forward and backwards. Viewer lenses generated some distortion on the edges of images, partially corrected by an intentional curve in the cardboard backing.

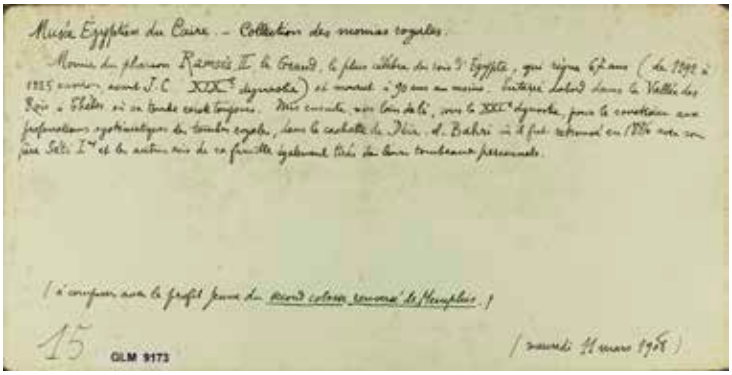
More expensive, and finer in reproduced detail, are positive photographic images developed on glass the same size as the cardboard mounts. The images were held to a light source which illuminated the image by transmitted, rather than reflected, light. The detail created by non enlarged contact prints on silver emulsion was microscopic. Glass allowed even greater detail, being unaffected by texture or brightness of the paper itself.

Any of these images could be hand tinted to produce dramatic color effects. Beginning in approximately 1904 the first true color photographs, Autochromes, became commercially viable. Individually unique, the color of Autochromes was created by shining a light through the glass substrate where tiny dyed starch grains were lit up in areas that had failed to deposit silver grains during development. Autochromes can be recognized by the "pointillist," painterly quality conferred by individual starch grains, each of a different color.



Front side of card mounts with decorative borders.

Reverse annotations on paper mounts.



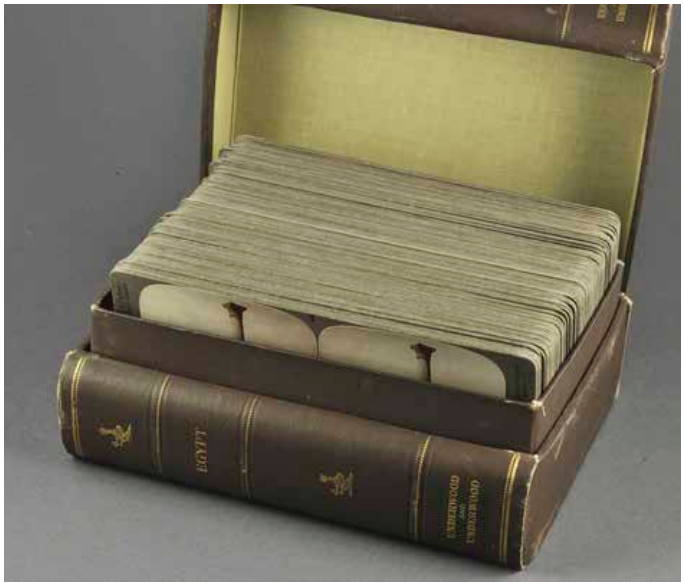
Borders of the mount, and the reverse side, often identified the subjects and photographer. This allows retrieval of specific information despite the scattering and disassembly of individual images from their original series or context. Period travel books are invaluable references for locations and structures depicted.

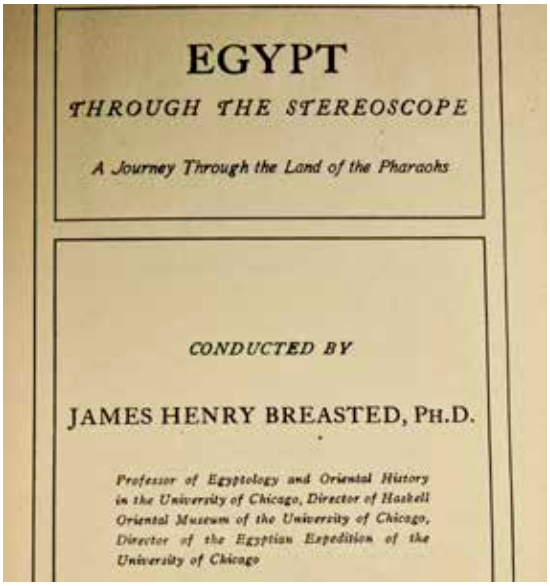
Physical formats of stereoviews. Left-Right. Translucent glass positive, curved paper mount, flat paper mount.

Glass Stereo Autochrome. Detail showing "pointillistic" color. France, near Burgundy, 1913.

Stereophotographs printed on translucent tissue paper, "tissue views," combined transmitted and reflected light for a unique viewing experience. In reflected light they are comparable to regular cards. But when partially lit from behind a second backing layer of tinted tissue paper contributes a gentle color, sometimes enhanced by pinpricks that produce brilliant lighting effects. Many original tissue views – have become torn, or even burned from holding up to a candle. Intact examples can be spectacular, with the fairytale brilliance or surprise elements that appear only when lit from behind.

Image series issued as topical sets provide "virtual tours" of specific locations or events which reconstruct the experience of a traveler or participant. Sometimes an interpretive narrative is provided, and such sets are especially valuable records of historic events (wars, fairs) and changing conditions. After 1897 the publishing house of Underwood and Underwood took up the idea afresh and issued numerous thematic boxed sets illustrating the major countries and regions of the world through 50-100 carefully selected stereoviews accompanied by specialty guidebooks books with relevant maps and descriptions. Bert Underwood took the photographs for his company's Egypt set himself. With the addition of a learned text from world famous Egyptologist Henry Breasted, this set, in various versions, remained popular for some 30 years, and elements of it were still being sold when the stereoview phenomenon began its final glide into obsolescence in the 1930s.





