

BPE 1999

On Paste, Paper & Cloth
The GBW Foundation Session
Chicago 1999

The aim of the Guild of Book Worker's Standards Seminar is to improve the quality of the work in the book arts. The majority of the presentations are at an advanced level with experienced people in the field lecturing on specialized topics and techniques, geared for an informed audience. Frequently, however, many of those attending the Seminar are new to the field and not familiar with the basic concepts and techniques, knowledge of which is assumed in the talks. To meet this need, GBW has initiated a series of annual pre-seminar sessions, called the Foundation Sessions. The Foundation Sessions are intended to be comprehensive introductions to broad, general topics, given by instructors who are teaching in the field. The first Foundation Session given in Chicago in 1999 was on Paste, Paper & Cloth, and the instructor was Betsy Palmer Eldridge.

Betsy Palmer Eldridge studied in Germany and France and worked in New York in the early 60's. She has maintained a private bookbinding and restoration workshop in Toronto since 1973. In 1983 she began teaching regularly for the Canadian Bookbinders and Book Artist Guild. She also has been a frequent lecturer and instructor in the United States in the various conservation programs and at conferences.

WORKSHOP

The Chicago session on Paste, Paper & Cloth began with a number of cautionary comments on setting up a workshop or studio that are not commonly covered in the textbooks. The working environment, for instance, is often taken for granted. Light, temperature, and relative humidity are factors that should not be overlooked: they need to be monitored, and modified if necessary.

Shop Environment:

All forms of light - but especially the invisible ultraviolet wavelengths (UV) - are potentially harmful to materials causing deterioration and fading of colors. Light from natural sources is full of UV. Full sunlight, of course, is harmful, but also the north light favored by artists has enough UV to be troublesome. Natural light needs to be filtered by curtains, shades, or filtering plastics. Artificial light sources vary according to the wavelengths they emit. Florescent tubes generally have high UV levels and require filtering plastic sleeves available from conservation suppliers. The normal incandescent light bulb is relatively safe. The most satisfactory bench light is an incandescent bulb in a swing arm lamp. The raking light from a directed light source gives shadows that are invaluable in critiquing work, showing air bubbles, paste pockets, and poor adhesion; flat overhead lighting is not helpful in that regard.

Most materials tolerate normal fluctuations in temperature. When combined with humidity, however, temperature fluctuations play a major role in relative humidity (RH).

RH is the amount of moisture that air of a certain temperature can hold: the warmer the air, the more moisture it holds; the cooler the air, the less it holds. The changes cause the problems. For instance in northern climates, hot summer air carrying a lot of moisture cools off in a basement and drops a precipitate on which mold grows; conversely, cold winter air with little moisture warms up inside a building and sucks available moisture out of materials. Changes in RH can cause dramatic changes in the working properties of materials at the bench, most specifically in the drying times. RH needs to be monitored as it varies tremendously geographically from one area to another as well as seasonally, often varying from 80% in the summer to 15% in the winter in the north. Hygrometers that measure RH come in many types and prices. The simplest are the cobalt impregnated tapes that change color from pink (damp) to blue (dry) and that can be hung around the shop as indicators and reminders. Then dehumidifiers or air-conditioners for damp summers or humidifiers for dry winters can be used to modify the climate. A reasonably stable climate is a great boon to working with paste, paper & cloth as it makes the handling properties more predictable.

Water is another factor that is often overlooked. Depending on the source, it may contain metal particles (rust) from the pipes, bacterial contaminants, chlorine purifiers, or other undesirable materials. On the other hand, pure H₂O, as in distilled or de-ionized water, lacks the desirable calcium or magnesium (so obviously present in “hard water”) that raises the pH, neutralizing any acids. Again, water sources vary tremendously. Water should be analyzed and modified if necessary with filters and additives. Fortunately bottled spring water usually tests well: low in minerals and contaminants, high in alkalinity. Boiling is often a simple safeguard. As paste is made with water, a little initial attention to water quality is worthwhile.

