Protecting Paper and Book Collections During Exhibition

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Exhibitions are educational and enjoyable. Exhibiting works of art or artifacts, especially the unique, the rare, and the wonderful, is an important part of the educational mission of many institutions. It is also an effective way of attracting the attention and support of the public. Exhibition is the chief activity of most museums. Many libraries and archives exhibit as well, albeit on a smaller scale than museums. Although exhibition can complicate or even compromise preservation efforts, measures can be taken to minimize risk or damage.

There are preservation considerations with all exhibits, even the most modest. Too often preservation issues are overlooked in favor of other priorities. It is essential that the planning of every exhibit include input from a staff member or consultant who is knowledgeable about preservation issues. The involvement of such a person can avoid costly mistakes and limit possible damage to the collection.

For sheet materials one especially effective strategy is to copy the originals and display the copies. This practice has become increasingly common, especially for photographs and documents. Laser color copiers make facsimile documents that are almost indistinguishable from originals, and high quality copying services are available in most areas. Copying can be used to improve photographic images. Digital scanning technology can copy a photograph and remove all blemishes and evidence of physical damage.

There are times, of course, when only the original can be exhibited. It must be protected from light, air, and touching by the public. Sealed frames or cases with preservation-quality components are essential as is control of light, temperature, and relative humidity (RH) in the exhibit area.

Artifacts on Paper: Five Simple Rules for Display

1. Use copies whenever possible.
2. Do not display a valuable paper artifact permanently.
3. Keep light levels as low as possible.
4. Minimize exposure to ultraviolet light with appropriate filters.
5. Insure that cases and frames are enclosed, sealed, and made of materials that will not damage their contents.

Light

Light can be a serious problem for objects on display. Paper is one of the most light sensitive materials, as are certain other writing and drawing media. Light can cause darkening of paper and fading of media and book covers. Damage by light goes beyond

visual alteration by attacking the physical structure of paper, causing weakening and embrittlement. Light also damages the emulsions of photographs.

All light is damaging. The higher the light levels, the greater the potential danger. Sources rich in ultraviolet (UV) radiation are especially hazardous. Because light damage is cumulative, even low levels can degrade paper if the exposure is long enough. Conservators therefore recommend that no valuable artifact be permanently displayed.

Natural Light (Daylight) Is Especially Harmful

Exposure to natural light is undesirable because of its intensity and high UV content. If there are windows in the exhibit area, they should be covered with blinds, shades, or curtains for as much of the day as possible. In addition, ultraviolet filters should also be installed to control this damaging component of light.

UV filters are available as plastic sheeting or as rigid panels. The sheeting, usually acetate film, can be cut with scissors and applied directly to windows or cases. Tinted UV films will reduce the intensity of the light as well. Although film is less expensive than rigid panels, it is less attractive and may be difficult to remove later on. At present it is not known how long UV-filtering films remain effective, although informal experiments suggest that they have limited life. The only way to determine if the film is still filtering is to measure the transmitted light with a UV meter (see below).

UV-filtering panels can be used in windows, cases, or frames. They are available in either glass or acrylic sheets. For several decades museums have used an acrylic, UF-3 Plexiglas made by Rohm and Haas. More recently other companies have introduced UV-filtering acrylics or glass. When choosing such glazing, check the product information to make certain the UV-filtering capacity is greater than 90%. Some acrylics and most types of glass filter little or no UV. Ordinary non-glare glass is not UV-filtering, although there are non-glare products with this feature.

Before using acrylic panels as window glazing, check that local fire regulations are not being violated. Filtering panels can also be used as secondary glazing on existing windows. If mounted inside in a manner similar to interior storm windows, filters give thermal control as well as UV filtration. If the budget does not permit this type of installation, hanging the sheets inside the windows from hooks is effective as long as the panels are larger than the window glass so that all light from outside is filtered.

White paint containing titanium dioxide on the walls and ceiling of a room will absorb a certain amount of ambient UV radiation. However, other measures to control UV are still necessary.