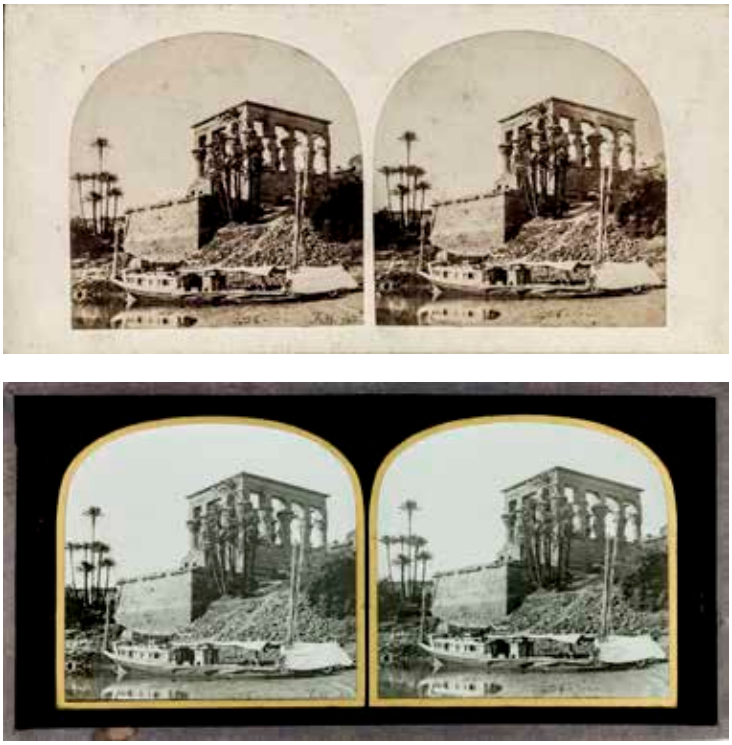
100-Image Boxed Set Tour of Egypt issued by Underwood and Underwood with accompanying book written by the American Egyptologist Henry Breasted, 1901.

Image Variants

Prior to 1900, technical and cost factors made amateur private photography impractical. Rather, stereoview production was an expensive and highly skilled endeavor, the cost of which needed to be recovered by commercial sale to an interested public. The photographer was only one component of a successful business model. Also required was an investor funded commission to generate original negatives that were then handed over for print production, marketing, and sales. Glass and paper prints of an identical image are common format variants. The finest quality images, printed as positives on glass, were luxury goods only the wealthiest could afford. Less expensive paper photographic silver emulsion prints, often made from the same negatives used for glass positives, were mounted on cardboard and sold at greatly reduced cost to an expanding middle class. Starting in the 1890s cheap photomechanical printing using the halftone method further lowered costs. These low resolution images, often poorly tinted, were printed directly on cardboard in huge numbers.

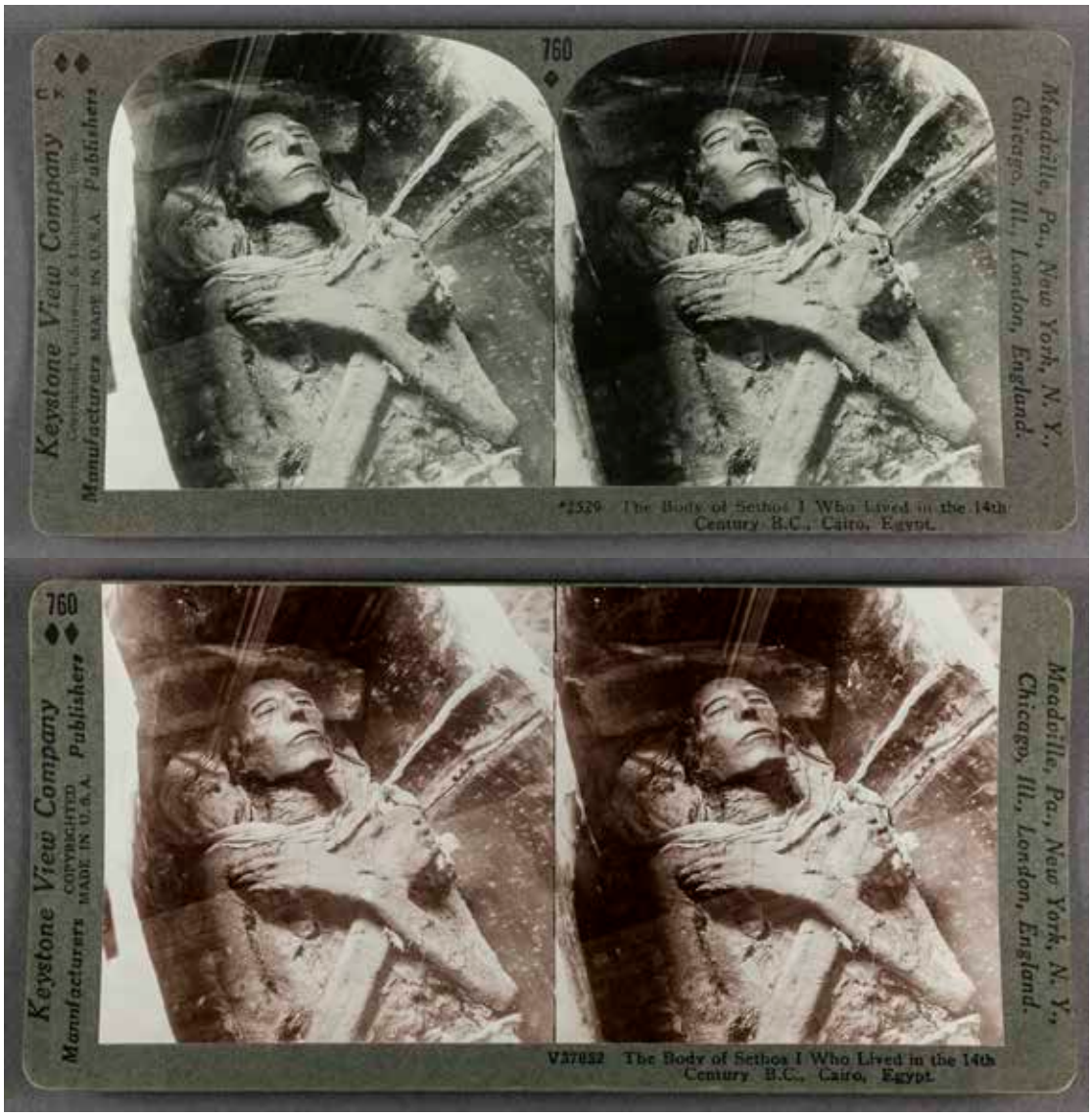
Pioneer stereophotographers in the 1850s and 60s had variable control over the way in which their images reached the public. Some, like the Englishman Francis Frith, were personalities and explorers in their own right, signing their work in the original negative and choosing a publisher who would make multiple prints under their direction for sale. More commonly, photographers were considered employees, or technicians, with the business backers not only taking credit for the work, but issuing prints according to their own agenda, in a manner that would maximize sales. Negatives were passed down to successors, and bought and sold between publishing houses. It is not uncommon for one negative to be issued over decades in different formats by different publishers. As public interests and expectations changed, captions themselves might change to reflect reissue as part of a series. Thus, a picture of the Sea of Galilee might be included in a Holy Land Tour series, as well as a Life of Christ series.