Even with favorable environmental conditions, the shop itself may have a number of hazards. Pets, notably cats that climb up on surfaces, can be a hazard. There once was a cat that used up one of its nine lives by tipping over a bottle of India ink on a manuscript. Children can be a hazard. There once was a small child that tragically colored in a Picasso with marker pens. A door – with a lock - is absolutely essential. Any food of course is a hazard. Even liquids like coffee, tea and water spill or leave rings on surfaces and never should be on the bench. There is a long list of other potential hazards: make-up, lipstick, fingernail polish, long fingernails, and jewelry such as rings, dangling bracelets and necklaces. Pasted paper (not to mention leather) is extremely sensitive and impressionable.

A proper bench – even if it is only a door on some form of support – is important for ergonomic reasons. It should be a good standing work height - with a stool available - to avoid eventual back and knee problems. Similarly, hard floors need mats to stand on to cushion the impact. Flat storage areas – dry and dust free - for papers, plus rolled storage for cloths (and leathers) must be provided. Solutions to these furniture needs are many. They can be inexpensive and imaginative but they must meet the requirements.

TOOLS

Similarly, the tools required are not many but need to have good working qualities. A

few specific comments are as follows:

Bone folders: The traditional tool of the trade. Usually made of bone, but also horn, wood, Teflon, and bamboo in the Far East. It is useful to have several in a variety of shapes and sizes. They can (and should) be shaped with sandpaper to suit your individual needs. A six inch pear shaped bone folder is a popular choice: pointed at one end, rounded on the other; flat on one side, rounded on the other, with the flat side often shaped up at either end to provide little finger leverage. Bone folders must always be kept scrupulously clean and free of paste in order to move smoothly across the materials. Traditionally they are run regularly through the hair or over the skin to slip more easily, especially over damp paper that tears readily.

Knives: A selection of knives is useful. For thin materials such as paper or cloth, a surgical knife with replaceable blades is ideal. Available at medical suppliers, different size handles fit different shaped blades. A bookbinders' favorite is a #4 handle with a #23 blade (slightly rounded). Paper conservators seem to favor a #10 blade (straight). For heavier weight materials such as cardboard, a sturdier knife such as a mat knife or a utility knife with a retractable (and replaceable) blade from a hardware store is fine. For slitting materials, a German slitting knife or an English cobbler's knife or even a regular kitchen knife (not serrated) with a long (6 inch) blade can be used. The edge is kept sharp, but not razor sharp. Slitting materials is much faster than cutting them with a knife and straight edge, and is a method frequently used in this work.

Shears: A variety of scissors is helpful. A Wiss #1 Rug Shear is a bent shear, designed for cutting pile on carpets, that cuts conveniently flush to the surface. It has become a favorite and is available at the suppliers.

Straight edges: Several are needed to cut and fold against. A light weight 12" straight edge is extremely useful, as is a heavier weight 18" or 24" one. As most "flat" surfaces are not truly flat, a slight flexibility in the straight edge allows for good contact with the surface. Too much rigidity or conversely too much flexibility causes loss of contact either in the middle or at the ends. Similarly, metal right angles of different sizes are very useful. In both cases, beware of incised calibrations for measuring that will cause the knife to chatter: unmarked is best. Rulers are seldom used for measurement as they are too inaccurate and unreliable, as is most binders' arithmetic. A marked strip of paper is better.

Dividers: An extremely useful tool for measuring and marking distances. A 6" leg is a good size. The tips of the legs should be able to meet (to measure 0) but should not cross over. The spring "through the leg" type is desirable as they lie flat on either side.

Awls: An awl is very useful for pre-punching holes. The needle should be slender and not too thick. If the handle is flat on one side, it will not roll off the bench.

Weights: A good selection is desirable. Brass bars, glass plates, old cast-iron irons (with self-stick felt on the bottom), wrapped bricks, and lead weights can all be used. Everyone accumulates a collection of favorites.

Paste brushes: An assortment of round and flat brushes of different sizes is needed, preferably without metal keepers that will rust. Natural bristles are best with paste; synthetic bristles are best with synthetic adhesives. Paste dishes should be flat bottomed and heavy (pet dishes work well) so as not to tip. When in use on the work surface, all brushes, paste dishes and water jars should be kept on a tray to avoid dribbles and accidental spills.

