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Preparing and Digitizing Brittle 19th- and 20th- Century Newspapers

Mark Coulbourne,
Bryan L.W. Draper,
and Robin Pike

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ABOUT THE PUBLICATION

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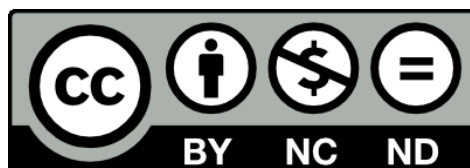
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Abstract

Digitizing brittle paper can be a difficult task that may cause tears and fractures, even when the material is carefully handled. Brittle paper in many formats can be found in archival collections. Bound newspapers in large, unwieldy, and deteriorating bindings pose a challenge for digitization by their size and number of pages. When charged with preparing late 19th- and early 20th-century brittle newspapers for digitization, the University of Maryland (UMD) Libraries developed a new process that serves as an effective, time- and budget-conscious approach to stabilizing brittle paper while preparing it for digitization. Those tasked with preservation and digitization can use a minimal amount of archival-quality tape, PhotoTex™ paper, and polyester folders, to enable extremely brittle newspaper to withstand the turns, flips, and movements required for optimal digital capture. Project staff can then select appropriate digitization and digital preservation standards available through their institution or partnerships to ensure a one-time digitization process, ideally using an overhead digitization setup to facilitate minimal pressure on the brittle pages. Lastly, the repository can store stabilized original newspapers in perpetuity in an organized and space efficient manner.

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Introduction

As the Industrial Revolution progressed throughout Europe and America and literacy rates increased during the 19th century, the demand for paper production forced the shift from the relatively stable, rag-based hand papermaking towards mechanized, groundwood-pulp papermaking. Wood pulp became the basis for “newsprint” paper made on large, high-speed papermaking machines that then fed the large, high-speed printing machines that produced newspapers.¹ Mechanical wood-pulp has less cellulose content than rag-pulp as well as other unstable ingredients, such as lignin. In addition, new developments in papermaking such as chlorine bleaching, and alum-rosin sizing produced cheaper paper in larger quantities.² While all these so-called improvements allowed for the explosion of print journalism, an unfortunate consequence was unstable, acidic paper that quickly discolored and became increasingly brittle over time. This “era of bad paper”³ spans from about the latter half of the 19th century to the 1980s.

The modern era has increased the demand for the digitization of paper records. This, in turn, has created a need to ensure that paper can safely and efficiently undergo this process. This is especially true when digitizing brittle, wood pulp-based papers. The method described herein will allow for digitization to occur with minimal disruption to the normal process while providing the means for protecting and preserving the paper.

Digitization Concerns

When evaluating a newspaper collection for digitization, the paper needs to be stabilized so that in-house labor can carefully handle each page to be digitized. This requires a mechanism for safely handling the issues and turning the page. Alternatively, if the collection holder lacks in-house capability to digitize overhead (e.g., planetary scanner or digital camera and copy stand), then the materials need to be protected enough for shipping to a vendor with this capability. A trained professional will need to separate the leaves to allow them to be turned safely because a fold in the paper creates a weak point that requires the digitization technician to handle a leaf more times. Most bound newspapers will yield single leaves when

disbound. For unbound newspapers that retain their gutter folds, the project staff should consult any applicable collections staff whether to separate the folds before proceeding. Often, older runs of bound serials or newspapers have pages, issues or entire bound volumes missing. Collections staff can also provide curatorial input on whether missing content can be procured. The completeness of a collection may help determine the priority or value of a digitization project. While an institution can only digitize the content it physically owns, the issue of completeness may be mitigated through inter-institutional collaboration, crowdsourcing, and the digital reunification of missing material.

Techniques for Disbinding

There are many methods of binding paper; and therefore, the techniques used to disbind vary accordingly. Because the possibilities are too numerous to consider within the scope of this publication, the following discussion focuses on a single method of disbinding. The goal of disbinding is to remove the text block from its binding and separate the leaves with as little loss or damage as possible. In addition, the technique employed should preserve as much margin as possible as binding efforts commonly involve consolidating the text block along the left margin and trimming the other margins square. This binding procedure commonly reduced the blank margins around the text or even cut away text. If the bound newspaper has been sewn through the fold, the archivist may want to consider simply cutting the sewing threads that are visible at the center pages of the sections or signatures which should allow the text block to open more fully. This allows greater visibility of the inner text margins and for the text block to remain in its protective binding.

The following equipment (see Figure 1) was used for the method described below (see Appendix D: Suppliers for purchasing options):

- Metal straightedge
- Utility knife (with either snap-off blades or replacement blades)
- Small snap-off blade knife
- PhotoTex™ Paper (cut slightly larger than newspaper page)
- Micro spatula

- Weights covered in book cloth
- Cut-resistant surface

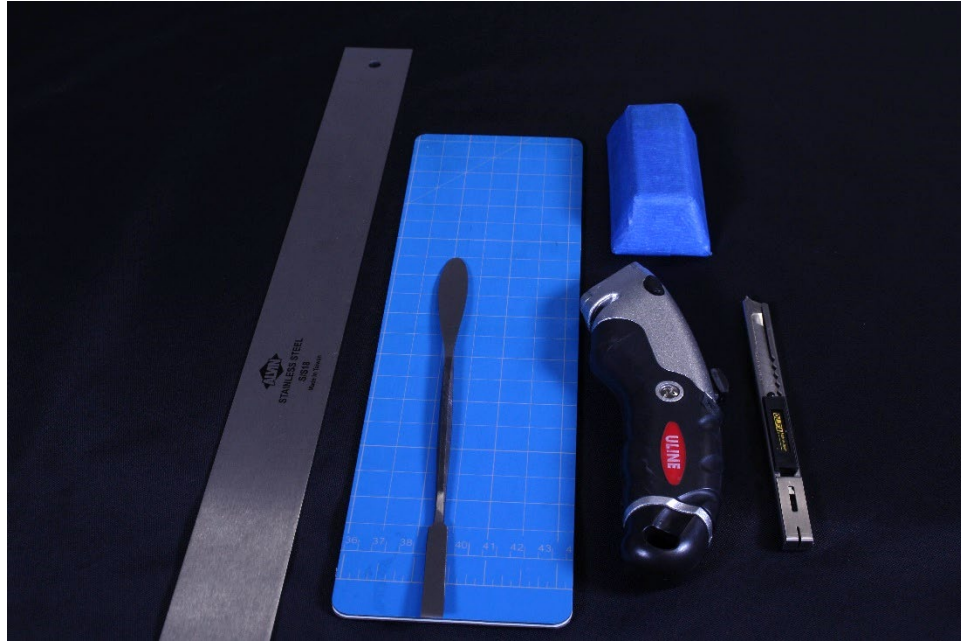


Figure 1. Disbinding supplies. From left to right: Metal straightedge, cut-resistant mat, micro-spatula, utility knife, cloth covered weight, small snap-off blade knife.

SETUP

1. Place the bound papers onto a stable flat surface with a cut resistant mat (or equivalent)
2. Open the binding as far as possible and expose as much of the gutter as possible.
3. Place the weights on the open portion. This will keep the binding open and will free up a hand.

USE

1. Set the metal straightedge as close as possible to the bound edge and leave enough room for the blade of the utility knife.
2. Using light pressure run the blade of the utility knife against the metal straightedge releasing the paper from the binding (see Figure 2).
3. Continue to use light pressure and repeat Step 3 as often as necessary to disbind all the paper.
4. Use micro spatula to separate papers if necessary.

5. While disbinding the volume, place the loose leaves onto the pre-cut pieces of PhotoTex™ to provide extra stability (see Figure 3). It is critical to maintain the correct order of the leaves or pages.
6. Note on handling and transporting oversized, brittle leaves: Once the leaf is detached, carefully lift it by gently grasping diagonally opposite corners to place it on a sheet of PhotoTex. Once the leaf is centered on PhotoTex, handling becomes easier as the brittle leaf will be supported by the PhotoTex's concave surface.

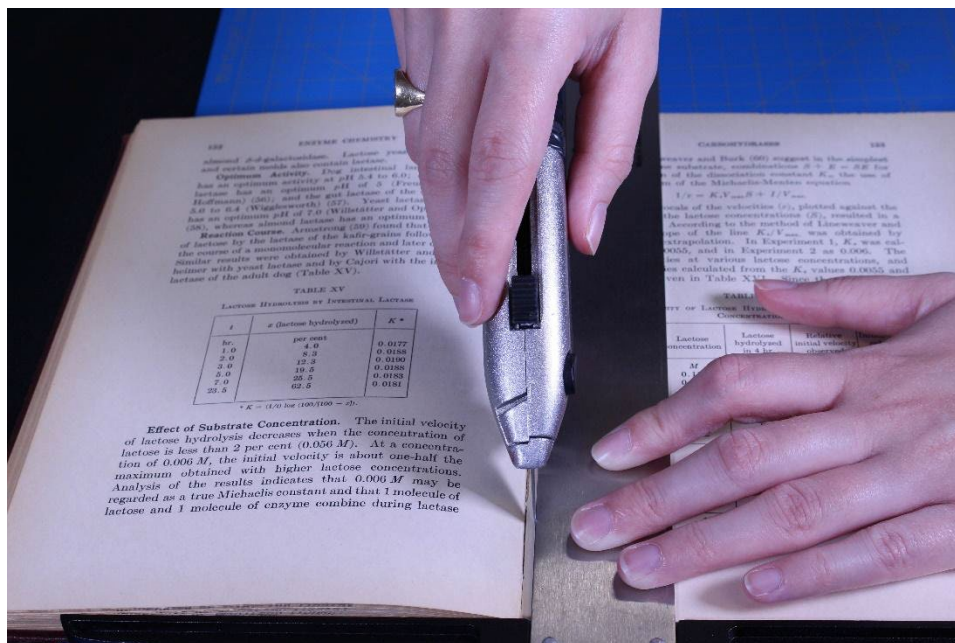


Figure 2. Using metal straight-edge and utility knife to disbind.

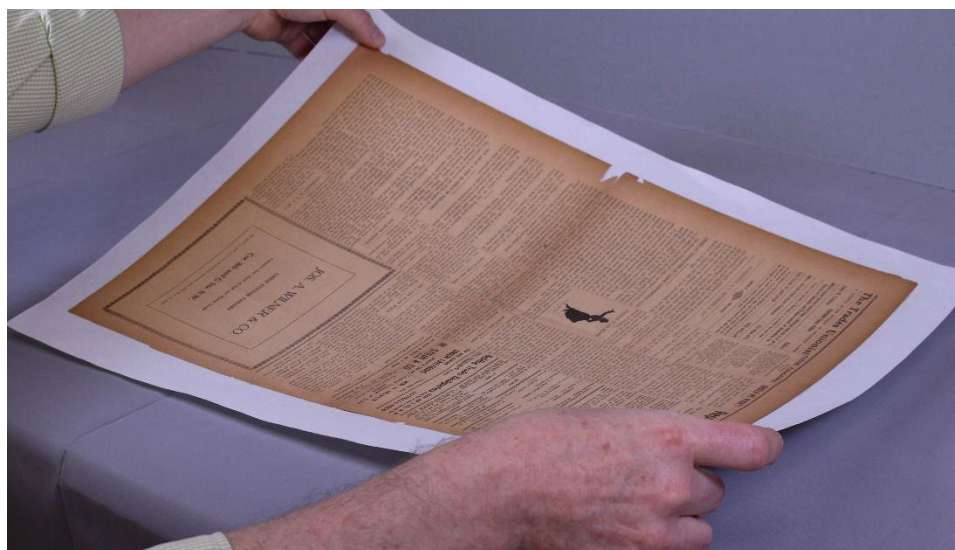


Figure 3. Using PhotoTex™ to support leaf.