It is often difficult to know with certainty which surviving version of an image is the “original” issue. The variable image quality and preservation across formats and issues can provide a perplexing series of possibilities for reproduction, restoration and interpretation of an image.



Paper and glass versions from a common negative, printed within a few years of each other. Inexpensive paper and costly glass versions were made for different markets. Although more fragile, the glass versions had superior resolution and lack yellow deterioration caused by interaction between emulsion and paper, or degradation of the underlying paper over the years. Dahibeyah at Island of Philae, Francis Frith, c. 1859.

Original and production versions. This picture of an Egyptian mummy was taken as a rectangular glass negative, shown as a first generation contact print made for the production catalogue. Cropping for mounting on card stock was done in rectangular (sepia) and arched (grayscale) window versions mounted on card. Underwood and Underwood (later Keystone view company), Mummy of Seti I, original negative c. 1900.



Digital Fidelity

The intended uses of an image determine the type of digital processing required. Generally, the goal is to achieve fidelity between the original and digital images. But not all "fidelity," or adherence to facts, is the same.

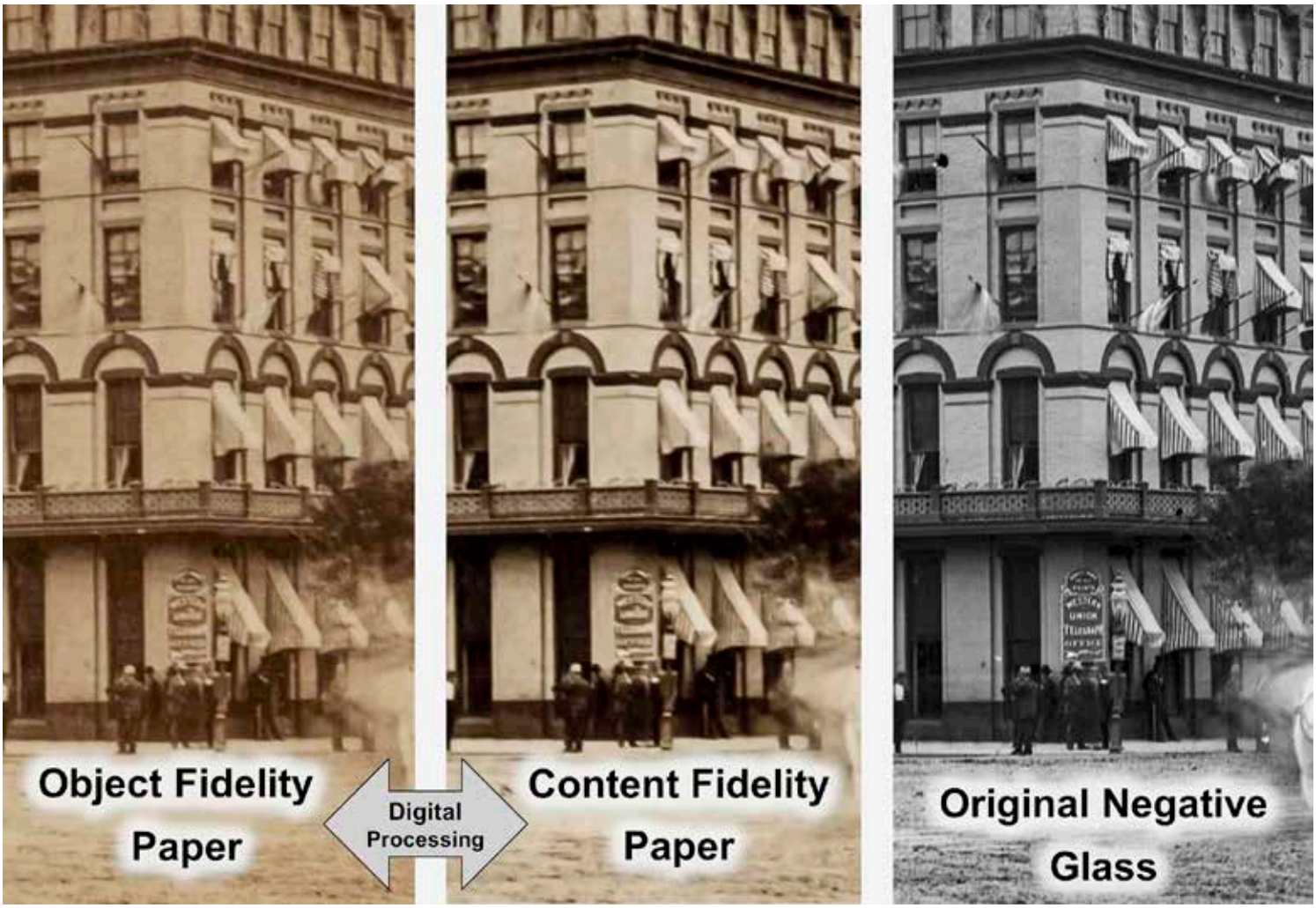
1. **Object Fidelity.** Pure documentary intent maintains fidelity to the physical object exactly as it is, complete with damage, and changes in color or contrast brought about over time. This is essential for museum, academic, and auction house work.

2. **Content Fidelity.** Fidelity to content is a different standard, whereby the image is optimized for viewers more interested in the image content than the physical photographic object. Image changes introduced by damage or deterioration since creation can in many cases be partially or completely reversed through digital restoration. High resolution digital zooming can display fine detail that was never accessible from the physically small original using legacy optics. Reversal of acquired damage from scratches, yellowing or loss of contrast, can both achieve greater fidelity to the artifact free originals while at the same time improving the viewing experience.