MATERIALS

Adhesives:

There are basically three classes of adhesives that are used in bookbinding: cellulose, protein, and synthetic.

The cellulose adhesives are known as “pastes.” They come from plant or vegetable sources such as wheat, rice, corn, or potato and may be in the full flour form or in a simplified starch form. They are usually cooked (in a double boiler) before use. While their handling properties vary marginally, they share common characteristics. They are strong, stable adhesives that are soluble and reversible in water, but they do not have quick “grab” and are not thermoplastic (soften with heat).

The protein adhesives are known as “glues”. They come from animal sources such as cattle hooves, and rabbit or fish skin. They have quick grab and are thermoplastic, and also are strong adhesives that are soluble and reversible in water. They tend to be more acidic, however, and are not as stable. Both cellulose and protein are traditional adhesives with well known properties. However both of them are unfortunately attractive to insect pests. A synthetic cellulose, methyl cellulose, is used instead in many areas where pests are a problem.

The synthetic adhesives, also generally known as “glues” rather than “pastes,” are designer adhesives, whose formulas can change to produce different properties. They are the common “white glues.” Most of them are PVA (polyvinyl acetate) products, such as Jade #403 and Elvace, two well known brands. As a class, they have quick grab and are thermoplastic, and are relatively stable and strong, but once dry they are not soluble or easily reversible in water (even those that say they are). For that reason, they are not used in direct contact with archival material. A mix of PVA and paste is commonly used where the paste acts as a poultice to lengthen the working time of the PVA, although mixing adhesives is generally not recommended scientifically. Paste with its cellulose base is still considered to be the ideal adhesive for working with paper and cloth that are also cellulose based materials. It has great versatility, depending on how it is used.

Paper:

Paper is basically a felting process of cellulose material and is made from many different types of plant material the world over. Some of a paper's qualities stem from the cellulose source of the substrate. In the West, the traditional sources have been linen

(flax) and cotton, or more recently wood pulp. Other qualities come from the size, the coating that is added either externally or internally to support the media such as ink or watercolor. Historically western papers were sized with a protein gelatin size although paste and other materials have been used. By far the majority of a paper's qualities however come from its manufacture, how the basic cellulose plant material was made into paper. How the fibers were beaten and for how long, what chemicals were used to break down the fibers and whether or not they were adequately removed, and how those fibers were formed into sheets. For instance in the first case, mechanically over-beaten fibers resulted in weak, short fiber papers with little strength, and in the second case, the acid used to break down wood pulp in the 19th century resulted in the brittle book problem in the 20th century. It is the third factor however, the alignment of the fibers in the formation of the sheets, that largely determines the handling properties of a paper. The dominant direction of the fiber alignment establishes the paper's "grain." Although the alignment in handmade papers differs somewhat from machine made papers, the grain is definitely a major characteristic in both. C)

In working with a paper's grain, the image of "logs in a river" is a useful one as it clearly explains many important properties. When folding, a paper folds more easily parallel or with the grain than it does against the grain. Similarly when wet, a paper expands more – and then later contracts – from side to side across the grain than it does end to end against the grain. This expansion when wet and contraction when dry of the paper fibers is a major factor in working with paper. Cloth on the other hand reacts quite differently.

Cloth:

Most cloth historically was also made of cellulose materials, either linen or cotton, with the notable exception of protein based silk. Of course many synthetics are now available. Cloths too have a sizing component. Historically book cloths were sized with a paste and are called "starch-filled." They were archival but the surface was not waterproof. Modern book cloths have been sized with a plastic and are called "pyroxylin-filled." Their surfaces are waterproof but they are not considered archival due to residual plasticizers. Many contemporary book cloths do not have a protective surface sizing at all, and are paper backed. They are designed to be used commercially with synthetic adhesives but the backing may delaminate when used with paste. Many book conservators (and artists) regularly make their own starch-filled book cloth, colored to meet their needs. Cloth too has a grain determined by its manufacture. The warp threads that are on the loom and run parallel to the selvage edge are stronger and straighter than the weft threads (the shuttle threads) that run across and are perpendicular to the selvage. The grain of cloth is said to run with the warp, parallel to the selvage.