Surface Cleaning

Prior to any repairs, project staff should remove any surface deposits such as dirt, dust, or soot that are within the text block and obscuring text if it is practical and desired by the curator. If the paper is brittle, project staff should strongly consider whether the surface soiling will impact the finished product or if the risk of potential damage from surface cleaning is too great to proceed.⁴ If there are additional questions or concerns about surface cleaning, then the Northeast Document Conservation Center (NEDCC) provides an excellent resource with additional information, which can be found on its website.⁵

Using the methods described below, the following supplies (see Figure 4) will be necessary (see Appendix D: Suppliers for purchasing options):

- Dry cleaning sponge (cut into small, easily handled pieces)
- A vinyl non-abrasive eraser (Magic Rub™ or equivalent)
- Eraser crumbs
- Brushes



Figure 4. Surface cleaning supplies. From left to right: Vinyl non-abrasive eraser, soft-bristle brush, eraser crumbs, dry-cleaning sponges.

USE

1. When cleaning with any of the products, always start by brushing off any loose debris or dirt that might be clinging to the surface of the paper.
2. If the surface dirt is a small spot, then either a piece of sponge or a white eraser can be used (see Figure 5). Work in small strokes away from the stain and away from any tears or losses in the paper. It will be possible to tell if the stain is being removed immediately by a color change on the sponge or eraser.
3. If the area to be cleaned is large, then eraser crumbs should be used instead of an eraser or sponge. Place a small amount of crumbs onto the stain and use a gloved fingertips to move the crumbs around in a gentle motion. If the crumbs work to remove the stain, it will be possible to tell because the eraser crumbs will change in color from bright white to a grayish hue.
4. After surface cleaning you should always brush away the crumbs into a waste canister using a brush.

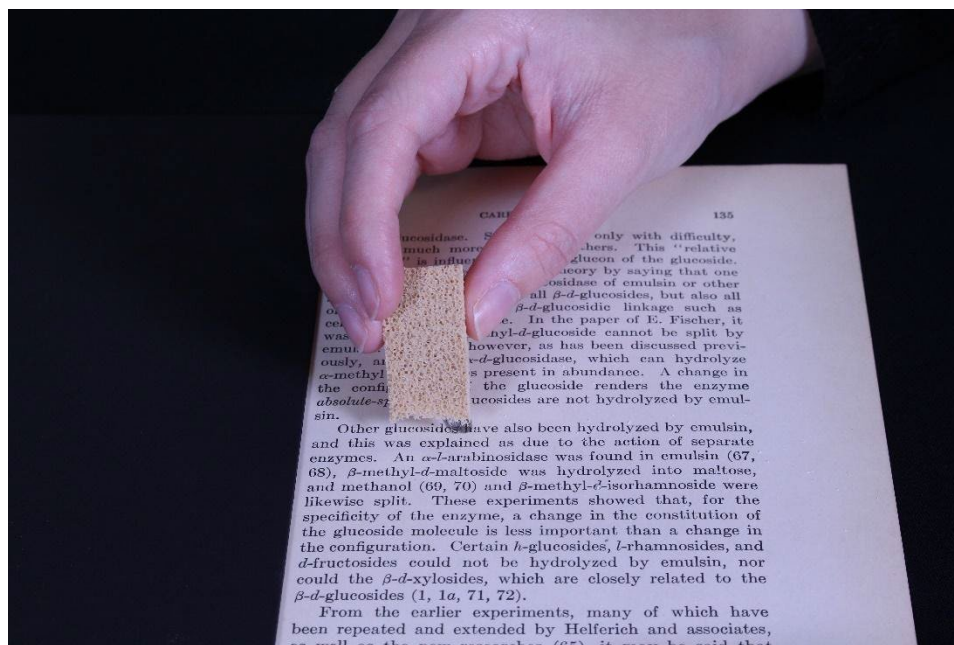


Figure 5. Surface cleaning with dry-cleaning sponge.

Methods of Paper Repair

Because brittle paper is easily damaged, archivists may find paper repairs will be necessary prior to handling by digitization staff. While there are numerous methods for repairing brittle paper, the focus of the following method includes using both Neschen filmoplast™ P 90 tape for simpler tears and Neschen filmoplast™ R heat-set tissue for complex tears and to fill in losses. Neschen filmoplast™ P tape is transparent, self-adhesive, buffered with calcium carbonate (CaCO_3) and is soft enough that it would not cause further damage to the paper.⁶ Neschen filmoplast™ R heat-set tissue is transparent and can flex and bend which is important when repairing complex tears and filling in losses.⁷ When preparing brittle materials for digitization the number of repairs that are necessary can seem overwhelming at first. Because of the potentially large number of repairs, it may be more useful to focus on the tears that are within the text block, as these would affect the legibility of the document. The methods described below are focused exclusively on these areas.

Relaxing Folds and Creases in Brittle Paper

Dog-eared pages and creases that can form in paper over time can obscure text, render a leaf out of plane, and snag during handling. In brittle paper, these folds and creases can fracture causing text to become detached. A simple and efficient method for relaxing and flattening folds or creases involves slightly moistening the fold with a mixture of 50% distilled or deionized water and 50% ethanol. (If reagent-grade ethanol is unavailable, 190 proof or 95% grain alcohol, such as Everclear®, can be substituted. See Appendix D: Suppliers for purchasing options.)

Using a 50% ethanol mixture contains enough water to swell the paper fibers and allow them to relax without completely wetting the area. The ethanol improves penetration of the mixture, decreases the drying time, and prevents tidelines in the paper.

You will need the following supplies (see Figure 6):

- A small bottle (about 2 ounces or 100mL, glass or plastic) to hold the mixture precisely labeled (the bottle can be placed in a small dish to prevent upsetting the bottle and spills)
- A medicine dropper
- A cotton tipped applicator, such as a Q-tip
- A small artist's watercolor brush(s), size from 4 to 9, pointed round style, of natural or synthetic fiber but not bristle
- Blotter paper, cut to small squares
- Non-woven polyester interleaving (or interfacing) such as Hollytex®
- Small weights

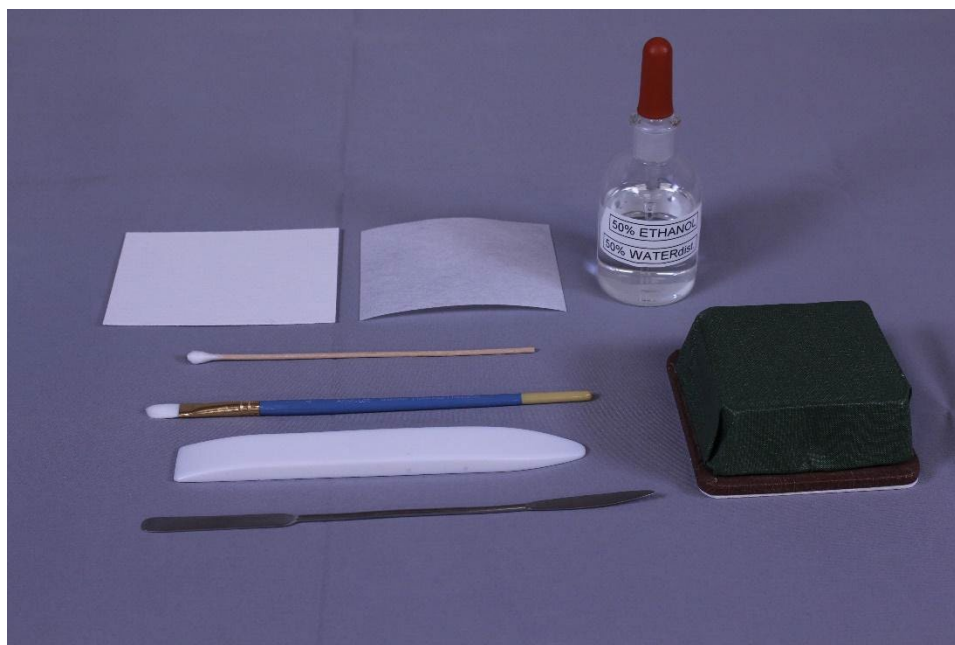


Figure 6. Supplies for relaxing folds. From top left to bottom right: Blotter paper, Hollytex®, bottle of ethanol and water mixture, cotton swab, small paint brush, covered weight, bone folder, micro-spatula.

SETUP

1. Position a square of blotter and Hollytex® under the crease or fold with the Hollytex® in contact with the paper (see Figure 7). Hollytex® is a porous, but non-reactive, polyester fabric with a smooth surface ideal for drying and flattening.
2. With the dropper, apply the mixture to brush (or cotton applicator) to fully wet but not saturate the brush. Briefly touch the brush to a square of blotter to remove excess mixture and prevent drips (see Figure 8).
3. Lightly brush or dap the outside of the crease or fold with the brush. As the water swells the paper fibers, the fold should begin to open. Additional mixture can be applied gradually to the inside of the fold as needed; apply just enough mixture to allow the fold to be flattened without breaking (see Figures 9 and 10).
4. Once the fold has been relaxed and can be opened without breaking, lay a square of Hollytex® on the treated area followed by blotter and allow to dry under weight; drying time is about 5 minutes (see Figures 11 – 14).

5. Remove the upper blotter and Hollytex® to confirm the fold has been reduced or flattened. If not, repeat steps 2 through 4.

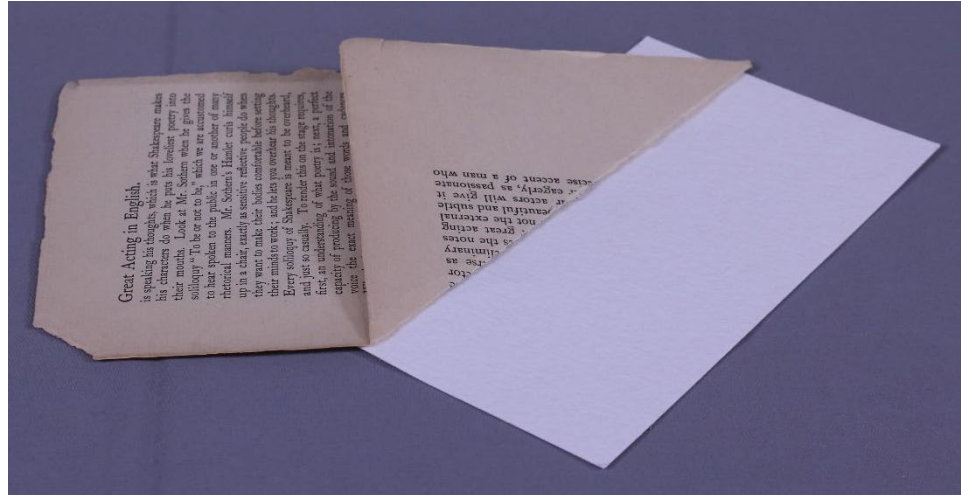


Figure 7. Leaf on blotter or Hollytex.

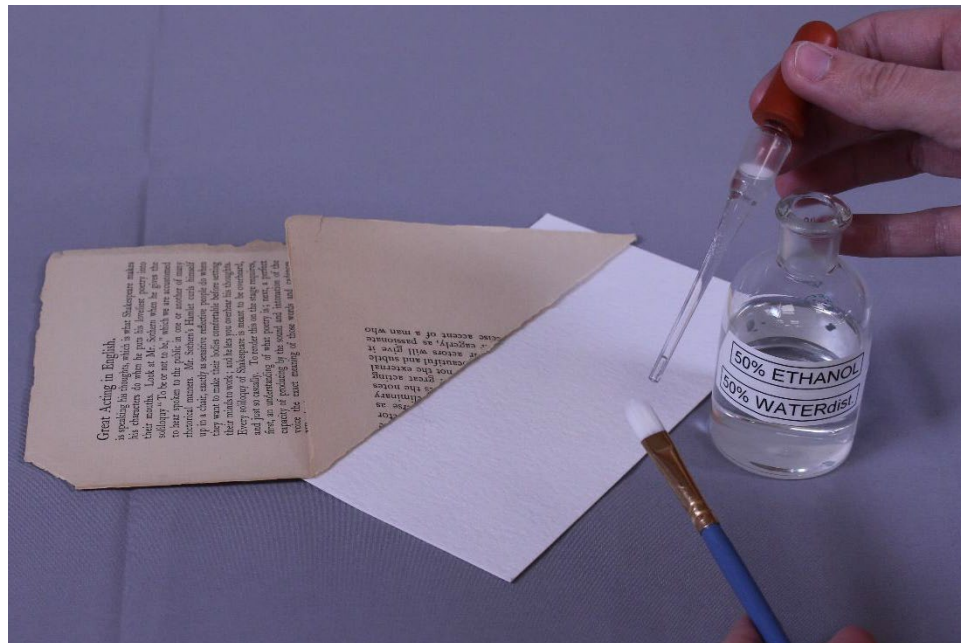


Figure 8. Wetting brush with ethanol mixture.