3. **Fidelity to the Photographer's vision.** This most difficult of all, is achieving fidelity to the photographer's intended vision. If the images were commissioned for sale, the photographer himself may be interpreting the extrinsic values of a commercial market. Often the surviving physical prints have been cropped, and image tones modified at the time of production without direct involvement of the original photographer. Captions are rewritten by an editor. Achieving fidelity to the original photographer's intent is thus an elusive endpoint.

Digital resolution of a 3 inch glass original digitized at 21 megapixels. The enlargement shows detail available on zoom, which is readily accessible to a viewer using contemporary digital displays.

Glass production negative and printed paper positive, 1876. Glass negatives could be used to print a positive image on paper glass. Retouching of the negative, such as reworking sky in this Philadelphia Centennial exposition image, was common. Reversal of the digitized negative provides crisp detail, full borders, and rich tones. The vintage paper print is now yellowed and cropped.



"Fidelity" in image versions. Three different image processing goals are represented here. Left: Object fidelity to a vintage paper print has no digital restoration, and a color balance matching a color standard included at the time digitization. Center: content fidelity of the same paper print is improved through digital restoration that includes enrichment of tone, restoration of contrast, conservative removal of yellowing, and smoothing of noise contributed by paper texture. Right: The photographer's intent is perhaps best approximated in the (reversed tone) original negative.

The Digitization Workflow

The various physical forms of stereophotographs, flat or curved, and the diversity of materials, glass or paper, present challenges for digitization. Paper requires a diffuse reflected white light, whereas glass must be backlit. All of these formats can be readily accommodated in a standard photographic light stand, illuminated either by a lightbox behind the image or tabletop lamps. High resolution capture previously required special flatbed scanners, but these have difficulty in imaging warped or curved cards, and special accessories are required for backlighting.

We here document our specific digitization protocol, as an example implementation. It is by no means required for success, as there are many workable alternatives. For example, scanning on a flatbed color scanner or drum scanner provides excellent color rendition and avoids perspective distortion of a misaligned or optically aberrant camera. Flatbed scanning can, however, be slow and yields very large tiff files designed more to preserve actual color fidelity than dynamic range during adjustment. Use of high quality apochromatic lenses and software removal of lens aberration artifact minimizes distortion when using a camera rather than scanner.

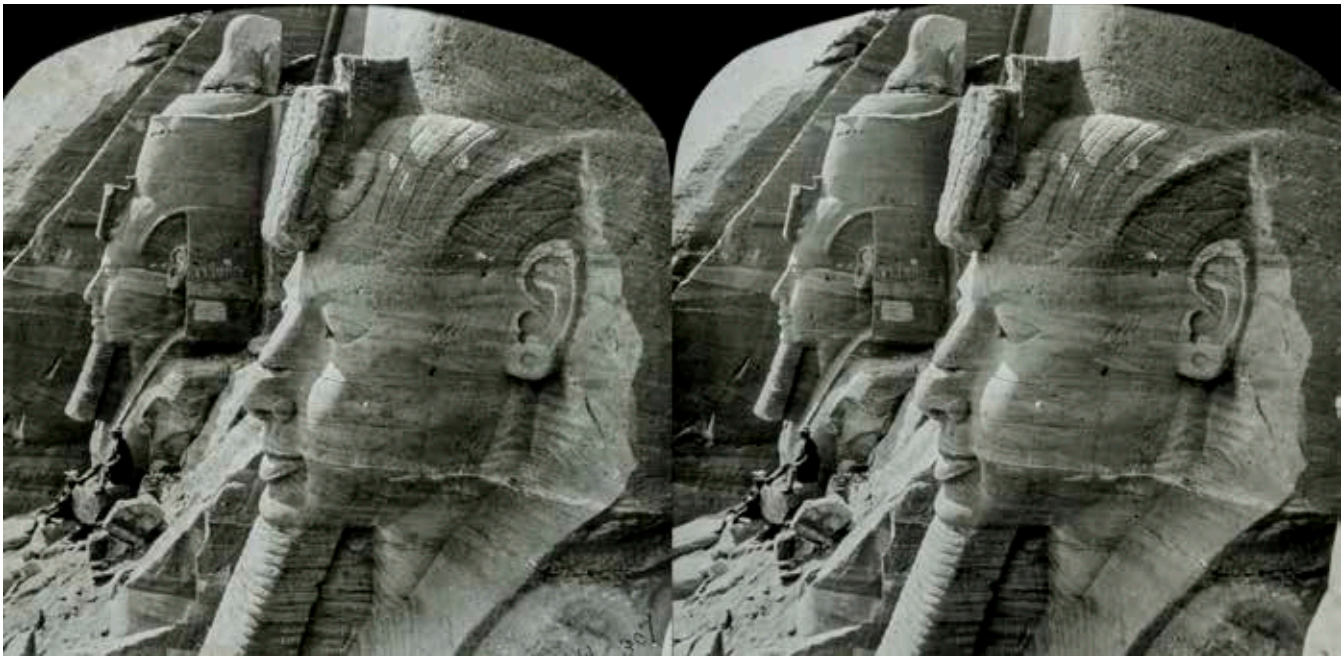
Original objects in the Photoarchive3D Collection were photographed on an aligned copy stand mounted

Copystand alignment of the camera leveled to the object platform is critical to avoid distortion. Multiple, diffused, daylight light sources in a dark room are provided by angled reflecters outfitted with diffuser screens.

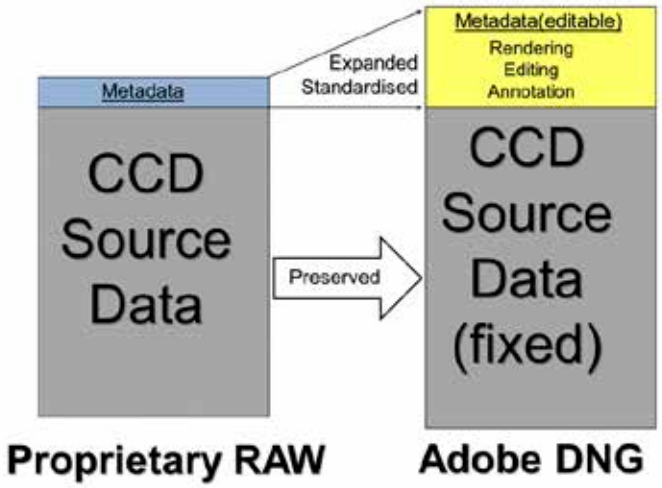
Image placement along a jig aligned to the camera field for primary photographic capture. Neutral photographic gray background and color standards facilitate high fidelity object documentation.

