Chapter Seven: Storage Mounts

Mount construction is a large topic and the subject of many books. The bibliography contains books that detail storage mounts for specific collections. Here we will discuss general forms that can be used for a variety of collections. Since many artifacts are unique, creativity when designing mounts is a must.

SUPPORTS

Gravity is a force that works against all of us as we age. Over time we start to sag and droop, despite our best efforts. Inanimate materials are no different. Objects that remain in the same position for extended periods undergo subtle -- and not so subtle -- physical changes because of gravity. Changes may be so slow that they are not readily perceptible or predictable. We have all seen artifacts damaged from inadequate support: distorted baskets, sagging canoes, warped arrows or spears, costumes torn at the shoulder, cracks, bulges or tears. Good mounts support objects so distortion and damage do not occur.

To build a support, imagine how the force of gravity will affect each object. Place the object as it would sit in storage and imagine arrows pointing straight down from all parts of the piece. Is the weight of the object supported in many areas, or is it supported only in a few? Are large expanses or projections supported? Because of gravity, we cannot hold our arms out from our sides for any great length of time. Although artifacts do not have muscles that tire quickly, they also are affected by gravity. An understanding of an object's weak points is required to produce a good support.

Also consider the rigidity of the artifact. If you pick it up does it sag or droop? Flexible objects such as textiles, heavily decorated skin and leather objects, baskets, strands of beads or paper are best mounted on rigid supports. Moving parts cause wear and tear on an object if they move. A good mount eliminates movement.

Objects with fragile surfaces or structures, such as gesso wood panels, chalky or powdering surfaces, shattering silk or badly cracked bone, will break or lose parts if they are touched. These materials need support so that they are not touched. Placing them on a rigid mount that is larger than the piece allows the mount and object to be moved and carried, without touching the object.

Objects require support because:
1. The object is weak, deteriorated or will be permanently deformed.

2. The object is safer to handle mounted on a rigid support.

Sideways shocks from human action, building vibrations or earthquakes can shift or topple artifacts off mounts. Security ties made from cotton twill tape, polyethylene tubing, cotton embroidery thread or velvet strips provide additional stabilization.

A poor mount may damage an object. Even distribution of the force of gravity results in minimal pressure on any part of the piece. Uneven distribution concentrates the force on small areas, resulting in excessive stress. Narrow points of contact under an easily deformed object can cause permanent distortion. The effects of uneven or poorly distributed supports may become evident only after a long time. What may appear to be an adequate and stable structure in the short term may have critical drawbacks over many years. Even internal features of an artifact that seem rigid have the potential to change stresses. Preventing changes from taking place within the artifact is the prime function of a good support. The mount should fit the object it is intended to support, not the other way around.

Why supports fail:

1. The points of support are wrongly placed, causing distortion of the object.
2. The object is poorly held or precariously balanced.
3. The points of contact are not padded, causing abrasion or distortion.
4. The mount is made of a material that may affect the artifact.

Use materials of known long-term stability and chemical inertness for mounts. Avoid materials that produce corrosive or reactive products. Avoid contact between incompatible materials. For example, metal should not be in contact with wood, wood should be sealed, adhesives chosen carefully and metals should not contact other metals.

A good display mount not only supports, but is also unobtrusive. Storage mounts can be obvious and may provide superior support because appearance is less important. For large, complex objects one mount usually is constructed for both storage and display. Examples include supports for hats, boats or canoes, and mats for art on paper.

Mounts should be softer and smoother than objects stored on them so that they do not cause damage. Soft and smooth are relative values; some artifacts can be padded with acid-free tissue paper without damage, while others are so delicate they would be

harmed by crumpled tissue.

A Little Physics...