Artificial Light

Lighting in areas where paper materials are on exhibit must be maintained at low levels. In addition, lamps that give off little or no UV should be used.

- Fluorescent Lighting. Although fluorescent lamps are common in most institutions, they have decided disadvantages in exhibit areas. Fluorescents cannot be dimmed, and most emit UV radiation. There are many brands of fluorescent lamps, however, and they vary greatly in the amount of UV they produce, from 0.5% to 12%. Purchase those with low UV output, not more than 2% UV.[1] For added safety, cover all

fluorescent tubes with UV-filtering plastic sleeves. Be sure the sleeves are long enough to cover the ends of the tube, where much of the UV is emitted.

- Incandescent (Tungsten) Lamps. Because these can be used with dimmers and because they give off little or no UV, incandescent lamps are suitable for exhibition. The ordinary household light bulb is an example of a tungsten lamp. This type of light does generate heat, however, and must be placed well away from objects, never inside cases. Tungsten sources should be equipped with dimmers.
- Tungsten-Halogen (Quartz-Iodine) Lamps. These current favorites in the museum community can be dimmed but give off significant amounts of UV. Tungsten-Halogen sources should be used with the UV filters made for this type of lamp.

It cannot be stressed enough that illumination must always be kept as low as possible. Good lighting designers know how to light exhibits effectively with low to moderate levels of light. If lighting is diffused rather than direct, for example, less light is needed. Visual interest can be created without subjecting a collection to intense spot lights.

Lights should be turned off when visitors are not in the room. Some museums have lights that do this automatically. Other institutions put cloth covers on cases containing especially valuable or light-sensitive objects.

How Much Light is Allowed? The Lux Hour Concept

If all light is potentially damaging and the damage is cumulative, any exposure is harmful, especially to a highly light-sensitive material like paper. Because works of art and cultural artifacts are meant to be seen, however, guidelines for limiting exposure are desirable. A limit of 50,000 lux hours has been suggested for very light-sensitive materials.2 Lux hours or lx.h are determined by multiplying the level of light, numerically expressed in lux, by the hours the object is exposed to that light (light can also be measured in footcandles or lumens; one footcandle [lumen] equals approximately 11 lux). If an object is lit for 10 hours a day at 50 lux, the limit of 50,000 lx.h is reached in 100 days (50 lux x 10 hours x 100 days). At 100 lux the limit is reached in 50 days. The higher the light level the shorter the exposure time. Some institutions have started to keep exposure histories for their most valuable or light-sensitive materials.

Rooms lit at 50 lux may seem very dim, especially to someone who comes inside on a bright day. The eye does adjust, however, and good lighting design helps a great deal. A sign explaining the reason for the low levels usually mollifies the public. Light is measured with a light meter. Lacking this, the built-in meter of a single-lens reflex camera can be used. UV meters measure the proportion of UV in visible light, expressing it in microwatts per lumen. Paper collections should never be exposed to UV in amounts exceeding 75 microwatts per lumen. If your institution does not have access to a dependable UV meter (they are expensive), you can safely assume that all daylight and most fluorescent or tungsten-halogen sources will contain unacceptable amounts of UV. Such light sources should have UV filters.

Cases

Paper materials must always be displayed in cases or in frames. If made of appropriate materials and properly sealed, cases and picture frames will protect against a variety of airborne hazards as well as physical contact by the public. These enclosures also reduce the effects of temperature and humidity fluctuations on a daily if not on a long-term basis.

Although it is not possible to prevent moisture from entering cases during seasonal periods of high humidity, silica gel will help stabilize the RH in a case if the latter is well sealed. Silica gel is a crystalline material that acts as a desiccant. In exhibit cases, frames, packing crates, and other micro-environments silica gel can be used also as a buffer to maintain a specified RH. Prior to use, the gel must be conditioned to the desired relative humidity (to do this, follow the supplier's instructions). Once conditioned, the gel will absorb moisture when the RH is too high and will release moisture when the micro-environment becomes too dry.