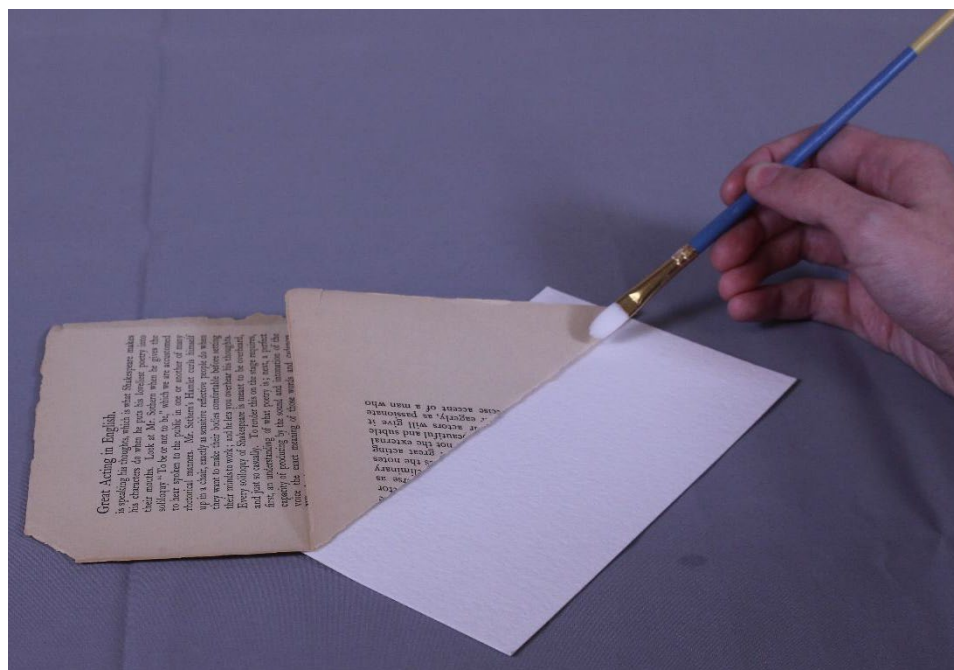


Figure 9. Brushing ethanol mixture onto fold.



Figure 10. Leaf moistened with ethanol mixture.

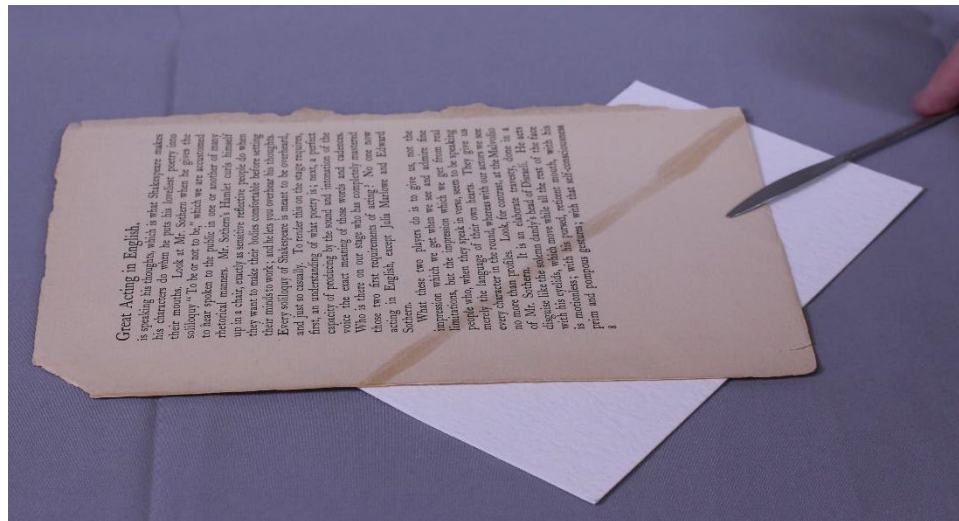


Figure 11. Flattening out fold.

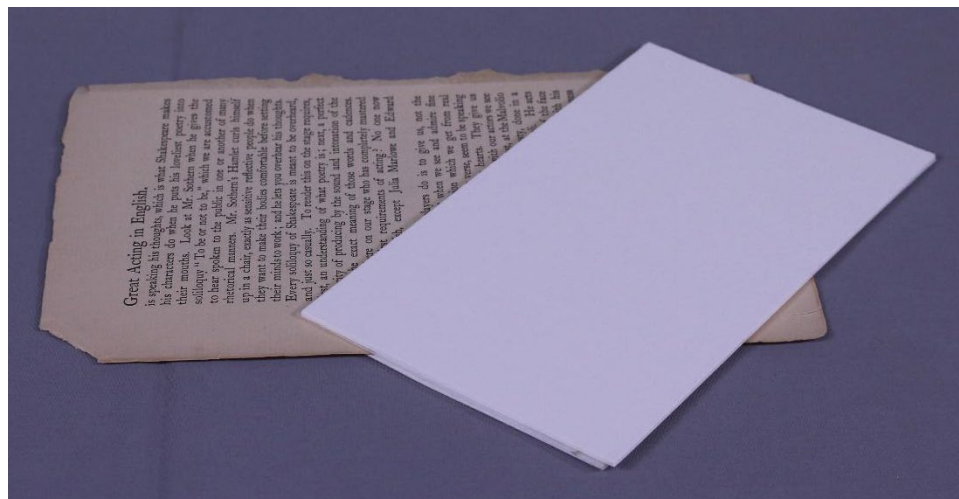


Figure 12. Blotter or Hollytex on moistened fold.

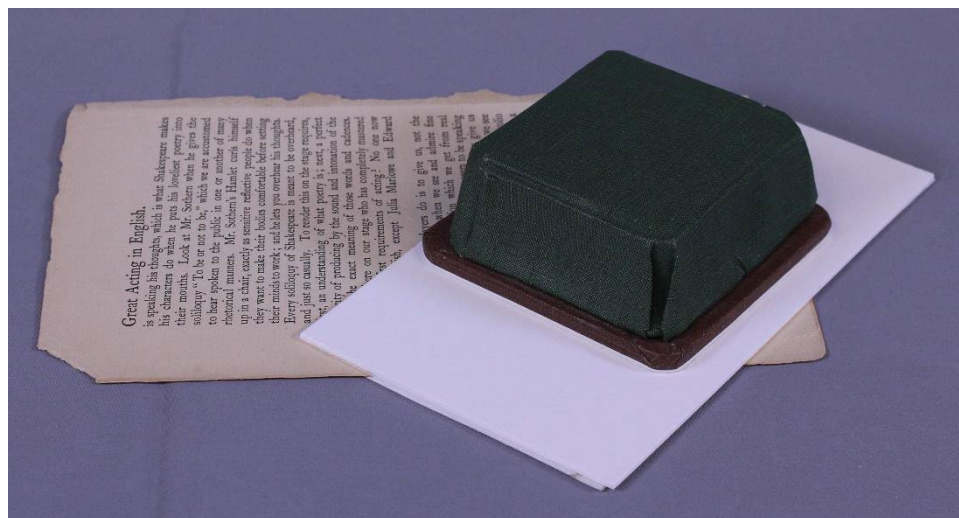


Figure 13. Weight on blotter or Hollytex.

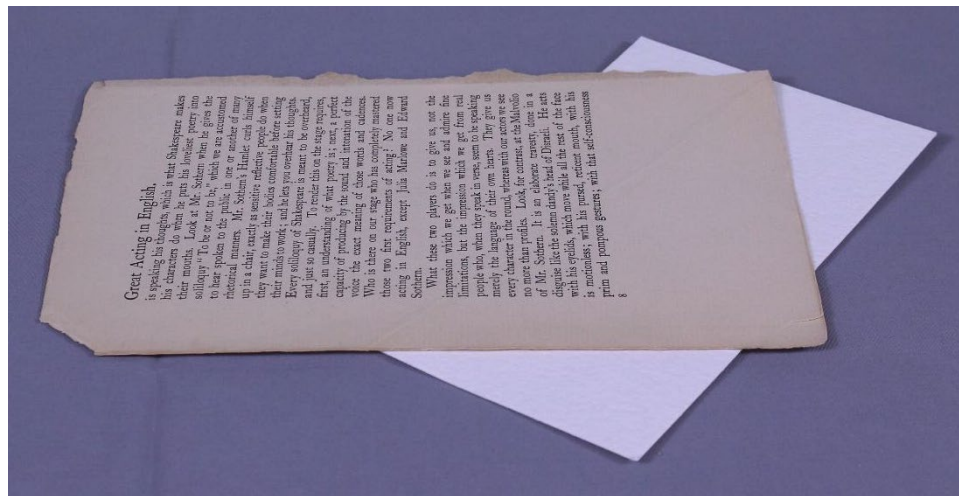


Figure 14. Leaf flattening completed.

Small or Minor Repairs

This repair method involves the use of small pieces of archival tape (approximately 5mm wide and 2 cm long) that are cut from the roll of tape. This helps to minimize the amount of tape being used.

Described below are the equipment and supplies (see Appendix D: Suppliers for purchasing options) as well as the methods that have been successfully used by preservation staff for small or minor repairs. While the following items are recommended, it is possible to achieve the same results with equivalent pieces of equipment (see Figure 15):

- Roll of Neschen filmoplast™ P 90 tape
- Small piece of glass (approximately 8 inches by 10 inches) with two pieces of non-slip, adhesive-backed rubber attached to the verso side
- A number 4 scalpel handle with number 24 scalpel blade
- Bent-nose tweezers
- Bone folder (natural or synthetic bone are acceptable)
- One small weight covered in book cloth, and two small plastic-coated weights.



Figure 15. Setup for small repairs. From left to right: Small piece of glass with non-slip adhesive backed rubber, scalpel handle with scalpel blade, box of filmoplast™ P 90 tape, bone folder, bent-tip tweezers.

SETUP

1. Open the tape box and unreel approximately 12 inches of tape. Close the box with the tape protruding from the tape slot. Place the box of tape on a flat surface with the tape slot down and the 12 inches of tape laying on the surface with the release paper facing

up. Place the glass (with the non-slip rubber side down) over the tape. Place the tape release paper side down on top of the glass surface. Use the weight at the top of the glass plate to keep the tape taut while working with it.

2. Using the scalpel, cut the tape lengthwise so that there are either two or three equal sized strips of tape (see Figure 16).
3. Using the scalpel again, cut small pieces of tape from the longer strips for making necessary repairs to the damaged paper.

USE

1. Working on a stable flat surface, place the plastic-coated weights onto the paper to ensure it does not move during the treatment process.
2. Use the tweezers to pick up the tape and place it on the aligned tear or fragment (see Figures 17 and 18).
3. Use the pointed end of the bone folder to burnish, or gently rub the tape until it is clear tape (see Figure 19).
4. Repeat as often as necessary, preparing additional tape as needed.