In normal conversation, stress and strain are used interchangeably, but their meanings are different. Stress is the force applied to an object; strain is the change in shape of the object. For example, the cushion of a chair is under compression stress when a person is sitting on it, and the strain is evident in how its shape changed. When the person gets up, the stress is removed and the strain is relieved because the elastic limit of the object (high, in the case of the cushion) has not been exceeded. If the elastic limit were exceeded, the cushion would remain distorted after the load had been lifted. Stress beyond the elastic limit of an object results in permanent deformation. Every substance has a measurable modulus of compressibility or elasticity, known as Young's Modulus after its discoverer. Once the point of failure (beyond its elastic limit) has been reached the substance is irreversibly changed.

SNAKES AND RINGS

Snakes and rings or donuts support a wide variety of shapes of objects. A snake is a long rod and a ring is a circular rod. Snakes pad out folds in textiles, support the sides of small boat models or toys, buffer objects so they don't touch in storage, and pad the sides of storage containers. Rings support round objects so they don't roll, act as a buffer or support for glassware, support the walls (outside or inside) of basketry, and help support hats that do not require special mounts.

Small snakes can be made from crumpled acid-free tissue paper. Larger snakes can be formed from cotton knit tubing (stockinet), well-washed unbleached muslin, or white cotton sheets sewn into a tube and stuffed with acid-free tissue paper, needle-punch polyester quilt batting, or foam pellets. Commercially available polyethylene insulation rods (backer rods) may also be used. Snakes can be joined into rings by sewing with cotton thread, ties, Velcro or clear hot glue.

PADDED MOUNTS

Padded mounts prevent distortion in storage or during handling. Padded mounts are made of a rigid material covered with a softer material, often covered with a smooth fabric or acid-free tissue paper. Padded supports should be one to two inches larger on all sides than the objects they support, so that a buffer zone is created between objects stored together. This allows someone to pick up the object and mount without touching the object, and allows objects to be stored without bumping into each other.

The simplest support is a padded board, excellent for flat textiles or ethnographic pieces. Sometimes a padded board has raised edges, so the object sits in a depression, and the padded raised edges keep the piece from sliding off of the padded board. Rigid boards include Coroplast (a corrugated polypropylene), acid-free cardboard, acid-free Foam-Cor, and aluminum or paper honeycomb. Polar Fleece (a polyester fabric) is an extremely soft fabric padding material excellent for display mounts. Many textile conservators cover slant boards use Lynda, another polyester fabric. Lynda has the added advantage that Velcro hook fastens to it. The padding and fabrics are available in most fabric stores. The rigid materials and Lynda must be ordered specially.

Padded mounts for more complex materials, such as tools or baskets, may be made from polyethylene foam planks or rods. Ethafoam (polyethylene foam) is cut using

kitchen knives, hot wires or hot tools. Backer rod, available in most hardware, stores as an insulation material for filling cracks, comes in a variety of diameters. Both materials can be joined with clear hot glue or with hot air melding. (Polyethylene has a relatively low melting point.) Backer rod, cut and joined to form a circle, forms perfect storage and display mounts for most baskets, hats, and round ceramic objects. Both foams can be covered with quilt batting and fabric, as described for the padded boards, to have a cleaner look for display.

Conserva-tip:
Not all acid-free items are created equal. There are alkaline-free, buffered, acid-free, pH neutral, and lignin-free. All of these mean different things. pH neutral may still contain lignin, a component of wood pulp papers that deteriorates to form acids. Buffered acid-free paper is actually not pH neutral, it has an alkaline pH that can damage protein materials (especially silk), and color photographs. Alkaline-free and lignin-free are exactly what they say; they do not contain either material. Acid-free, lignin-free, pH neutral paper is the most stable, as well as the most expensive. Do not trust advertisements for "museum quality," "conservation quality," or other non-specific verbiage. Often the only way of assuring you have acid-free paper is to test each batch with a pH pen.