There are two types of silica gel. Regular silica gel is white, and the indicating type is blue. Indicating gel is especially useful because it shows when it has reached the saturation point by turning a dull pink. Indicating gel is much more expensive, but you can save money by purchasing a small amount of indicating gel and mixing it with the regular type. Once saturated, silica gel can be dried and reused by heating it in a 300 degrees F oven for three hours.

The proper quantity of silica gel for the volume of the case must be carefully calculated.[3] Contact the supplier for guidance on this. Art-Sorb and Arten are high performance silica gels that can absorb five times as much as regular silica gel. These come in the form of sheets, beads, fiber cassettes filled with beads, or tiles. These can be inserted into frames and small boxes as well as into cases.

As useful as these products are, controlling the environment in the room as a whole with 24-hour air conditioning and dehumidification is the most effective way of protecting an exhibit from seasonal changes.

Materials used for case construction should be chosen carefully. Woods, wood sealants, paints, adhesives, gasketing materials, and display fabrics can give off harmful gaseous emissions. These volatiles, often acidic in nature, build up in sealed cases. Although they cause obvious damage to materials like silver or lead, these gases can attack paper in subtle ways. Although some conservators recommend ventilation holes in cases, free air exchange would subject the contents to dust and external pollutants. High-tech cases have been developed, including some with filtered air exchange, but at this stage they are beyond the means of most institutions. It is more practical to use cases built with safe materials. If your institution has inappropriate cases and lacks the resources to replace them, the cases should be lined with a barrier material as described below. Sealing the wood as well will give added protection

Wood and Wood Products

Wood is often used for cases because it is readily available, easy to work with, and attractive. Resulting degradation products, however, pose a great danger for paper. Although there is wide variation, all wood, even old and well seasoned examples, generate volatile acids.

If the budget allows, one can avoid use of wood in new case interiors. Anodized aluminum or properly manufactured coated steel frames are available, but are expensive. Cases can also be designed without a wooden floor, with the frame on the outside of a Plexiglas or glass box.

If wood must be used, choose a type that is comparatively low in harmful emissions. Certain softwoods, notably poplar and basswood, are recommended. One hardwood, mahogany, is also low in volatiles, but true African mahogany must be used. Oak,

frequently found in older cases, is the most acidic wood and potentially the most dangerous.

Because they are both strong and economical, plywood and other wood composites are frequently used for case construction. These can be even more problematic than solid wood because they may be fabricated with adhesives or resins containing formaldehyde, which oxidizes to formic acid. Of the composites, exterior plywood bonded with exterior glue, a phenol formaldehyde adhesive, is recommended.[4] Phenol formaldehyde is more stable (off-gasses less) than urea formaldehyde, which is common in wood composite products. A particle board that does not give off formaldehyde, such as Medite II, is also acceptable[5] as are MDO (Medium Density Overlay) and HDO (High Density Overlay), plywood signboards faced with Kraft paper. The American Plywood Association (APA), which creates standards and specifications for the industry, endorses only products bonded with phenol formaldehyde resins,[6] and these bear the APA stamp.

Most important, collection materials should never be placed in direct contact with wood, and all wood surfaces in both new and old cases should be covered with appropriate barrier materials. This protection is especially important with cases made of wood composites or oak.

Barrier Materials

Barrier materials can be active or passive. Passive barriers that are chemically stable and relatively impermeable include polyester film (e.g., Mylar), 4-ply 100% ragboard, and polyethylene foam sheeting (e.g. Ethafoam or Volara). Marvelseal, an adhesive-free laminate of aluminum foil, polyethylene, and polypropylene, is especially recommended because it is the one product that is totally impermeable to gases and moisture. In addition, Marvelseal is a flexible sheet that can bend and wrap.

Active barriers are relatively new. These "scavengers" react chemically with polluting gases, trapping them and removing them from the enclosure. A well known example is MicroChamber, which is available as board or sheets and is being used for storage containers. The active ingredients in MicroChamber products are activated carbon and zeolites. Because these scavenger products are fairly new, little is known about their long-term effectiveness. It is possible they could get used up in time. Such products have great possibilities and bear watching.