21 megapixel Canon eos 5D Mark two digital camera with 4400K daylight lighting. This produces a 5616 by 3744 pixel digital raw file at approximately 750 pixels per inch. Proprietary Canon raw files were converted to Adobe digital negative, DNG, format in Adobe Lightroom. Lens corrections were applied during import into Lightroom. The DNG format preserves original source data from sensors in the camera capture device (CCD) while standardizing access to an open source common standard. An additional advantage of the DNG format is embedding of metadata and image editing instructions in a file header which does not alter the lossless source image capture. Thus, a DNG master file can be edited or restored at will with complete reversal to the original state at any time. DNG files are easily exported as any common format including JPEG, tiff, gif, png, etc.

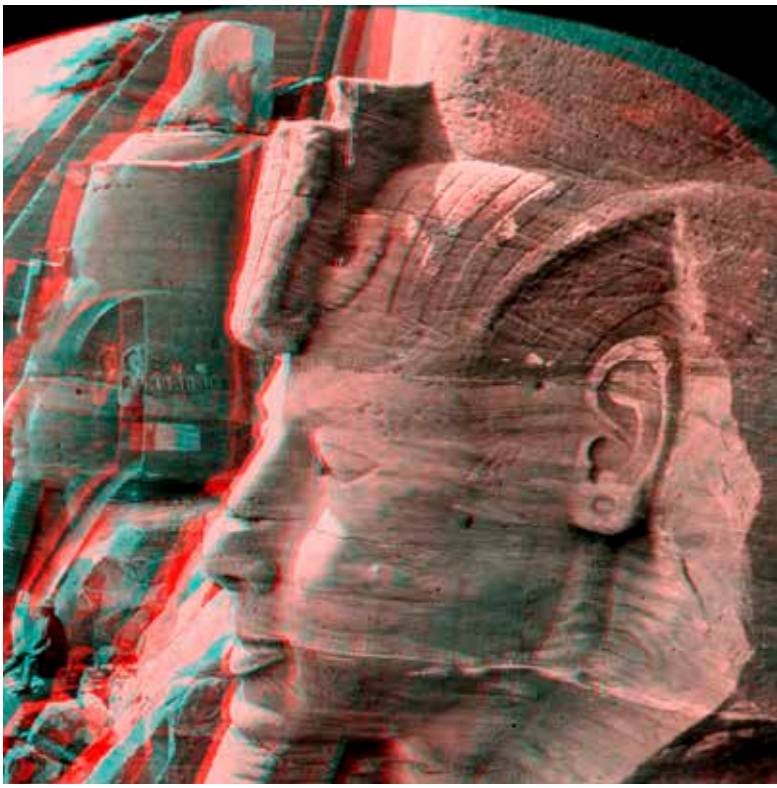
Image processing for public presentation typically includes digital restoration, export in lossless tiff format, and re-separation of left and right components into separate files cropped to proportions of actual image. The separate left and right half files can then be recompiled using software into 3D viewable format such as red cyan anaglyph (projection with red-cyan glasses), or multiple picture objects (mpo, for shutter glasses). We use Masuji Suto and David Sykes freeware software “Stereo Photomaker” which is available online at: [http://stereo.jpn.org/eng/stphmkr/].



Aligned, cropped, and color intensity normalized image pairs from vignetted glass stereoview. Left and Right sides are saved as different files that can be combined into a single frame in any display platform. Options include streaming separate sides to respective eyes (virtual reality headsets), dynamic swapping of sides on one display (shutter glasses), or overlay of differently tinted sides viewed through colored lenses (anaglyph).



The Digital Negative (DNG) file format created by Adobe in 2004 is a standardised container that preserves the source RAW data from the capture device (CCD) of many brands of camera. Image editing and annotation is nondestructive to the RAW data, but rather writes editing history to the file metadata. DNG files can be edited, resized, and converted to many other file types. Retention of editing history allows immediate redisplay and export of any state. Common states might include color card corrected unrestored images (fidelity to original), digitally restored images (fidelity to content), and various resized and cropped versions for specific applications.



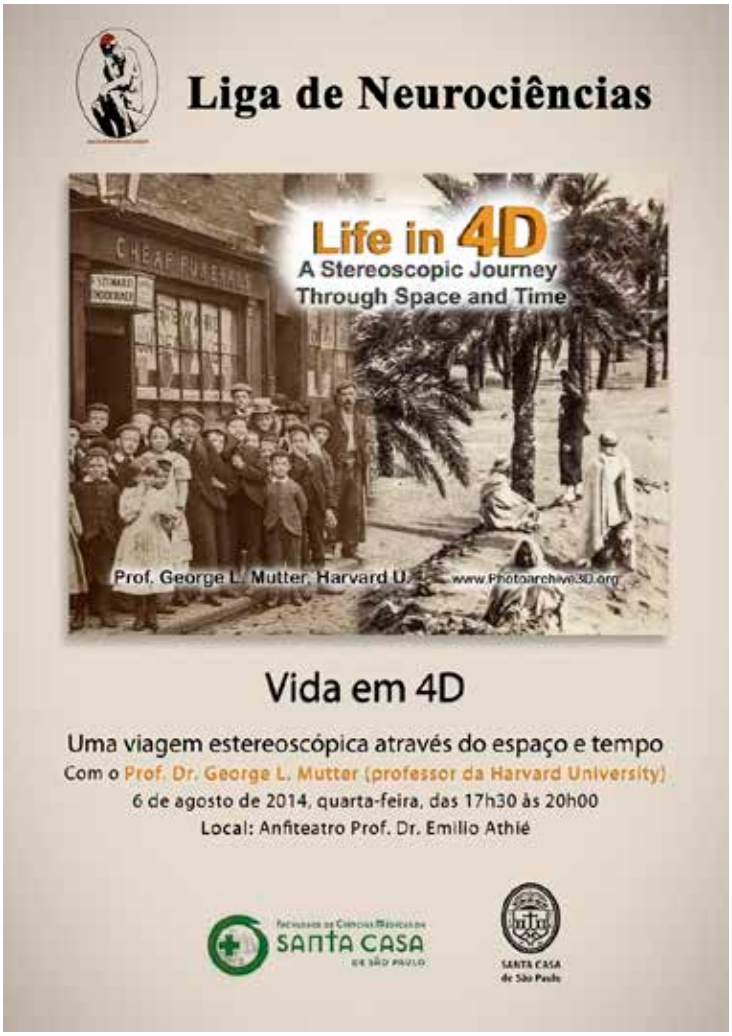
Red-cyan anaglyph. Right and left images are superimposed as independant color layers, to be viewed in 3 dimensions with red-cyan glasses.