BOXES

Acid-free cardboard boxes are available in a variety of sizes. They are made of buffered or pH-neutral cardboard. Some more expensive boxes are made of acid-free cardboard lined with a better quality paper on the interior. Boxes have been misused in many museums for years. They are often overcrowded, items are stacked with inadequate padding, or the object is far too small or too large for the box housing it. It is best to store one item per box, fitting the box to the dimensions of the piece, if you can afford the room and the materials. Barring that, there are some alternatives.

Many museums have been dissatisfied with the commercially available box sizes or commercially available materials and have trained volunteers to make boxes that match the item to be stored. This is excellent for gowns or fragile objects. Some volunteers become excellent at devising new boxes to solve complicated storage problems. Boxes can incorporate fold down sides and sliding bottom trays for ease of removal. Rather than use adhesive, many people sew their boxes together or devise clever ties. Learning to make boxes is an important collections care skill. Because cardboard melts if it gets wet, some museums have started constructing boxes out of corrugated plastic (commercially known as Coroplast).

The temptation to stack items directly on top of each other within a box may be great. Instead, convert boxes into multiple layer storage units. Some boxes have commercially available acid-free cardboard shelves and dividers but for many boxes, you will have to make your own. Cut rigid liners or "shelves" from acid-free cardboard or acid-free polystyrene covered board (Foam-Cor) to the inner dimensions of the box. Rest the shelves on small supports inside the box. Supports can be pieces of Ethafoam or strips of Foam-Cor. By stacking Foam-Cor shelves on supports, a box can be created that has three or four separate shelves. Attach cotton twill tape handles to make the shelf easy to lift without disturbing other items.

Photographs and artwork on paper are often stored in Solander boxes. Constructed with a wood frame, cloth covered exterior, and paper lined interior, these boxes are conveniently sized and easy to move. When using these boxes, be aware that Solander boxes with Pyroxylin impregnated fabric exteriors will deteriorate to form nitric acid and therefore are not recommended. Solander boxes with starch impregnated fabric exteriors are preferred. The wood in Solander boxes may affect the interior air quality. Test boxes with A-D strips before use.

PLATFORMS AND CARTS

Furniture, pianos, sculptures and mechanical objects may be too large and heavy for shelving. Store these objects on platforms or carts, at least 10 inches above the floor. Pad the platform or cart with polyethylene foam (best), cotton mattress pads or carpeting. Use high quality, locking wheels on the carts. If objects are temporarily on the floor, place a moisture barrier, such as Mylar or polypropylene, between the cement floor and the object. Cement retains high levels of moisture. It is also alkaline and potentially harmful to sensitive materials. A padding layer of closed-cell polyethylene sheet foam or heavier polystyrene can be placed over the moisture barrier for objects that require padding. Objects should also have dust covers (old cotton sheets work well) and a protective layer of polyethylene sheeting (clear plastic) over them.

BOARD SUPPORTS FOR THREE DIMENSIONAL ITEMS

To support small three-dimensional items (or small repetitious collections) stored on shelves or in cabinets, design individual or group mounts of Foam-Cor.

1.) Cut acid-free polystyrene Foam-Cor or Coroplast to the size of the shelf or drawer, or into easily handled sections.

2.) Set each section on a table. Arrange artifacts on the board leaving ample space

between them.

3.) Mark their location with a pencil and remove the objects.

4.) On the board, at strategic safe points for each object, cut slits the width of cotton twill tape. Insert the tape through the board so the two ends show on the top of the board.

5.) Pad the object with acid-free tissue paper or polyethylene foam, lay it on the board and tie the twill tape. The object should be gently, yet securely, tied to the board. Twill tape can be fastened with Velcro, too.

Items supported on a board can be lifted out of their storage drawer without jostling the artifacts. This lessens the risk of damage and prevents wear from handling.

FLAT ITEM SUPPORTS

ROLLED STORAGE

Ideally, storage should minimize any distortion of an object, including the need to fold or roll it. When there is not enough room to store a textile or large canvas painting flat and the piece is in good condition, it may be rolled on a tube. Use a rigid tube (with a large enough diameter not to deform the textile), a barrier layer, sometimes a padded layer, and a waterproof cover that seals out dust and light.