Barriers should cover the sides of cases as well as the floor. They can be attached to the sides with Scotch brand #415 double-sided tape (made by 3M). Marvelseal is heat sensitive on one side and can be ironed onto many wood surfaces.

Sealants and Paints

Before the barrier material is installed, sealing the wood will further reduce gaseous emissions. One must choose a sealant that does not give off problematic volatiles of its own. In general, avoid oil-based products. The coatings currently favored by conservators are moisture-borne polyurethanes (not the more common oil-based types) and two-part epoxy sealants. Not all water-based polyurethanes are safe, however, and formulas may change. It is best to check with a preservation professional for the name of the polyurethane currently being recommended. Should you want to test the products yourself, a simple test requiring no special equipment is found in the NEDCC leaflet, "Storage Furniture: A Brief Review of Current Options."

When using a sealant, allow at least three weeks for it to air after application. Proper safety precautions must be taken during application and drying.

If the case is to be painted, use acrylic or latex paint, not oil. Do not use acrylic or latex paints as sealers because they are too porous to seal well. The best paint for that purpose is a two-part epoxy.7 Two-part epoxy paints and sealants have to be mixed carefully, however, according to the manufacturer's instructions. An incorrect ratio of hardener to adhesive produces an unstable paint.

Cloth, Gaskets, and Adhesives in Cases

Other case components such as fabric linings, adhesives, and the gaskets used to seal the case must also be chosen with care. Fabrics made of silk are acidic and those made of wool emit sulphur compounds and are therefore not recommended. Undyed cotton, linen, polyester, or cotton-polyester blends are acceptable. All fabrics should be washed before use to remove any sizing. Fabrics may also be purchased from a provider that guarantees no additives. If it is necessary to use a dyed fabric, and the wash water shows color, wash it until the dye stops running. As an added precaution, allow no object to come in direct contact with the fabric.

For gaskets, acrylic or Teflon should be used rather than rubber. The best adhesives for use in cases are acrylics or hot-melt glues rather than protein glues or cellulose nitrate. For attaching linings, Scotch #415 tape is preferred over other commercial tapes.

If the exhibition time is limited (as it should be), do all case components have to be absolutely emission free? Can any of the volatiles be tolerated for short periods? In what amounts can they be tolerated and for how long? Until we know the answers to these questions, it is best to be safe and use proven materials, even for such minor case components as gasketing and adhesives.

Placement within Cases

Sheet Materials

If the case is well sealed, objects inside need not be glazed or otherwise covered. Unless they are matted or encapsulated, paper materials should be attached to pieces of ragboard or other archival material cut slightly larger than the size of the sheet. This mount not only adds another barrier between object and case but provides support when the object is moved. For appearance, exhibit designers often specify that the edges of the object be flush with the edges of the ragboard mount. A larger mount, however, gives better protection to the sheet. In the design of an exhibit, preservation concerns such as this must be addressed.

Paper sheet materials should be attached securely to the mounts. Sheets may be mounted in window mats (see below) or onto ragboard backings. They can be hinged or attached with corner supports. Edge strips may be used if the edges of the object are covered by a mat. Strips and corner supports are becoming popular because adhesive need not be applied to the object. For non-adhesive mounting, commercially available archival paper or plastic (polyester) photo corners will work on small documents or photographs. Most artifacts, however, require the more substantial support of corner strips. These can be made of polyester film or woven polyester. Finely woven polyester is both transparent and matte and therefore less conspicuous than polyester film.8 For further information about mounting systems, see the NEDCC leaflets, "Matting and Framing for Art and Artifacts on Paper" and "How To Do Your Own Matting and Hinging."

Objects may also be encapsulated in polyester film, which will protect and support the object during and after the exhibit. Research at the Library of Congress, however, shows that acidic papers deteriorate more rapidly within polyester envelopes and other closed systems. Since almost all old, untreated papers are acidic to some extent, they should be professionally deacidified or at least washed prior to encapsulation. If such treatment is not possible, an alkaline sheet inserted behind the object will slow the acid degradation.