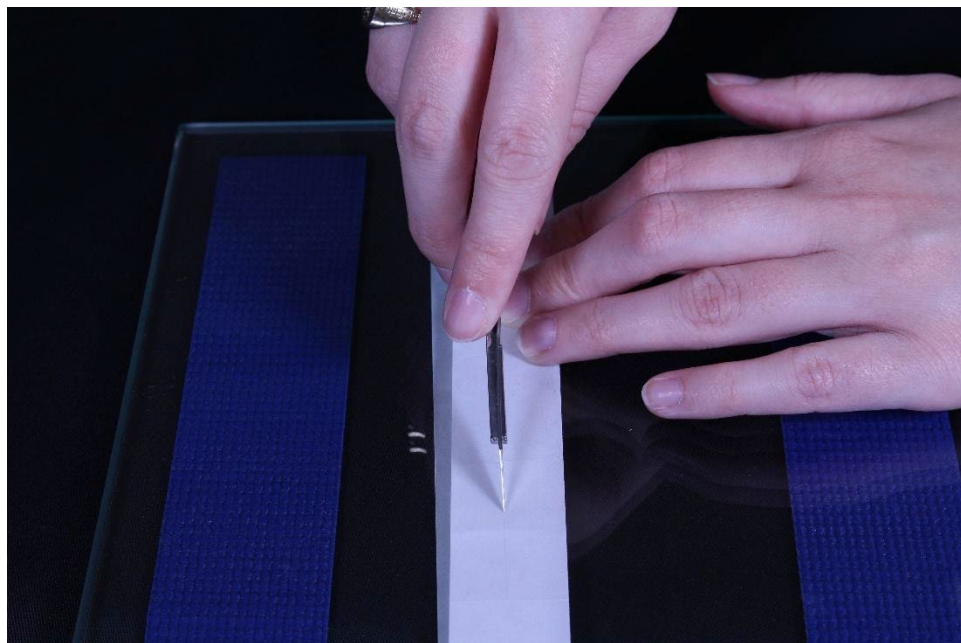


Figure 16. Cutting Filmoplast with scalpel.

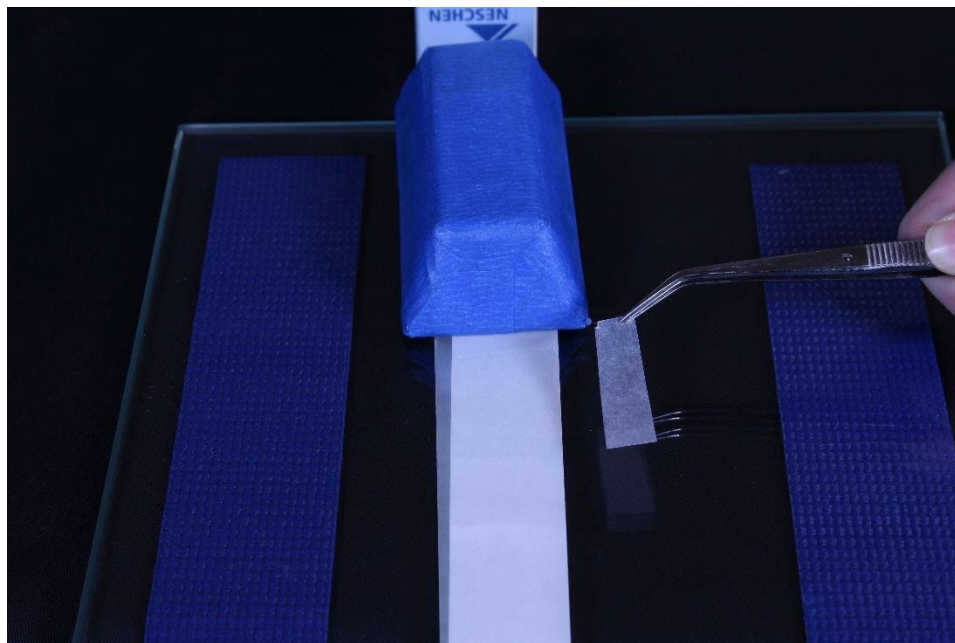


Figure 17. Cut strip of Filmoplast.



Figure 18. Placing Filmoplast strip on tear.



Figure 19. Burnishing Filmoplast with bone folder.

Large Repairs

This repair method involves the use of medium to large pieces of heat-set tissue to repair larger tears and as a fill for areas of loss. Preservation staff have used the methods described below with the following equipment and supplies (see Figure 20 and see Appendix D: Suppliers for purchasing options):

- Roll of Neschen filmoplast™ R heat-set tissue
- Adjustable temperature tacking iron
- Two pieces of silicone release paper (can be any size that is comfortable to work with, but is larger than the areas that need to be repaired)
- Bent-tip tweezers
- Scissors
- Small covered weight

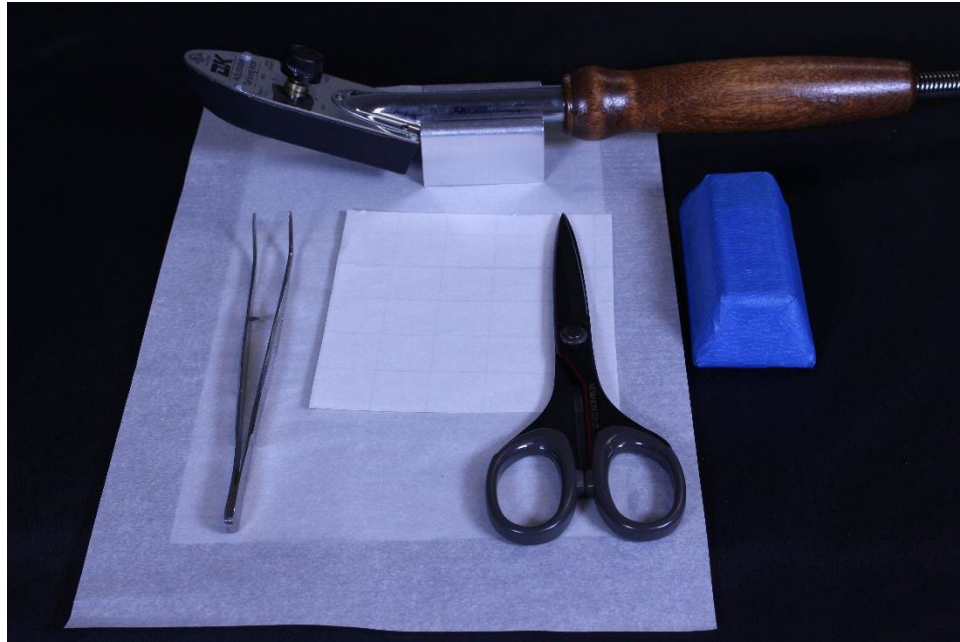


Figure 20: Tools for heat-set repairs. From left to right: Two pieces of silicone release paper, adjustable temperature tacking-iron, bent-tip tweezers, small sheet of filmoplast™ R heat-set tissue, scissors, covered weight.

SETUP

1. Work on a heat-resistant flat surface (a silicone craft mat would be sufficient) with enough space for the paper requiring repair to lay flat.
2. Plug in and adjust the temperature of the tacking iron. The maximum temperature for filmoplast™ R is 100 degrees Celsius or 212 degrees Fahrenheit.⁸
3. Place one of the sheets of silicone release paper under the area to be repaired.

USE

1. Using scissors cut the heat-set tissue to a size that is slightly larger (at least 5mm on all edges) than the area to be repaired (see Figure 21).
2. Remove the release paper on the underside of the tissue.
3. Carefully place the tissue, with the adhesive side down, over the area needing repair, ensuring that the tissue overlaps the damaged area. Use the bent-nose tweezers if precision guidance is necessary (see Figure 22).
4. Place the second sheet of silicone release paper on top of the heat-set tissue.

5. Using the front portion (toe) of the pre-heated tacking iron, apply moderate pressure to the heat-set tissue until it adheres to the damaged paper. Multiple passes with the tacking iron may be required to completely adhere the heat-set tissue to the damaged paper (see Figure 23).
6. When using heat-set tissue to fill large areas of loss, it will be necessary to perform steps 1 through 5 on both sides of the damaged paper (see Figure 24). This is because of the tacky nature of heat-set tissue; if both sides are not treated then the end result will stick to anything placed beneath it.

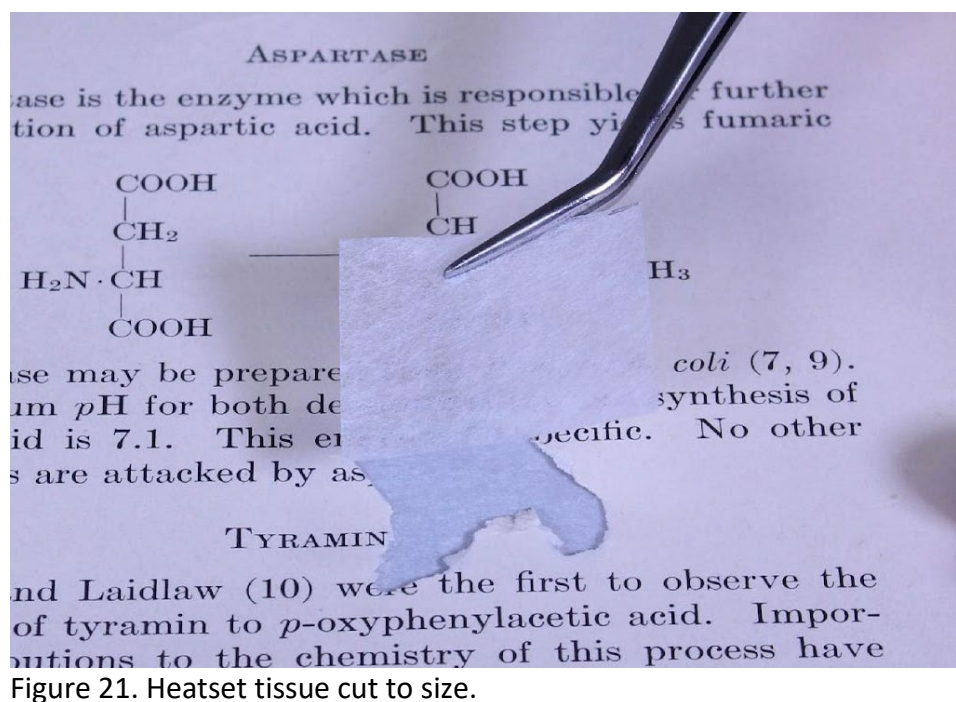


Figure 21. Heatset tissue cut to size.

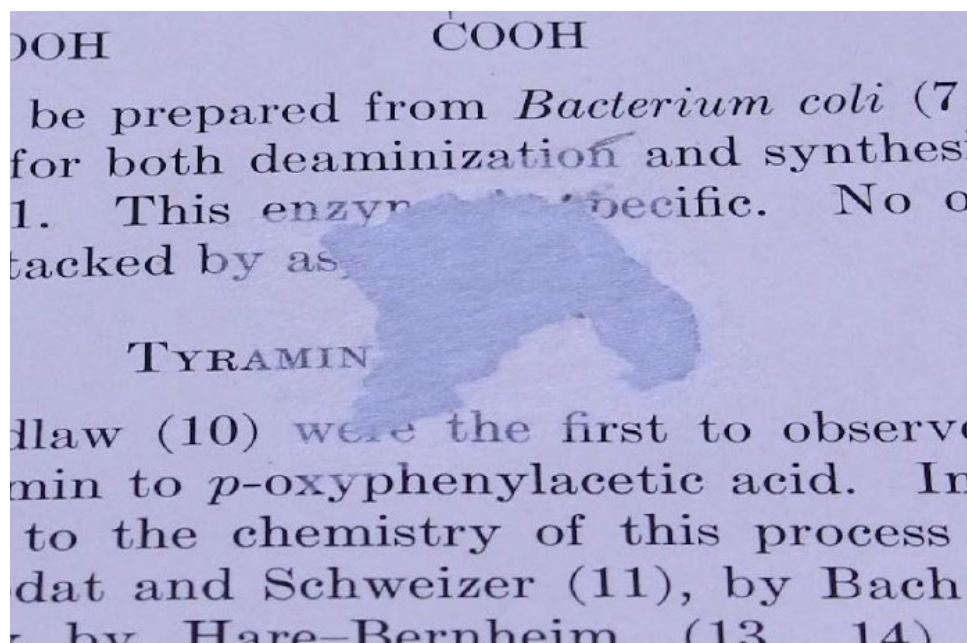


Figure 24. Heat-set repair complete.