RIGID TUBES

In general, smaller, thin textiles can go on smaller, thin tubes and larger, heavier textiles and murals need larger, heavier tubes. For example, roll carpets, murals or tapestries on large carpet or Sono (construction) tubes, and small ribbon yardages on toilet paper tubes. Remember, rolling causes compression of the inside surface and expansion of the outside surface, which can result in curling. The severity and permanence of distortion is minimized by increasing the tube diameter. Fragile or sensitive materials should always be rolled on a generous diameter. The length of the tube is determined by the width of the textile. Several inches of the tube should protrude at either end.

Acid-free tubes are preferred. Acidic cardboard tubes, such as carpet tubes, Sono tubes (used to pour concrete foundations), paper towel tubes or toilet paper tubes must be isolated with a barrier layer to prevent acid from migrating to objects. The best acid barriers are polyaluminum laminate, aluminum foil and Aklar, a new, expensive plastic that is impermeable to gases. Polyethylene sheeting (Mylar) is slightly permeable to gases, so it is less effective. Secure the barrier without tape by rolling it around the tube

and tucking the excess on each end into the tube's cavity. If the tube is thick enough, staple the barrier on the ends with stainless steel staples.

Cover the barrier with a layer of unbuffered, acid-free tissue, unbleached, washed muslin, or washed cotton stockinet. Also secure the tissue or fabric by tucking the edges into the hollow of the tube or stapling the edges neatly. If the textile to be rolled is thick or has quite a bit of raised decoration, cover the tube with polyester quilt batting before the final fabric covering. Next, lay the textile on a clean, flat surface. Cover it with an interleaving material. Set the prepared tube on the edge of the textile, aligned with the warp (the vertical threads) if possible. Roll with an even tension. Tension that is too tight will strain and stress the fibers, whereas tension that is too loose will result in sagging and drooping. Loose tension followed by tight tension causes wrinkles and creases to be rolled into the textile and is very damaging. It is sometimes necessary to re-roll a textile several times before the tension is correct. Long or wide textiles should be rolled by two people, one at each end of the tube.

Interleave rolled textiles with unbuffered, acid-free tissue, or washed muslin. Interleave rolled paintings with acid-free glassine or Mylar. For thick textiles or textiles with raised decoration, interleave with quilted, washed muslin. This provides padding for each layer. Deformation in a textile (a stretched area, for example) can cause difficulty in rolling and result in creases and wrinkles. If necessary, lightly pad out the deformation with polyester quilt batting, layered tissue paper or muslin. Pad only enough to avoid creases; never pack in the padding. Roll most textiles onto the tube with the right side, or face, inward. Exceptions are textiles with a raised or painted surface (such as murals, quilts, pile carpets, embroideries and velvets). They should be rolled face or right side out. If possible, re-roll the textile every year in the opposite direction so that the innermost edge of the textile is outermost and vice versa. Do not re-roll paintings.

Cover the rolled textile with a few layers of unbuffered, acid-free tissue, a layer of well-washed muslin or a cotton sheet. The outer layer acts as a dust cover and light barrier. Replace the tissue or wash the muslin when it gets dirty. Some museums roll clear polyethylene sheeting or Mylar D (clear polyester sheeting) over the muslin cover for water protection. Plastic covers may cause mold to form inside the roll. Weigh your risks before using them.

Secure the rolled textile with cotton twill tape ties over five inch wide strips of acid-free bristol board (folder stock). Wrap strips of the thin cardboard around the textile at evenly spaced intervals. Tie the cotton twill tape around them. The bristol board strips prevent the cotton tape from cinching the roll and cutting into the textile. Labels can be

affixed to the matboard strips or to the sections of tubing not covered by the textile. Wide twill tape attached with Velcro is another smooth method of securing rolled textiles.