A potential problem with encapsulation is slippage. If positioned vertically, large or heavy objects encapsulated in enclosures with double-sided tape may slip and become embedded in the tape seal. When possible, encapsulation should be done with ultrasonic or heat seals, which are also more attractive.

If unframed artifacts are displayed vertically, a safe and visually acceptable method of securing them must be found. Some institutions use hot-melt adhesives to attach ragboard mounts to vertical surfaces. These can be used in small amounts, and they hold well. Like other materials, however, they must be chosen with care and applied only to the back of the mount. Investigations by the Canadian Conservation Institute indicate that the ethylene vinyl acetate-based type of hot-melt adhesives that are clear or whitish are the least problematic, such as Black and Decker's Thermo Grip Hot Melt Glue GS-14.[9]

Books

Books and pamphlets have their own special exhibition requirements. Volumes should be displayed horizontally or at a gentle angle. It is especially important that books not be propped upright as that can cause the volume to warp or weaken its binding. When ordering or designing exhibition cases for books, specify types that allow horizontal display.

If a volume is shown open, it should be supported so that the binding is not under strain. An open book must never be laid out flat (at a 180° angle). Open it only as much as its binding will comfortably allow. Because books differ in this respect, book cradles custom-made to fit each volume are recommended. Such cradles can be ordered from mount makers or made in-house; instructions are available in the conservation literature. Cradles should always be large enough to support the whole book. If the pages do not remain open naturally, a strip of polyester film can be placed around each side of the open book. The strip can be closed with double-sided tape. Commercially-made molded acrylic cradles or wedges, available in different sizes and angles from conservation suppliers, offer an alternative to custom cradles. At the very least, supports can be made with folded museum board or polyethylene foam wedges.

Turning the pages every few days will protect the text from long-term exposure to light. If a title page must be displayed long term, consider using a copy. Even with page turning, periods of exhibit should be limited. Keeping a book open for long periods can damage its structure.

Although showing a volume closed is less stressful to the book, remember that most book cover materials can be damaged by long-term light exposure. Even closed volumes should be shown for limited periods with low light levels.

Framing

Framing plays an important role in exhibition. Use of stable framing and mounting

materials is especially important since the objects may remain in the frames after the exhibition is over.

Glazing is a must with artifacts on paper. The glazing should not come in contact with the object. Ultraviolet-filtering glazing is recommended especially if the room has sources of UV radiation. Note, however, that acrylics are not always appropriate for use in frames since these plastics carry a static charge that can dislodge pastel and other friable media. In such cases, ultraviolet-filtering glass can be used.

The mounting materials inside the frame must adhere to conservation standards. Conservators recommend use of pH-neutral or slightly alkaline (buffered) mats or mounts. Hinges or the non-adhesive systems described in the NEDCC leaflets cited above should be used to attach the objects to the mount. If hinges are used, a high-quality, strong paper such as Japanese kozo must be used with an appropriate permanent, non-staining adhesive such as starch-based paste. Further information is given in the leaflets.

Emissions from wooden frames can damage the edges of paper objects. One frequently encounters "burned" edges on old prints or other artifacts that have been framed for many years. Visible damage seems not to occur if the object is an inch or more away from the wood. If for historical reasons it is necessary to keep an artifact in its original frame and the sheet extends to the wood, line the wood with strips of Marvelseal, polyester film, or ragboard. Sometimes Marvelseal can be ironed onto the frame rabbet with a small tacking iron. Unless the artifactual value of the frame prohibits alteration, the rabbet can be enlarged slightly with a router. If this is done, the inside of the frame should still be sealed and lined.

The back of the frame should contain backing layers of archival cardboard that are thick or dense enough to protect the object. Frames should be well sealed and hung securely. Avoid hanging items in damp areas such as on uninsulated outside walls, which can be problematic in winter or during periods of high humidity. If it is necessary to exhibit on an outside wall, a moisture barrier of polyester film or Marvelseal can be inserted between the backing layers or over the back of the frame. The frame should be deep enough so that its back is recessed, allowing a space for air circulation between the frame and the wall. Frames can also be held away from the wall slightly by small rubber bumpers or by push pins attached to the reverse of the frame.