Stabilization

Brittle paper can be supported by layering it with PhotoTex™ tissue and additional sheets of brittle paper. A common best practice is for preservation staff to use PhotoTex™ tissue, which is a cotton rag paper, because the tissue is light (40g/m²), translucent, durable and unbuffered.⁹

USE

1. Prior to interleaving the leaves and the tissue, ensure that any fasteners have been removed.
2. After completing repairs to the damaged paper slide the paper onto a sheet of PhotoTex™ tissue (see Figure 25).
3. Add leaves to new sheets of tissue to create a layered package of brittle paper and tissue (see Figure 26).
4. Prior to digitization or storage, the preservation staff may want to consider deacidifying the brittle paper. This process can be accomplished by outside vendors or by using a spray such as Bookkeeper™. If using a spray product then follow all directions provided by the manufacturer.

5. When finished gently slide the layers into a polyester film that has been heat welded on one side (see Figure 27).
6. Note: Placing appropriate metadata (issue dates, volume and issue numbers, etc.) on the outermost piece of tissue prior to sliding the layers into the sleeve will assist in the digitization process and will reduce the number of times the paper is handled (see Figure 28). It is not recommended to place the brittle leaf directly into a polyester sleeve without the tissue as the static from the sleeve may cause additional breakage.

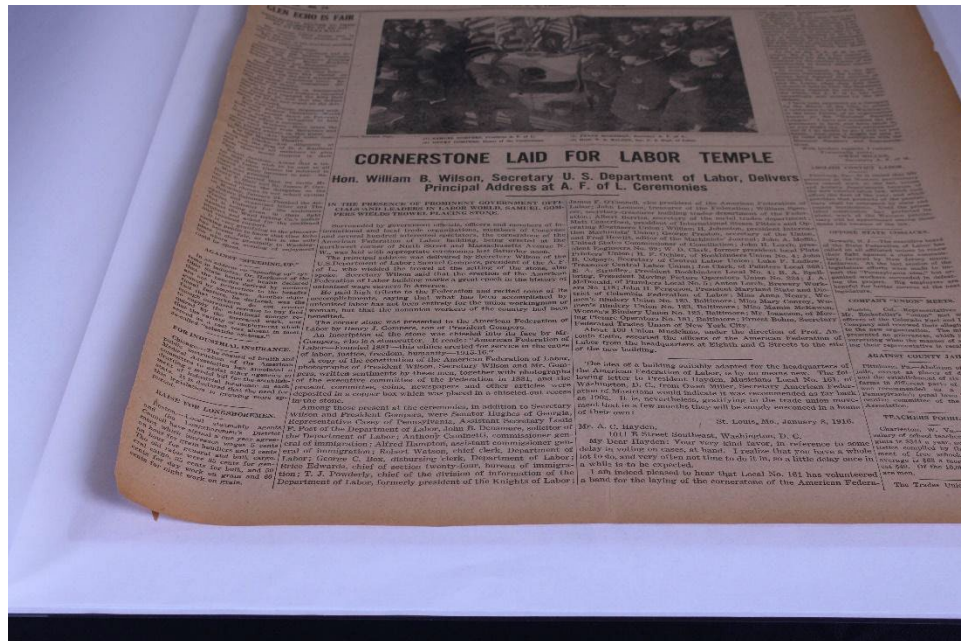


Figure 25. Brittle paper on a sheet of PhotoTex.

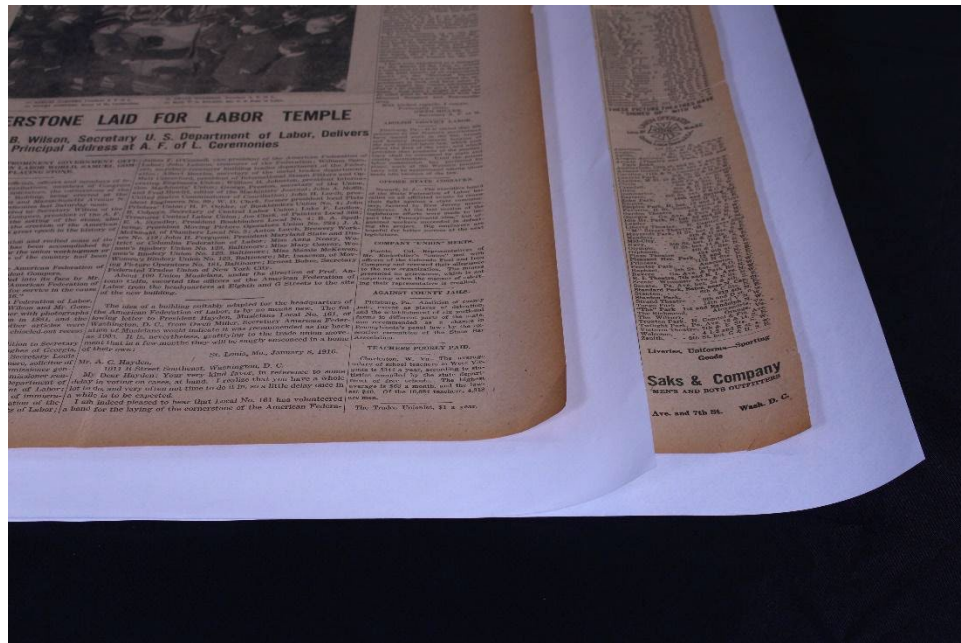


Figure 26. Layered brittle paper and PhotoTex.

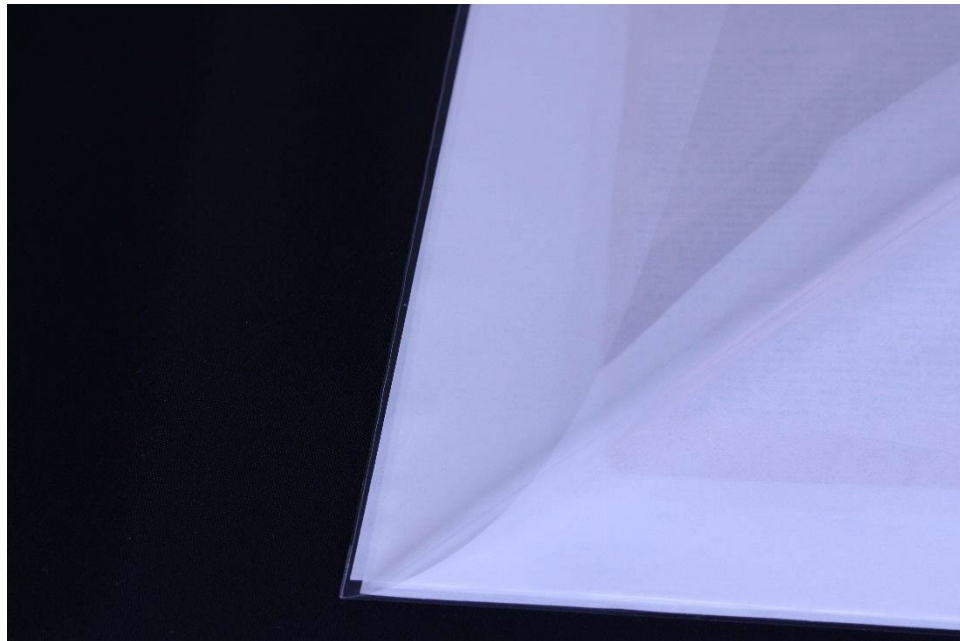


Figure 27. Polyester sleeve with heat weld.

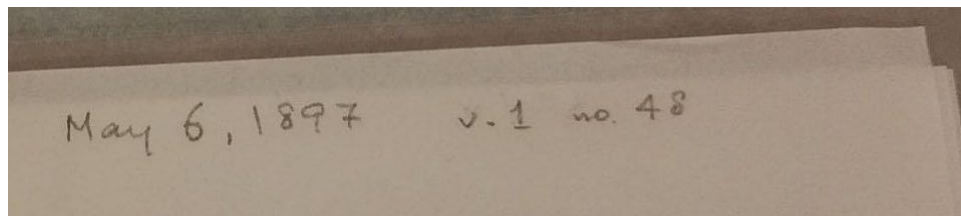


Figure 28. Example of metadata on outermost tissue.

Storage

1. The polyester sleeves can be stacked into archival quality boxes for both short-term and long-term storage. The sleeves should fit into the box with little room to move.
2. To extend the life of the brittle paper store the finished sleeves in a cold environment. While this will not reverse the existing damage the acids have done to the paper, it will extend its life.¹⁰
3. Storing individual pages in polyester sleeves and PhotoTex™ will add bulk and weight to the newsprint. To reduce the weight, bulk, and cost of expensive archival supplies, such as tissue and polyester sleeves for long-term storage, leaves can be combined so that multiple leaves are not separated by tissue but only have tissue at the front and the back of the polyester sleeve.

Digitization Best Practices

Making an Ingest and Preservation Plan: A Case Study Featuring the Internet Archive

Project staff should consider where they will ingest files after production. Factors like the repository infrastructure, digital preservation plan, and storage capacity may influence or dictate the selection of technical specifications, metadata, and other digitization decisions. For this reason, in every project kickoff meeting, UMD Libraries staff discuss where the files (high-quality preservation and lower-quality web) will eventually go and document this in the project plan. Staff also estimate the total amount of storage needed for digital preservation, usually measured in Terabytes (TBs), and plan for the long-term preservation of those files. This proactive approach saves time at the end of the project because it ensures technicians do not need to re-digitize materials and expedites making content available to the public.

For the UMD project, the collection manager decided that digitization staff should upload the newspapers to the Internet Archive, where the Libraries have also ingested some previously-digitized labor newspapers, for broad accessibility. This decision meant we would

need to create descriptive metadata according to the Internet Archive metadata template. We should also aim for 300 to 400 ppi, specified as best-practice by the Internet Archive. Additional specifications required us to produce multi-page PDFs with embedded optical character recognition (OCR) to upload to the Internet Archive as the web file along with our standard TIFF page-level preservation files. This digitization process has been used internally as well as with a vendor to produce 300 to 400dpi TIFF files for inclusion in Chronicling America through the National Digital Newspaper Program (NDNP), which is a partnership between state awardees, the Library of Congress, and The National Endowment for the Humanities.¹¹ Files are post-processed by the vendor according to the NDNP standards.¹²

Any individual or institution can create an Internet Archive account to upload publications and other materials. Most importantly, contributors can upload content to the Internet Archive for free. As stated by Internet Archive on its website, its goal “is building a digital library of Internet sites and other cultural artifacts in digital form.”¹³ After ingesting a minimum of 50 items, an account gains the ability to create a collection of material that is linked to a single page. If an institution is unable to host its content and is not interested in the Internet Archive, alternative hosting options may exist within the state as a shared repository (e.g., Digital Maryland),¹⁴ an institutional repository, Chronicling America (if partnering with the state NDNP awardee),¹⁵ or other hosting services.

In addition to making the multi-page PDFs available via the Internet Archive, the UMD systems librarian archives the preservation TIFF files. As of November 2020, the Libraries’ current model is to run checksums on files, upload the preservation files to Amazon Web Services’ Glacier storage (automatically backed up in multiple locations), and then to verify checksums periodically. Storage choices and workflows will vary by institution, but checksums are important to determine whether data changes or degrades.