Consumption of Digital Stereophotographs

Display modalities are ever expanding, both in concept and detail. All can be implemented from the starting point of a pair of separate right and left aligned images, the most flexible archive format of source files intended to be used across multiple display platforms.

In its least processed form, a photograph of the physical stereocard can be reprinted and viewed with an old style lenticular viewer. New versions of these dual lens viewers are available as lorgnettes (handheld), and dual lenses aligned to a fixed image window that can be placed against the print (Holmes style). An updated fully digital approach is projection of left-right pairs onto a small screen visible in 3D using virtual reality headsets (Oculus, Google cardboard).

Printed or projected anaglyph images can be viewed with special colored glasses in which the tint of the left and right lenses are inversely matched to the overprinted left and right images. Polarized projection avoids the color distortion of anaglyphs. Left and right pairs are polarized to different angles by passing the light output through differently rotated polarization filters. The viewer then puts on polarized glasses in which the rotation of right and left sides complements the intended source. Dynamic shutter lenses have emerged onto the consumer market of televisions and small theaters. This method displays left and right images alternatively on a single screen at a very high frequency. The trick is to don a pair of glasses in which the left and right lenses can separately and rapidly be electronically blackened n synchrony with the projection signal.



Contemporary audiences of historic stereophotographs have access to virtually every kind of activity and element of history, art, lifeways, geography, natural history and science from the early 1850s onwards. There will always be a substantial audience for stereoview images among scholars, researchers, academics, research and teaching institutions, and older students. Modern technology can revive and greatly improve what was in fact a major educational component of classroom instruction from about 1900 through 1940, when stereoview sets could be found in every American school system and many libraries. The potential here is only limited by the knowledge that such views exist, and digitization of images that makes them much easier to study.

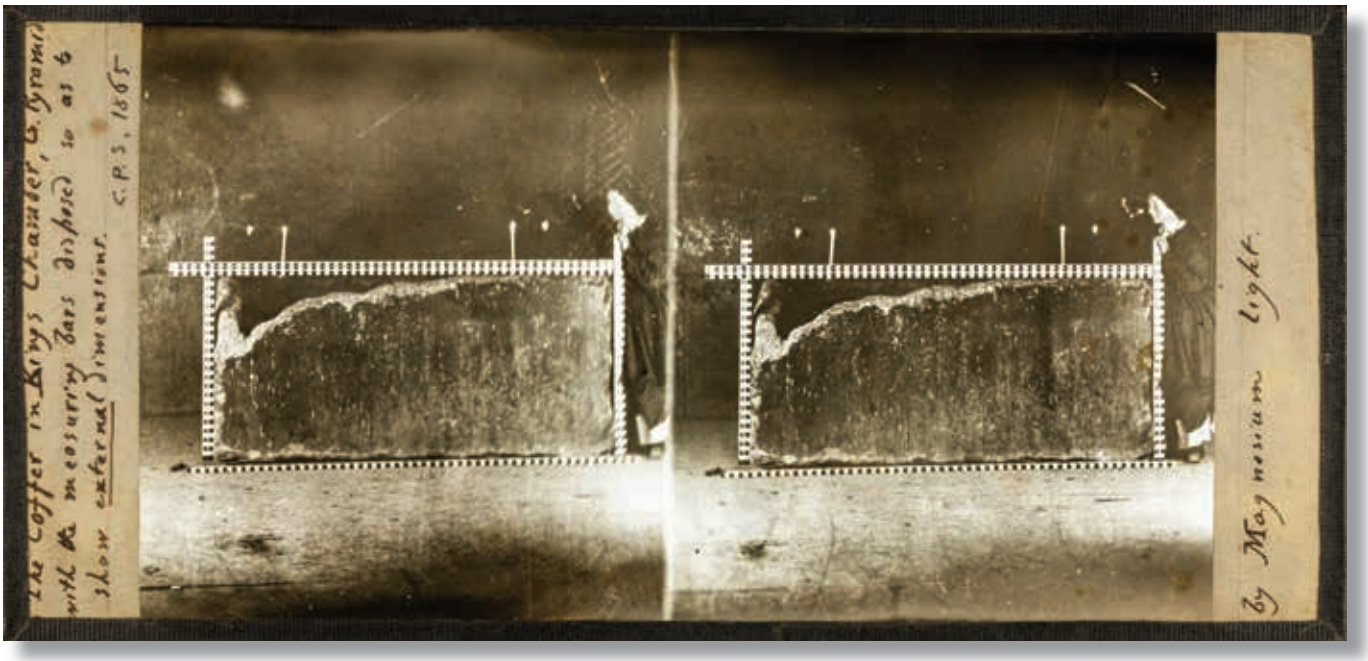
Photoarchive3D has not yet undertaken the marketing and distribution that would make its archive the major commercial or educational entity it has the capacity to become. The founders have given many presentations in 3D related to countries (Egypt, Russia, etc.), and themes (historic preservation, hunting, past lives, etc.). The audiences for these public topical talks have been very enthusiastic and are always thrilled to see the past presented in three dimensions, something they hardly imagined possible. One of the best received of these presentations was given at the annual conference of the New England Museum Association in Boston in 2014, which combined a stereoview survey of New England with the technical information to introduce the audience to the existence of stereoviews and to provide help for collecting institutions and private collectors considering how best to digitize or otherwise document their own images. That presentation was he basis of the essays presented in this booklet. We have also given presentations in the USA, Germany, England, and Brazil. Specialized audiences have included photo collectors, historians, art collectors, and 3D fans.

Image Gallery: Collection Highlights

Twenty one example images are reproduced here in full, from a total of 33,000 in the Photoarchive3D collection. These represent the variety of formats seen, range of locations and subjects encountered, and some rarities. Most were "published" as multiple identical copies for sale, of which only a fraction have survived. Others are unique: daguerreotypes, ambrotypes, autochromes and tintypes were all direct exposures in the camera developed as originals. Hand finishing of others such as tinted tissue or paper views rendered each different than another in their fine details. Some notes regarding digitization (digital rendition) are included. Object numbers (ObjNr-xxxxxx) are Photoarchive3D accession numbers.