Exhibition without Cases or Frames

Any object made of paper must be protected from airborne particulates and pollutants and from the fingers of visitors. Some institutions, however, may lack the resources to purchase cases or frames especially for large or complex paper objects that would be costly to frame and are too large for the available cases. If there is no other solution and if the objects are not of great value, they may be encapsulated and mounted on walls temporarily. Note that such display creates a greater risk for damage and theft, and the object is more vulnerable to adverse environmental conditions. Once encapsulated, the objects can be attached to an archival board with double-sided tape (Scotch brand #415) and the board securely fastened to the wall. If the encapsulation is sealed with double-sided tape, the object should be watched and taken down if it appears to be slipping toward the tape at the bottom edge. If the object has not been deacidified or encapsulated with alkaline paper behind, it should be removed from the envelope immediately after exhibition.

Loans

Lending objects from the collections is a standard practice for many institutions. Although loans promote the collection and the institution, exhibition at remote sites understandably involves additional risk. Potential dangers can be minimized, however, with an appropriate loan policy and procedures.

All lending institutions should establish a formal policy governing loans for exhibition. A written summary of your institution's loan policy would be helpful in negotiations with prospective borrowers.

It is important to establish well in advance that conditions at the borrowing institution are reasonably safe. A visit to the site is recommended if possible. It is the responsibility of the borrower to submit a loan agreement and a facility report. The lender should review these and negotiate amendments as necessary. There is a standard facility report form that was adopted by the Registrars Committee of the American Association of Museums (AAM) in 1988. This 21-page questionnaire, available from the AAM, covers all aspects of an institution's operation that could affect exhibition safety: security (fire and theft), light levels, case materials, environmental controls in the building as a whole, shipping and receiving facilities, and personnel and insurance coverage.

When shipping is necessary, it goes without saying that objects must be well packed and a reliable shipper must be used. Framed materials should be glazed with acrylic rather than glass. If the framing can be done at your institution prior to the loan, an additional measure of control is gained.

Standards for Exhibition

A committee of the National Information Standards Organization (NISO) has spent several years developing standards for exhibition of library and archival materials. The report of this committee will be available, probably in 1999, and will address criteria such as maximum permissible light exposure, relative humidity, temperature, and pollutants. It will also deal with materials for case construction. For more information, contact NISO Committee MM, Cathy Henderson, Chair, HRHRC, PO Drawer 7219, University of Texas at Austin, Austin, Texas 78713.

Finally, Involve the Conservators

Do not ignore the risks of exhibiting paper and books. A conservator or other collections-care professional should be involved with the exhibit from the earliest stages of planning. Preservation concerns must not be overlooked in favor of other priorities such as exhibit design.

In collections-holding institutions an ongoing relationship with a preservation professional has become a necessity. If the staff of an institution does not include a specialist on collections care, such a person should be consulted on a regular basis. The field of collections care is changing rapidly as scientific investigation uncovers new information about materials and the mechanisms of deterioration. New products are being introduced and existing products are subject to change. Information in print can become obsolete in a short time. Because a preservation professional is best able to keep up with changes in this increasingly complex field, an ongoing relationship with such a person is essential for responsible collections care.

Suggested Further Reading

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1. Exhibiting Collections LIS 619 Team 4 Nicki Garces Valancy Rasmussen Sarah Vornholt October 25, 2011. 2. Agendaâ€¢ Introduction to exhibitsâ€¢ The standards in exhibit preservation & conservationâ€¢ The use of technologyâ€¢ Short "field trip" to Curators Choice Exhibition.Â "Protecting Paper and Book Collections During Exhibition" NortheastDocument Conservation Center (2007), accessed October 21, 2011,http://www.nedcc.org/resources/leaflets/2The_Environment/05ProtectingCollections.php. 35. Gorman, G.E. and Sydney J. Shep, Preservation Management for Libraries, Archives andMuseums, (London: Facet Publishing, 2006), 223.Laboratorio Museotecnicio Goppion.