Multiple models exist for digital preservation, depending on the resources of an institution. The UMD Libraries’ digital preservation strategy is based upon National Digital Stewardship Alliance (NDSA) Levels of Digital Preservation, version 2,¹⁶ and varies within the matrix based on several factors including the type and content of the material, its digitization reproducibility, the necessary data security, and other factors. A digital archiving plan with

multiple preservation copies ensures an archivist can recover preservation files without the need to re-digitize the materials in the future, an aspect particularly important given the handling concerns with brittle newspapers.

Technical Specifications

The technical specifications selected for this project reflect the equipment, repository, and storage capacity of UMD Libraries. Another institution may decide to implement a different standard or use different equipment that is locally available, but for the purpose of illustration the standards the UMD Libraries have selected and the rationale for this selection are outlined below.

Imaging

In addition to considering technical requirements suitable to the repository, UMD Libraries aims to meet Federal Agencies Digital Guidelines Initiative (FADGI) 3-Star or 4-Star levels on historic print collections (see Table 1). These requirements ensure high-quality images that are a true reflection of the original content and should meet imaging standards for text media into the future.¹⁷ These standards also insure a high-enough image quality that will produce “accurate enough” OCR. Equipment limitations, explained below, may also determine technical requirements. For the brittle newspaper digitization project, the Libraries digitization staff decided to digitize at 3-Star levels described as follows:

Preservation File	Access File	Resolution	Bit Depth	Color Space	Color
TIFF	PDF (w/OCR)	300ppi	8-bit	Adobe 1998	Color

Table 1. FADGI 3-star level specifications.

For the bit depth and color space, some notations reflect this as “Adobe 1998, 24-bit RGB” because red, green, and blue are each 8-bit (together totaling 24-bit). The technician used file extensions “.tif” for preservation files and “.pdf” for web files.

To meet the recommended visual quality of the images, a technician digitized or cropped to approximately ¼ inch around the edge of the page to show the user we have

digitized the entire page. The technician did not need to use a white backing paper for these pages because they were opaque enough, though this is an option for pages that are more translucent. For this project, the white PhotoTex™ tissue incidentally served as white backing.

The digitization standards selected meet publication and exhibition reprint best-practices, ensuring that the papers do not have to be rescanned for future reuse. Additionally, these standards meet the minimum imaging guidelines not only for the Internet Archive, but also for Chronicling America and other repositories. By producing TIFF files at this quality, we can reprocess them to create additional secondary files (image derivatives, OCR, and metadata) to meet the technical standards for other repositories and projects.

OCR

For this project, the digitization technician used the Adobe Acrobat “Recognize Text” feature to OCR the PDF in post-processing. Staff achieved approximately 90% accuracy of English word recognition with this method, which the UMD Libraries have determined is an acceptable tolerance for historic text materials on darkened paper with somewhat faded ink. Acceptance levels may vary at other institutions. This method may be less accurate for non-English language text where the OCR recognition in Adobe Acrobat is less accurate. We did not produce a separate OCR file for our case study, as the Internet Archive only requires an OCR-processed PDF for access. Other repositories’ needs may require the digitization manager to discuss technical specifications with the repository manager prior to beginning a project. For projects destined for Chronicling America, we follow NDNP technical specifications and have a vendor create coordinate-based METS-ALTO OCR (.xml) through DocWorks. For an internal project destined for a repository that can accept METS-ALTO, we follow NDNP-lite specifications¹⁸. For other projects, we have a vendor create OCR plain text (.txt) files or coordinate-based hOCR (.xml) files through either ABBYY FineReader or Tesseract (depending on the vendor’s operations). All of these OCR options produce acceptable results. While the software varies based on the repository’s technical specifications, most tools will deliver similar accuracy as the condition of the original text determines the end-result across all OCR tools.

Metadata

Multiple staff members gathered descriptive metadata throughout the process—at the point of conservation and during digitization. Typically, student assistants working under collection managers gather metadata as a separate stage, but for this project UMD Libraries aimed to minimize the number of people touching the newspapers. Conservators wrote down the date and page numbers, noting any missing pages or unknown page numbers (if the issue was not paginated and they could not make a guess based on formatting). The digitization technician confirmed this data at the point of digitization and input this data into the metadata spreadsheet. From working with numerous newspaper collections in the past eight years, the formatting guidance we provide to those entering metadata states that masthead is on page one, editorial information is on page two, and ads are usually on the last one to two pages. Before digitization staff ingested the materials, the collection manager confirmed the metadata using the digitized files instead of the original paper copies (see Appendix C: Sample Metadata).

Equipment Selection

To meet FADGI 3-Star requirements, the technician used an A0 (841 x 1188 mm) size planetary scanner, also known as an overhead scanner. This equipment allowed the technician to digitize the page image in one shot (as opposed to taking multiple shots and then stitching the images together), to move the fragile pages a minimal amount to align them for scanning, and avoid direct contact of the scanner with the fragile page. An A0 scanner provided the additional surface area to align two scanning areas on the right and left, though an A1 (594 x 841 mm) scanner area would have been sufficient to align one page at a time. Overhead digitization is particularly necessary for brittle pages as the glass from platens or flatbed surfaces may create enough static electricity to loosely adhere the paper to the glass surface, which can further crumble the paper.

Additionally, the lighting from a planetary scanner or a diffused lighting setup used with a digital camera minimizes the heat to which a flatbed scanner may expose a page. While the printers' ink is usually fairly stable and can be exposed to heat and light for a short period of time during capture, staff were concerned that exposing the paper to additional heat sources

could cause further brittleness. UMD Libraries' planetary scanner digitizes up to 300ppi optical resolution (without pixilation), which determined our maximum resolution.

As demonstrated above, digitization staff selected equipment to meet FADGI 3-Star standards for imaging and light exposure. If we did not have a planetary scanner available to us, we may have selected a DSLR camera mounted on an overhead camera stand (also known as a copy stand). In lieu of a DSLR camera, many smartphones have high-quality rear-facing cameras, which when mounted on an overhead copy stand, can produce high-quality images on a low budget. The megapixel (MP) range, aperture (size of lens opening), and shutter speed (ability to let in light) of the available equipment are important considerations in setting up an overhead digitization system on a budget. It is advisable to experiment with the equipment to see if it can produce high-quality images before deciding to proceed with the technology.

If a digitization project employs a digital camera instead of a scanner, the technician would need to select an output of RAW format files to ensure the camera produced images with no compression. These RAW format files would need to be exported to TIFF files to produce cross-compatible uncompressed preservation files.

If an institution does not have suitable equipment, a reputable vendor can meet the specifications above and should be adept at equipment setup and handling for brittle material. UMD Libraries either deliver our materials in a personal vehicle or work with the vendor to coordinate a courier shipment to their facility. We do not ship brittle newspapers via commercial shipping companies as we would other more stable materials.

Onsite Storage and Handling

After preservation staff prepared the newspaper issues and placed them in their boxes, they transported the boxes on large carts, which supported the boxes and newspaper issues inside. The boxes were then carefully transferred to wide metal shelving in the digitization center, near the planetary scanner, specifically allocated to storing oversize materials (see Figure 29). Digitization staff store boxes stacked no more than three high due to weight distribution, and store the boxes so that they are fully-supported on the shelf with no overhang.



Figure 29. Oversize boxes containing newspapers stored on metal shelving.

The manager trained student digitization technicians to transport each issue in its mylar envelope on a piece of acid-free cardstock to support the issue between the shelf and the scanner. Once the technician digitized the issue, it was transported back in the same manner and was placed in the lid of the box. At the end of the shift, the issues were carefully placed back in chronological order in the box with an acid-free cardstock flag marking the starting point for the next shift. Technicians put away all materials in a closed box at the end of each shift to ensure they would not be accidentally damaged by pressure or environmental concerns and for security purposes.

Digitization Process

SETUP

The planetary scanner model UMD Libraries uses scans a white balance target at the beginning of each “project.” The technician created one “project” in the software per issue to ensure an even color capture across each shift and to ensure no confusion between partial pages and pages without pagination. Additionally, the technician scanned each page with a Kodak Q-13 Gray Scale target so that they could spot-check color accuracy in the Adobe Photoshop histogram during post-production.

The technician dusted the white balance ceramic tile on the scanner at the beginning of the shift and, as needed, to clear paper crumbs from the target. They also cleaned up paper

“crumbs” in the scanner bed and in the workspace at the end of the shift; some edge shedding naturally occurs, even when brittle materials are carefully handled. The technician did preliminary quality control while scanning the pages, ensuring no paper “crumbs” obscured the text on the page. This prevented later re-digitization, again minimizing handling.

The technician also set up the software scan area to slightly larger than the newspaper page and grayscale target (see Figure 30). This facilitated cropping in post-production.

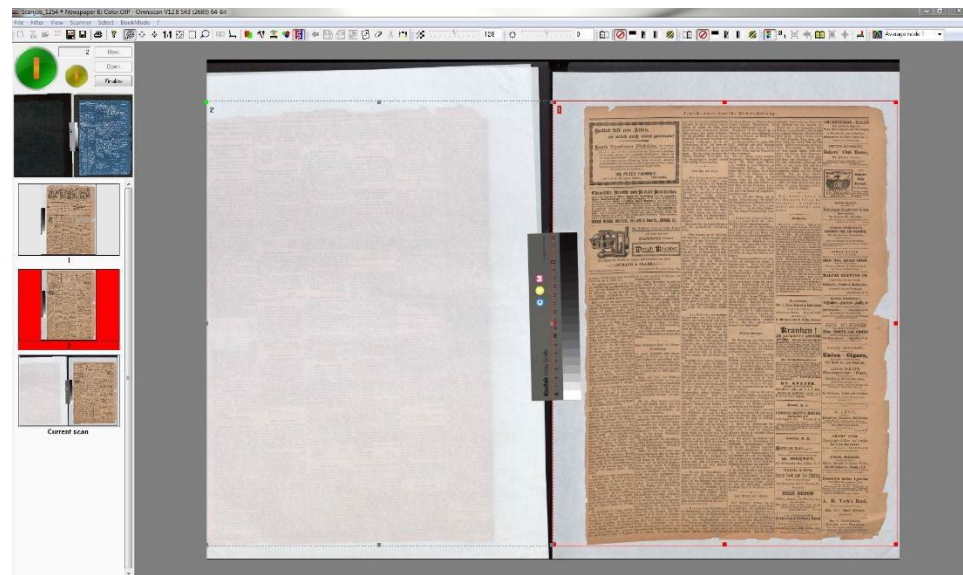


Figure 30. Screenshot of scanner software showing how the page is aligned for scanning and the bounding box is aligned for cropping.

To meet FADGI standards, the technician straightened pages as much as possible on the scanning bed to eliminate the need to do a lot of de-skewing in post-production. The technician handled and straightened the PhotoTex™ tissue the page lay on instead of the newspaper page to minimize handling. Text on pages needs to be less than 3% skewed on the horizontal to facilitate more accurate OCR, otherwise the software may not be able to read and create an accurate bounding box around each word. The technician scanned one page at a time to facilitate ease of setting up that single page.

In order to prevent pages from getting out of order, the technician scanned all odd-numbered pages and then scanned all even-numbered pages, using an interleave function in the scanner software to automate the interleaving process, preventing confusion and additional handling in post-processing. If an institution does not have this software, and if pages

are not paginated, the technician may consider re-ordering pages as they scan or naming files as they go to represent the correct page order.

DIGITIZATION OPERATION

The newspaper issues scanned were typically 4- to 12-page issues. The instructions below can be expanded for longer issues. Depending on the digitization software used, it may be necessary to establish a file naming scheme prior to digitization. If your institution does not already have a naming scheme then consider using collection identifiers, standardized titles, ISO formatted dates, volume and issue numbers, or project identifiers alongside sequential numbers. Establishing file naming standards will allow project staff to easily identify images and maintain better control of the digitized collection. It should be possible to easily match the digitized images to the specific physical items that they represent based on their file names. Some digitization software can rename or renumber files based on a set scheme at the end of a project.