The physical stereocard images shown here can be viewed right from the page with an old style lenticular viewer. New versions of these dual lens viewers are available as handheld lorgnettes and dual lenses aligned to a fixed image window that can be placed against the print (Holmes style). An excellent new issue of a modified Holmes style viewer for standard sized cards (7") is the Owl Viewer from the London Stereoscopic Company (http://www.londonstereo.com/).

Early stereoview manufacture ***ObjNr-201707***
Format: Square mount paper, hand tinted. 7" wide.
c.1856, France



First picture inside Great Pyramid, and first flash picture series outside a studio. ObjNr-008513
Charles Piazzi Smyth Manuscipt labels.
Format. Positive enlargement print on glass. Manuscript label. 7” wide.
Digital rendition: Composite digital image of transmitted (image) and reflected (mount) light.
1864, Egypt (printed 1865)

Venice (glass). ObjNr-209437
Format: Glass positive contact print with gilded passe partout windows. 7” wide.
Digital rendition: Composite digital image of transmitted (image) and reflected (mount) light.
c.1858, Venice

Ambrotype portrait of 3 women and a girl, with stereoviewer *ObjNr-010147*
Format: Wet emulsion negative produced on dark background glass. 7” wide.
Digital rendition: Reflected light capture appears as a positive image because of reversal effect of bright reflective silver deposits against dark glass background.
c.1855-7, UK

Daguerreotype portrait, tinted. Antoine Claudet *ObjNr-010502*
Format: Iodine sensitized, mercury fumed, silver plate. 7” wide.
1852-60, London

Slaves in sugar house ***ObjNr-202132***
Format: Square mount paper view. 7” wide.
1860, Cuba

Nude in paradise. ***ObjNr-008699***
Format: Glass medium format. Original is 13cm wide.
c.1890-1900, France

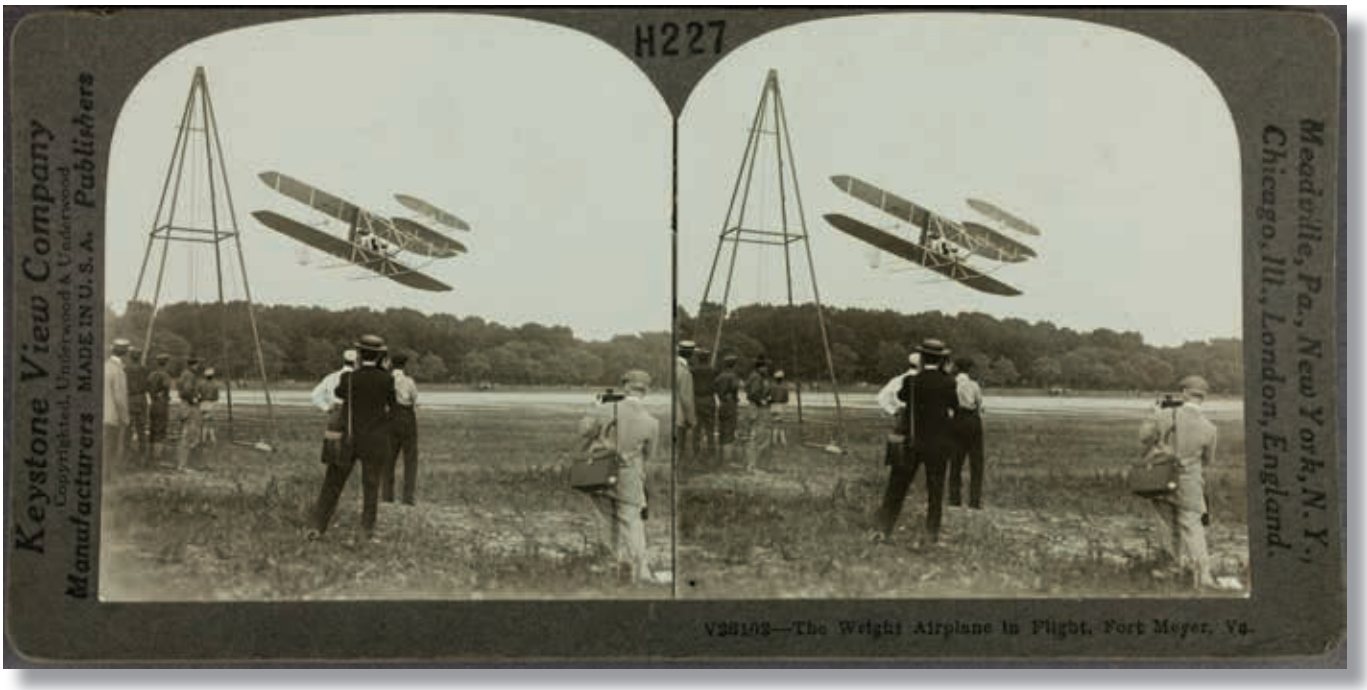
Jerome, youngest brother of Napoleon lying in state *ObjNr-004499*
Format: Albumen print on translucent tissue paper with hand tinted and pierced backing layer. 7” wide.
Digital Rendition: Reflected-light tissue view showing photographic image layer only.
1860, France

Jerome, youngest brother of Napoleon lying in state. *ObjNr-004499*
Digital Rendition: Transmitted light (backlit) tissue view showing photographic layer augmented by substrate piercings and painted backlayer.
1860, France

Autochrome, Child at Beach (glass). *ObjNr-005779*
Format: Colored microcopic starch granules with overlaid silver emulsion on glass. 13 cm wide.
Digital Rendition: Backlit, color provided by colored tinted "micro-dots".
1910, Scarboro, UK

Allied material abandoned on the beach, with German soldiers. *ObjNr-007429*
Format: Raumbild Verlag photopaper view. Original is 13 x 6 cm.
1940, Dunkirk, France

Tintype stereo portrait of Rev. John Robinson ***ObjNr-010511***
Format: Wet emulsion negative developed on black japanned metal substrate. 7” wide.
Digital rendition: Reflected light capture appears as a positive image because of reversal effect of bright reflective silver deposits against black substrate.
1870, USA