Rolled textiles should always be suspended, not horizontally stacked. To suspend the tubes, insert a rod through the cavity and support the rod ends. Metal rods are stronger and less acidic than wood dowels. Supports range from bracket or drawer systems in commercial steel cabinets to homemade racks to metal chains with hooks, to acid-free boxes with grooved Foam Cor supports inside. If the tube is longer than the textile, its ends can be supported on polyethylene foam blocks.

Conserva-tip: Easy Rolled Storage
Method 1: Hang two lengths of chain from the ceiling, approximately 4.5 feet apart. Suspend 5-foot metal rods horizontally between the two chains using U-clamps or automotive muffler clamps. The clamps should engage and disengage the rods easily.

Method 2: Suspend small rolled textiles horizontally in the interior of an acid-free box. Nestle the ends of the tubes into notched supports made from Ethafoam or Foam-Cor. Several layers can fit into a box by using these supports to hold the rolls apart, allowing adequate space so the rolls do not touch.

Although it is often necessary to roll large, painted canvases to save on space, it should only be done as last resort and only as a temporary measure for paintings in good, stable condition. Roll paint side out with proper barriers of cast nylon (such as Dartek) or acid-free tissue paper. Unlike a textile, never re-roll the canvas. Remember, this is only a temporary measure.

Steps for rolling textiles and paintings:
- Select a tube of correct diameter and length.
- If the tube is not acid-free, cover it with a barrier material.
- Roll the textile with even tension.
- Interleave textile with unbuffered, acid-free tissue or muslin or other material as described for special cases. Pad if necessary.
- Cover the roll with a protective layer of tissue or muslin to block light.
- Secure the rolled textile with strips of acid-free matboard and cotton twill tape.
- Re-roll textiles every year in the opposite direction.

MATS

Matting and framing are used to store and display artwork, maps or important documents on paper, as well as some flat textiles. Usually, a museum establishes a relationship with a local framer to mat and frame pieces in the collection. Unfortunately, most framers are not trained in techniques for long-term preservation. They rely on catalog descriptions, using products termed "archival" or "conservation approved." You need to know what is meant by these terms. Most framers will tell you they do "conservation framing," but still use pressure-sensitive or gummed tapes. Be sure to ask for the following:

- Non-buffered, all-rag matboard. If a piece is particularly acidic ask for buffered.
- 100 percent bast fiber Japanese hinges, on the top edge only, attached with wheat starch paste OR paper or Mylar corners or tabs.
- If framed, space between the frame's glass and the surface of the paper. More space for pastels and chalk drawings.

Mats are rigid supports for paper or fragile textiles. The mat should be at least 1-1/2" larger on all sides than the piece. Mats consist of a front and back matboard of equal size hinged together with gummed linen tape along the upper or left edge. Artwork is attached with hinges, corners or tabs to the back mat. The front, or window, mat has an opening cut into it to display the object. For storage purposes, the window is bigger than the paper or textile, so no weight is ever on the collection piece. For display purposes, the window may be slightly smaller. Four-ply, 100 percent rag matboard will support most art on paper; oversized artifacts may need eight-ply or heavier. Acid-free rag board is available buffered with an alkaline reserve or non-buffered. Buffered board can slow the degradation of acidic paper, but should not be used for matting Japanese woodblock prints, blueprints, 19th century photographs and contemporary color photographs. Never use matboard made from untreated wood pulp. It breaks down and forms acids that are transferred to the attached artwork. Paper and media in contact with an acid mat will become discolored or "burned" along the cut edge or mat bevel. Conservation board is made from wood pulp that has been chemically treated and then buffered. While cheaper than ragboard, conservation board, is not as good long-term. Any mat board containing wood pulp will eventually become acidic.