1. Dust the white-balance tile (see Figure 31).



Figure 31. Image of a clean white balance tile.

2. Open box and select issue.
3. Slide issue in polyester folder onto acid-free cardstock sheet.

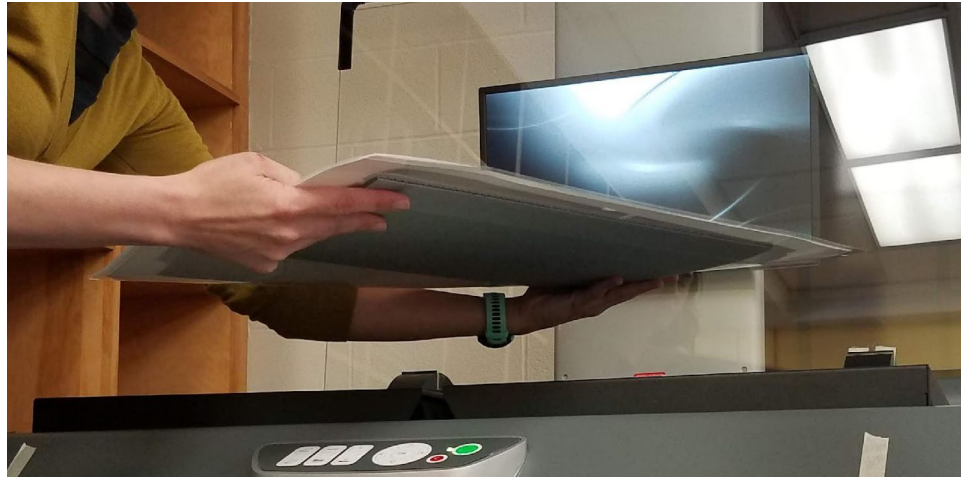


Figure 32. A technician moves the newspaper issue in its mylar enclosure.

4. Transport issue to scanner bed on the right side of the scanner (see Figures 32 and 33).



Figure 33. Newspaper issue in unopened mylar enclosure on the bed of a planetary scanner.

5. Carefully open the polyester folder at the same time as the PhotoTex™ paper to not create static (see Figure 34).

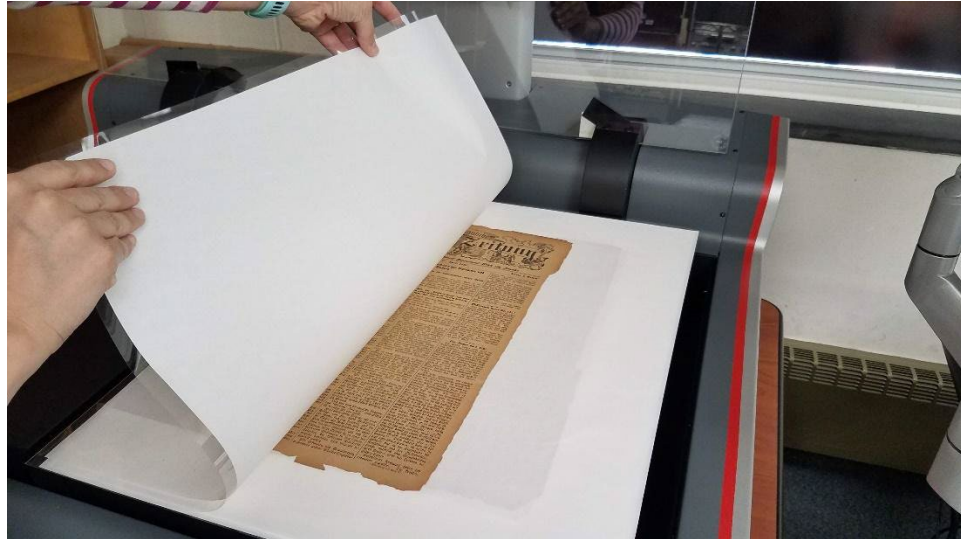


Figure 34. The technician carefully lifts the mylar and tissue off the first page to scan.

6. Confirm the issue volume, number, date that preservation staff wrote on the outer PhotoTex™ tissue matches the metadata spreadsheet and the first page of the newspaper.
7. Place grayscale target and scan page 1 (See Figure 35).

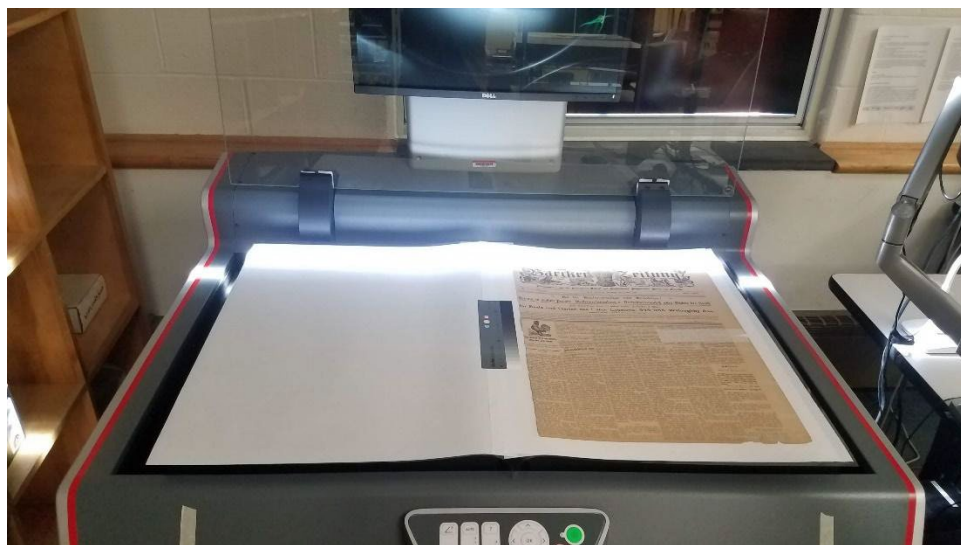


Figure 35. In progress scanning the first page.

8. Take up grayscale target and replace the PhotoTex™ tissue (see Figure 36).



Figure 36. The technician replaces the tissue enclosure.

9. Flip the page 1 and page 2 leaf as a sandwich (see Figure 37) inside the layers of PhotoTex™ paper to reveal page 3.



Figure 37. The technician flips a page between two layers of tissue.

10. Place grayscale target and scan page 3.
11. Remove grayscale target and replace PhotoTex™ tissue and continue to flip each page in the PhotoTex™ tissue sandwich to capture the remaining odd-numbered pages, replacing the grayscale target each time.

12. When completed with the odd pages, close the back polyester and PhotoTex™ tissue sheet to the left side of the scanner bed.
13. Open the polyester folder and multiple PhotoTex™ tissue sandwiches to the right keeping page 2 face-up on the left.
14. Place grayscale target and scan page 2.
15. Take up grayscale target and flip page 3-4 to the left in the PhotoTex™ tissue sandwich.
16. Remove grayscale target and replace PhotoTex™ tissue and continue to flip each page in the PhotoTex™ tissue sandwich to capture the remaining even-numbered pages, replacing the grayscale target each time.
17. Note any missing pages and any misprinted dates or page numbers on later pages in the metadata spreadsheet.
18. Use a pipet to blow paper crumbs off the scanning bed, the page, and the white-balance tile as needed (see Figure 38). Check after every issue.



Figure 38. Using a pipet to blow away paper crumbs from the scanning area.

19. When finished scanning the even-numbered pages on the left, close the polyester folder and slide the issue back onto the cardstock sheet.
20. Place the issue in the lid of the box.
21. After scanning an issue, export and save all the files, making sure the page files are named in the correct order.

22. Select the next issue and repeat the process.

23. When a sufficient volume of issues is scanned, begin post-processing.

Post-Processing

Technicians completed all post-processing at the end of each shift to avoid having a backlog of TIFF files to process. For the preservation files, the technician cropped to ¼ inch around the page and grayscale target and minimally de-skewed to less than 1% using Adobe Photoshop (see Figure 39). They also checked the histogram against the grayscale target for accuracy, again making minimal corrections if needed. They saved the preservation TIFF file and then made a production file cropping out the grayscale target. UMD Libraries uses a high-quality JPEG as the production file for this workflow to create the PDF more quickly, although a TIFF can also be used. Freeware image processing programs, such as GIMP, can serve the same purpose as Adobe Photoshop.



Figure 39. Image of a preservation file including the grayscale target.

At this point, the technician began the process to create OCR. To meet the technical specifications for the Internet Archive, the technician used the production TIFF files (without the grayscale target) to create the PDF in Adobe Acrobat through a batch process. The technician then ran the “Recognize Text” tool on the PDF creating the embedded OCR. If the files were destined for another repository, they would undergo a separate OCR process to meet the technical requirements, being loaded into ABBYY FineReader, Tesseract, or DocWorks to produce a different set of OCR and technical metadata deliverables.

Then, the technician divided the files between those destined for preservation and those for ingest. For most UMD Libraries projects, preservation and access files are managed separately. The exception is projects that meet NDNP or NDNP Lite specifications, where the METS-ALTO wraps all the files in a discrete package that will not operate the same way if the

preservation files are removed. In this situation, UMD archives all the files together and ingests all the files to the repository.

The technician saved the preservation TIFF files in a folder for later archiving and then deleted the production files without the grayscale target. The manager saved the PDF files to a second folder with the metadata spreadsheet exported to a .csv file and then queued a batch load into the Internet Archive using Python. An archivist can load files one at a time to the Internet Archive without knowledge of Python via web interface. The web interface now has an option to upload items with standard metadata templates across a collection, where an archivist can add unique item-level metadata before the upload. For more information, see the Internet Archive's documentation covering the full ingest processes on their website.¹⁹

The ingest process for another repository would look similar, with all the files prepared for ingestion being moved to a separate location. A repository manager or another staff person with the technical expertise to upload the files would run the ingest process. For files destined for *Chronicling America*, the project manager submits a batch hard drive and then works with a Library of Congress liaison to have the batch approved and queued for ingest by their technical staff. With files destined for our internal repository that accepts NDNP Lite specifications, we transfer files on a hard drive to a systems librarian who is adept at the more involved repository batch load process.

Digital Preservation

Once the preservation files are separated for preservation, the manager submits an archive ticket to the systems librarian responsible for routing files for digital preservation to AWS Glacier. The systems librarian generates checksums and other file fixity checks, submits the files, and then checks the fixity checks to ensure the files were not altered during the transfer. The systems librarian then deletes the local copies. This process may look different at other institutions, though the process of having dedicated preservation storage, generating fixity checks, and verifying those fixity checks should remain the same.

Conclusion

The method described in this publication details the preparation, digitization, and digital preservation process to support a one-time digitization process of brittle newspapers. While the preservation, preparation, and digitization processes for this material take notably longer and involve more staff time than working with a less brittle collection, digitization technicians have noted a much-decreased rate of paper breakage, fewer crumbs, and limited content loss when they handled only the PhotoTex™ tissue and polyester folder during digitization. Metadata creators are able to do their work without interacting with the physical materials at all, eliminating one point of contact with the fragile materials. Collection managers feel that the time added to the process for stabilizing the collection and digitization is not a detriment to the process, preserves more content, especially at the edges of the pages, and enables our institution to make this very brittle content finally accessible to patrons. Since developing this process for an in-house project, we have implemented it on an additional project for the NDNP Maryland project and have successfully instructed our vendor to handle the fragile pages in the same manner. Though the cost has increased compared to non-brittle pages (see Appendix A: Sample Cost Estimate and Appendix B: Sample Time Estimate), we feel the time and cost have been worthwhile to preserve the content for future generations.

Appendix A: Sample Cost Estimate for Repairs and Stabilization

This chart provides a cost estimate for a digitization preparation project that has 500 leaves that will fit into 250 polyester folders. The initial size of the brittle paper for this estimate was 16 inches x 22 inches and the PhotoTex™ and preservation staff ordered larger polyester sleeves to allow for additional room to protect the edges of the brittle paper and when handling the interleaved items.