Wright brothers in flight. ***ObjNr-001835***
Format: 7”wideCurved paper mount.
1906, USA

St. Basil Cathedral, Moscow. (Zuccalmaglio) *ObjNr-010645*
Format: Salt Print , 7” wide
1855-60, Moscow, Russia

Moscovite peasant and his daughter *ObjNr-203962*
Format: Square corner paper mount, 7” wide
c.1855-60, Moscow, Russia

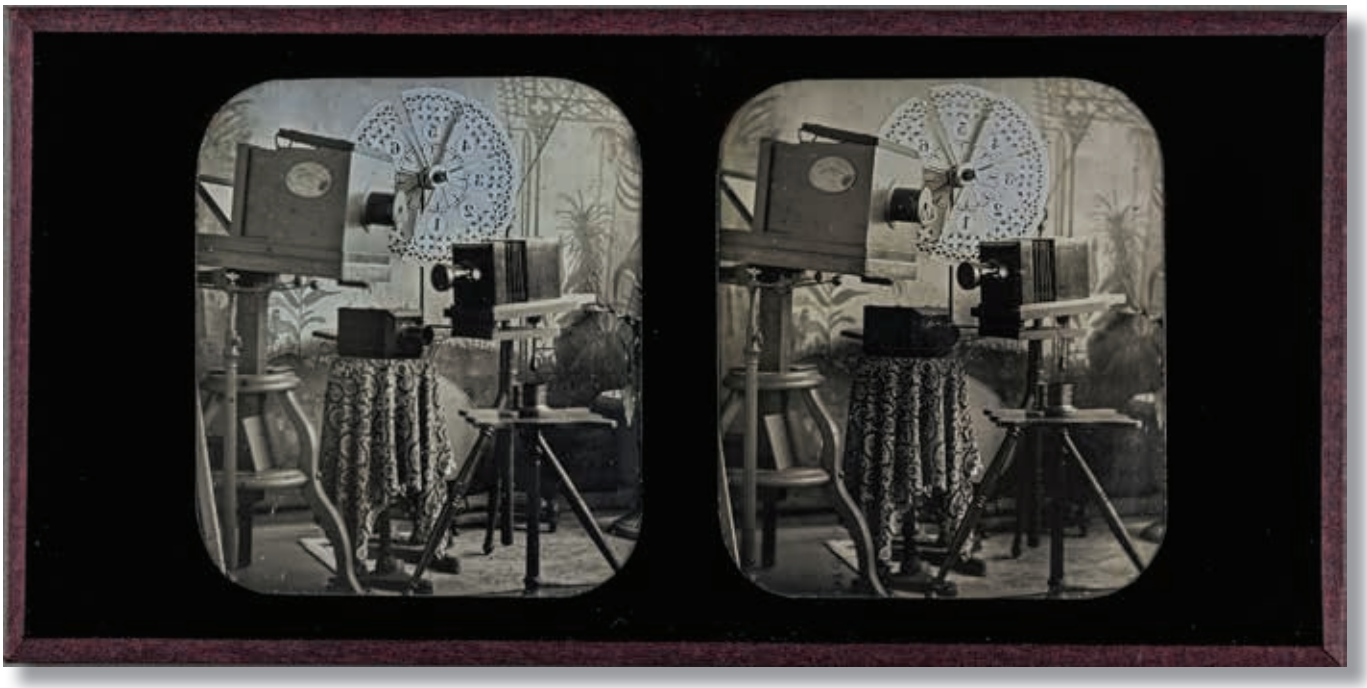
Head of Liberty statue at Paris Exposition ***ObjNr-209795***
Format: Glass positive, 7" wide
1878, Paris

Paris 1937 Exposition, stereo autochrome ***ObjNr-010299***
Format: Stereo Autochrome. 13 cm wide
1937, Paris

First Published photo of moon (on glass). De LaRue ***ObjNr-005695***
Format: Glass positive with overlaid paper vignette. 7" wide
1859, UK

Study of a chicken, Schreiber. ***ObjNr-003612***
Format: Paper mount. 7" wide
c.1875, Philadelphia, USA

American section at Paris Exposition (glass) *ObjNr-209823*
Format: Glass positive, hand tinted. 7”wide
1889, Paris



Century Darkroom photography equipment, daguerreotype. *ObjNr-010503*
Format: Silver clad metal plate, sensitized and then developed with mercury vapor. 7” wide.
2016, Mike Robinson, Toronto, Canada (https://centurydarkroom.com)

Cover:
Transcontinental Hotal, Philadelphia.
Located just outside the main entrance of the 1876 Centennial Exhibition.
James Cremer, Philadelphia, 1876.

Left: Paper Photo as preserved (fidelity to object).
Center: Paper photo, digitally restored (fideliy to content).
Right: Tone reversed original glass negative (fidelity to original)

This booklet is a series of technical essays abstracted from the The Photoarchive3D Handbook of Historic Stereophotographs. The Handbook contains additional background essays, a detailed description of the Photoarchive3D collection including statistics of the holdings, and a larger number of examples illustrated as full size stereo pairs. Visit our website or contact the authors for details.

Contact Us:
George L. Mutter: **gmutter@gmail.com**
Bernard P. Fishman: **bfishman77@gmail.com**
Website: **www.Photoarchive3D.org**

Published by Photoarchive3D.
1st Ed, September, 2018
www.Photoarchive3D.org

George Mutter (Left) and Bernard Fishman(right) have over six decades of combined experience searching for, and studying, historic stereophotographs. The prospect of bringing these to a broad audience through digitization launched what has become a fruitful collaboration, Photoarchive3D. The result is a freshly digitized archive of approximately 33,000 original photographic stereo images covering many subjects, most of which has not been seen by the public in the last century.

George Mutter trained in medicine at Harvard and Columbia, is currently a Professor of Pathology at Harvard Medical School. He is a prolific scientist and educator, having authored over 100 scientific papers, and delivered numerous invited lectures internationally. Bernard Fishman is an Egyptologist trained at Columbia U. and U. of Pennsylvania. He worked in Egypt with the Oriental Institute of the University of Chicago before becoming a nonprofit institution administrator. He is presently the Director of the Maine State Museum in Augusta, Maine.

Tintype wetplate photo by Mark Bingham, Portsmouth, New Hampshire, 2011.

www.Photoarchive3D.org

ISBN: 9780464817307
Publish Date Sep 16, 2018