Hinges -- little tabs that attach an artwork to the back matboard -- should be attached only to the upper edge of artwork on paper. This allows movement in the paper from temperature and relative humidity changes. Paper, an organic material, responds physically to changes in temperature and relative humidity. Some surface "liveliness" is acceptable, provided neither media nor paper is endangered. Size and space the

hinges to adequately support the paper without extending too far into the sheet. If paper is hinged on more than the top edge, cockling (rippling or buckling) and tearing may occur. Oversize artwork may be hinged at points along the lower edge using folded accordion pleat hinges that gently restrain the artifact and allow the paper to expand and contract. Hinges should be made from 100 percent bast fiber Japanese paper and attached with wheat starch paste. The number, size and placement of the hinges is dictated by the size, shape and weight of the art. Pressure-sensitive tapes such as Scotch, masking, so-called archival tapes and gummed linen or cloth tapes are inappropriate for hinging and should never be adhered to a work of art. Removal of these inappropriate materials and attempts to reverse the damage they cause make up 95 percent of a fine-art paper conservator's workload.

Corners, made from 100 percent rag paper or clear Mylar, are adhered to the back mat only. They provide support for an artifact that cannot be hinged, such as a water-sensitive gelatin photograph. Use corners only with more rigid artifacts that will not slump. Mylar corners are very rigid and could cut into artwork that moves within the mat. Paper corners are softer and usually preferred. Use three corners, leaving the fourth corner free so the piece can be easily removed from the mat if necessary. For storage, corners can be visible. For display, they may be hidden behind the window mat.

GLAZING

Glazing refers to the clear cover in the front of a frame. A work's surface should never be in contact with glazing. The media can become stuck to the glazing or, in high relative humidity environments, condensation and mold can occur at the areas of contact. When artwork is framed but not matted, a clear acrylic or all-rag matboard spacer can be placed in the frame rabbet to provide adequate separation between the artwork and the glazing. More space between the glazing and the artwork's surface should be used for friable media, including pastels and chalks.

Glass and clear acrylic sheet are used as glazing materials. Clear acrylic is preferable for framing larger pieces and artwork that will travel. It is light and will not break. However, it scratches easily and carries a static charge. Glass is easier to clean. Its lack of static charge makes it more suitable for artwork with friable media such as pastels and chalks. Both glass and clear acrylic are available with an ultraviolet light filter, essential protection for media and paper. While ultraviolet filtering slows light induced degradation in paper and most media, it does not prevent it. Artwork should not be exposed to direct or reflected light, even if framed with UV filtering materials.

FRAMES

A sturdy, well-constructed frame is essential to safely house and display artwork. The frame members should be closely joined at the corners. There should be no free play in the frame. The frame should be capable of easily bearing its own weight as well as that of the matted artifact and the glazing material. Wire and hanging devises should be sturdy and well attached.

The glazing material, matted artwork, and a protective, acid-free backboard such as Foam-Cor should be held in the frame from the reverse with an adequate number of brads. If it is an especially heavy package, use brass mending plates. The protective board keeps the mat package clean and adds rigidity. The framed artifact can also be sealed from dust by adhering paper to the back of the frame. If hangers are added to the frame, use two D-hooks on either side of the frame. Don't use wire.

TEMPORARY STORAGE AGAINST A WALL

Storage against the wall may be required during exhibition installation or de-installation for framed artwork. Use padded blocks beneath the paintings to protect the frames. Make padded blocks by covering 2-by-4 lumber with thick foam or carpeting. Cover the foam with tightly woven fabric or felt and attach a skid-proof pad to the bottom of the block. Separate paintings with acid-free corrugated cardboard larger then the work. Stack paintings front to front and back to back. External walls are often sites of excessive or rapidly changing relative humidity and temperature and should be avoided.

Conclusion

This was only a brief overview of storage mounts. More details are provided in articles listed in the additional readings and in the articles provided on-line in conjunction with this lecture. Please make sure you read the Science Museum of Minnesota's chapter on storage mounts.