Supplies	Dimensions	Thickness	Quantity	Unit Cost	Total Cost
Polyester folders heat sealed on one side	24.5" x 18.5"	3 mil	250	\$1.55	\$387.50
Archivart® Unbuffered Phototex™ tissue ¹	24" x 36"		250 pack		\$296.65
filmoplast™ P Tape	1" x 100'		3	\$20.20	\$60.60
filmoplast™ R Heat Set Tissue ²	12.25" x 164'		1		\$213.20
Total Cost					\$957.95

¹ The Phototex™ tissue will need to be cut into half on the long edge to fit into the polyester folders, and this will double the amount of tissue you will have available.

² The amount of filmoplast™ R Heat Set tissue specified above is the minimum order for this size. Unless the paper being repaired has large tears and losses it is unlikely that all this product will be used.

Appendix B: Sample Time Estimate for Repairs and Stabilization

This chart provides a time estimate for a digitization preparation project that has 500 leaves, requires both minor and large repairs, and is placed into PhotoTex™ tissue and polyester sleeves.

Task	Number of Person Hours
Disbinding	8-16 hours
Mending	250-300 hours
Collation and Quality Control	1-2 hours
Total Hours	259 – 318 hours

Appendix C: Sample Metadata

ISSUE LEVEL METADATA (TRANPOSED TO FIT ON PAGE)

Reel Info	Box number	2018.005.D-10
	DCMR file name	labor-080862
Title Information	Language	ger, eng
	Title	Baecker Zeitung
	Publication location	New York, NY
	Vol	8
	Edition order	1
	Issue no	1
	Issue date	1892-04-27
	Issue date as labeled	
Page Information	Page count published	8
	Dup pages	
	Missing pages	
UMD Notes (Internal Use)	Additional Comments	
	Collator ID/Date	SRS 4/23/2019

INTERNET ARCHIVE METADATA (TRANPOSED TO FIT ON PAGE)

identifier	mdu-labor-087690
file	labor-087690.pdf
mediatype	text
collection[0]	university_maryland_cp
creator	
title	Deutsch-amerikanische Baecker Zeitung
volume	v. 8 (April 27, 1892 - April 26, 1893)
date	1892

language[0]	eng
language[1]	ger
contributor	University of Maryland (College Park, Md.)
publisher	Journeymen Bakers' and Confectioners' International Union
call_number	1990-557-LBR
description	
Subject[0]	Journeymen Bakers' and Confectioners' International Union Periodicals
Subject[1]	Bakery employees Labor unions United States Periodicals
Subject[2]	Labor unions United States Bakery employees Periodicals
Subject[3]	Confectioners Labor unions United States Periodicals
Subject[4]	Labor unions United States Confectioners Periodicals.
rights	
licenseurl	http://rightsstatements.org/vocab/NoC-US/1.0/
IA URL	https://archive.org/details/mdu-labor-087690

Appendix D: Suppliers

B&H Photo – <https://www.bhphotovideo.com>

Brodart – <http://www.shopbrodart.com/>

Fiskars – <https://www.fiskars.com>

Gaylord Archival – <https://www.gaylord.com/>

Hollinger Metal Edge – <https://www.hollingermetaledge.com/>

The Library Store – <https://www.thelibrarystore.com/>

Talas - <https://www.talasonline.com/>

University Products – <https://www.universityproducts.com/>

Appendix E: Glossaries

American Institute of Conservation – Book and Paper Group Glossary of Terms
http://www.conservation-wiki.com/wiki/BPG_Glossary_of_Terms

Terms

Copy stand: A flat surface with an arm mounted vertically that has a camera mount on it to which a user can attach a camera. It may also have additional arms on which to mount lights, light diffusers, a photography reflector or tent.

DSLR camera: Digital single-lens reflective camera. A digital camera that saves digital photos on an SD card, with a single, interchangeable lens. Interchangeable lenses provide the photographer with the ability to use the same camera for different purposes.

FADGI: Federal Agencies Digital Guidelines Initiative (<http://www.digitizationguidelines.gov/>) Makes recommendations for Federal institutions digitization guidelines; widely adopted as best-practice by the GLAM profession.

JPEG: Named for the Joint Photographic Experts Group who created the format. It is a well-supported, lossy compressed image file format.

NDSA: National Digital Stewardship Alliance (<https://www.digitalpreservation.gov/ndsa/NDSAtoDLF.html>) Makes recommendations on digital preservation standards for the GLAM profession.

OCR: Optical character recognition, the process of encoding printed text into machine-encoded text.

PDF: Portable document format. Developed by Adobe to present documents including formatted images and text.

Planetary scanner: Also known as an overhead scanner or large format scanner. A scanner with an overhead arm where the camera sits to scan the object. The camera may be motorized to scan in a panning motion or may be stagnant. Companies that produce planetary scanners include Bookeye, Digital Transitions, Image Retrieval, Zeutschel, etc.

ppi: Pixels per inch, a unit of measurement for resolution of an image that measures the number of pixels across one inch of an image. Now used synonymously with dpi, or dots per inch, which was previously a measurement used only for printing.

RAW: raw image file, named as such because they are not processed can cannot be printed or edited. The format can be converted to create a “positive” file format such as a JPEG or TIFF.

TB: Terabyte, 1,024 gigabytes (GB), a unit of measure of bytes.

TIFF: Tag image file format. A well-supported, uncompressed image file format ideal for high-resolution, high-quality images.

Notes

¹Matt Roberts, Don Etherington, and Margaret Brown, *Bookbinding and the Conservation of Books: A Dictionary of Descriptive Terminology* (Washington, D.C.: Library of Congress, 1982), 175-176.

²Diane Vogt-O'Connor and Dianne van der Reyden, "How to Preserve Acidic Wood Pulp Paper," *Conserve O Gram* 19, no. 24 (June 2001): 1, <https://www.nps.gov/museum/publications/conserveogram/19-24.pdf>.

³Mary Lynn Ritzenthaler, *Preserving Archives and Manuscripts* (Chicago, IL: Society of American Archivists, 1993), 53.

⁴Northeast Document Conservation Center (NEDCC), "Surface Cleaning of Paper," accessed December 2020, 1, https://www.nedcc.org/assets/media/documents/Preservation%20Leaflets/7_2_SurfaceCleaning_2018.pdf.

⁵NEDCC, 1-5.

⁶Neschen Coating GmbH, "Neschen Coating." *filmoplast p Technical Specifications*, 2021.

⁷Neschen Coating GmbH, "Neschen Coating." *filmoplast R - Technical Specifications*, 2021.

⁸Neschen Coating, *filmoplast p*.

⁹Nielsen Bainbridge, "Archivart PhotoTex Tissue." *Archivart*, accessed March 23, 2020, <https://www.nielsenbainbridgegroup.com/nielsen-bainbridge/archivart/>.

¹⁰Charles S. Tumosa et al., "The Deterioration of Newsprint and Implications for its Preservation," *Western Association for Art Conservation Newsletter* 30, no. 3 (September 2008): 1, <https://cool.culturalheritage.org/waac/wn/wn30/wn30-3/wn30-305.pdf>.

¹¹Library of Congress, "About the Program: The National Digital Newspaper Program," accessed December 6, 2021, <https://www.loc.gov/ndnp/about.html>.

¹²Library of Congress, "National Digital Newspaper Program (NDNP) Technical Guidelines for Applicants 2022-2024 Awards," accessed December 6, 2021, https://www.loc.gov/ndnp/guidelines/NDNP_202224TechNotes.pdf.

¹³Internet Archive, "About," accessed November 18, 2020, <https://archive.org/about/>.

¹⁴Digital Maryland, “Digital Maryland,” accessed November 20, 2020, <https://www.digitalmaryland.org/>.

¹⁵Library of Congress, “NDNP Award Recipients,” accessed December 6, 2020, <https://www.loc.gov/ndnp/awards/>.

¹⁶National Digital Stewardship Alliance, “NDSA Levels of Digital Preservation, v. 2,” created October 14, 2019, accessed November 18, 2020, <https://osf.io/2mkwx/>.

¹⁷Federal Agencies Digital Guidelines Initiative (FADGI), “Technical Guidelines for Digitizing Cultural Heritage Materials: Creation of Raster Image Files,” accessed November 18, 2020, https://www.digitizationguidelines.gov/guidelines/FADGI%20Federal%20%20Agencies%20Digital%20Guidelines%20Initiative-2016%20Final_rev1.pdf.

¹⁸“NDNP Lite Metadata Draft,” accessed December 6, 2021, <https://sites.google.com/site/digitalnewspaperspractices/technical-specifications/metadata-specification>.

¹⁹Internet Archive, “How to Upload Scanned Images to Make a Book,” accessed November 20, 2020, <https://archivesupport.zendesk.com/hc/en-us/articles/360001820212-How-to-upload-scanned-images-to-make-a-book>.

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About the Authors

Mark Coulbourne is the Preservation Librarian for the University of Maryland, College Park.

Mark has a Bachelor of Science from Towson University, and a Master of Information and Library Science from the University of Maryland. Mark has worked in Preservation Department since 2017, starting as a Graduate Assistant before being appointed as the Preservation Librarian in 2019. Mark has been directly involved in three large-scale newspaper conservation projects that account for over three thousand pages of brittle newspaper. Mark is the current co-chair of the American Library Association's Preservation Administrators Interest Group, is a member of the Society of American Archivists Preservation Education Committee, and is the current MARAC Maryland Caucus Representative.

Bryan L.W. Draper received his BA in Art History from the University of Delaware and with a background in chemistry, entered the field of preservation at the University of Delaware Library, 1990. His interest in preservation was sparked by the documentary, *Slow Fires: On the Preservation of the Human Record*, 1987, which focused on the problem of acidic wood-pulp paper in libraries and archives. He participated in the U.S. Newspaper Project which supported the effort to locate and microfilm historical newspapers in Delaware.

Draper received his bench training during an informal apprenticeship at the Etherington Conservation Center in North Carolina. Under Don Etherington & Michael Lee, Draper developed his conservation skills treating rare books, maps, photographs, as well as documents on paper and parchment. He was part of a team that conserved the ca. 1830s French scenic wallpaper from Willow Wall House, Old Fields, West Virginia.

Since 2007 Draper has been the conservator for Special Collections at the University of Maryland Libraries' Preservation Department. Major challenges and projects include:

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- Helping to reshape the preservation program to focus more on the Libraries' special collections;
 - Managing the environmental conditions in 8 library buildings with the addition of the off-site high-bay Severn storage facility that opened in 2016;
 - Addressing the almost annual mold outbreak in McKeldin Library;
 - Inventorying, assessing and packing the special collections of the George Meaney/AFL-CIO archive when it was donated to the Libraries; and
 - Striving to work effectively and efficiently with limited staffing to meet the preservation and conservation goals of the Libraries.

Robin Pike transitioned in February 2022 to a new position as the Head, Digital Collections Services Section in the Serial and Government Publications Division at the Library of Congress. From February 2012 through February 2022, Robin was the Head, Digital Conversion and Media Reformatting at the University of Maryland, managing digitization and digital conversion operations across the seven College Park Libraries. She managed a portfolio including large and complex digitization and other digital projects. She was a Co-Principal Investigator for an NEH National Digital Newspaper Program grant for three two-year phases, and other grants funded by the NEH and CLIR. Robin served as a grant peer-reviewer for NHPRC, NEH, and Lyrasis. Robin also previously worked as the Audiovisual Archivist at The Catholic University of America, managing the acquisition, description, preservation, and digitization of photographic and audiovisual media for four years. She graduated in 2007 from the University of Pittsburgh with an MLIS, specializing in Archives and Records Management. Robin is an ACA Certified Archivist and holds the Digital Archivist Specialist certificate from SAA. She has written and presented about audiovisual collections and managing digitization projects. She serves on the Steering Committee of the Digital Library Federation Project Managers Group.