The twist of the thread and the subsequent weave of the fabric give cloth its strength and its flexibility. The twist of the thread acts like a coil or a spring that can bend in any direction, often called "the slinky effect." However the twist also causes other distinctive properties. When wet, the expanding fibers in the twist cause the thread to shorten dimensionally, end to end, often called "the clothes line effect" after old rope clothes lines that became taught in the rain. The swollen thread in turn tightens the weave and causes the fabric to shrink dimensionally. The result is that cloth shrinks and contracts

taut

when wet, and relaxes and expands when dry, the exact opposite of paper.

These two opposing sets of characteristics have traditionally worked well together in cloth case bindings. With cloth on the outside of the boards and paper on the inside, the boards invariably develop a subtle warp to the inside. That convex shape keeps the pressure on the margins to keep out dust and dirt, and keeps the pressure off of the punch of the type in the text. It also allows books to slide nicely into place on the shelf.

To work with these materials, many bench techniques have been developed over the years that should be mastered through practice. Actual demonstrations of craft techniques are always best, but in this case a verbal description will have to suffice.

BENCH TECHNIQUES

Work Area:

(2) The habit of maintaining an orderly work area at the bench is well worthwhile to avoid tools and paste dribbles from accidentally showing up in unfortunate places. For a right handed layout: Tools are kept to the far right. Next comes a cutting area with a cutting board to protect the bench, and then a paste area with a pre-cut pile of pasting papers and with a tray above for a paste bowl, brushes, a sponge and a water jar. The working area is in the middle and should be covered with un-printed newsprint that will immediately show up any stray paste and water - often hard to see on the bench. A drying area is to the left, or alternatively above, with work in progress kept between wooded boards with a weight on top. Being methodical keeps variables to a minimum; flying on automatic pilot allows attention to concentrate on the work at hand.

Establishing Grain:

(3) A basic skill is developing the ability to recognize the grain direction in materials, which is not difficult with a little practice. In paper and board, the common way is a simple bounce test, either in the air between the hands, or on the bench surface. If the curve at the end of the fold has a V shape, the fold is parallel to the grain; if the curve at the end has a U shape, it is against or across the grain. If the difference is difficult to determine, as it can be with some lightweight papers, two or three sheets bounced together often makes the difference more pronounced. Another test is to try to make a small tear in each direction. Tearing parallel to the grain leaves a clean edge tear; tearing across the grain leaves a more ragged tear. The ultimate test of course is dampening the surface. The arch or tube that the expanding surface fibers form will be parallel to the grain. Grain running parallel to the short dimension of the paper is said to "run short"; grain running parallel to the long dimension is said to "run long." Establishing the grain direction in full sheets is relatively easy; establishing it in small cutoffs, particularly in small pieces of stiff board, can be a nightmare. Be religious in marking the grain on cutoffs. If the surface will not be seen (on board, or the back of decorated sheets), cover the surface with pencil strike marks. On better papers, a small pencilled arrow regularly placed in a corner will suffice. Pre-marked scraps can be used for many purposes; unmarked scraps are trouble.

Measuring and Marking:

A measuring tape or calibrated ruler is generally only used when measuring materials to estimate supply needs. Otherwise it is much safer to use a set of dividers for small measurements, or a marked board or strip of paper for larger measurements. Strips of paper also can be folded in half to find mid-points, or in thirds, fourths, or sixths to quickly and accurately divide up the spine into panels and establish sewing stations. Generally, measuring from the materials themselves is best, for instance the book or box itself. To make a mark, a knife point (or a divider point or an awl) is often better than a pencil. It is more precise, can be seen on both sides of the material, can be felt, or seen with a raking light, and virtually disappears when dampened and pressed with a bone folder.

Folding and cutting:

Materials are folded by lining up the edges and using the palms of the hand or a bone folder to press down the fold using strokes that fan out from the center. Folds parallel to the grain are always easier to make than folds across the grain, which may need to be scored with a bone folder and straight edge to depress the fibers first, especially with heavier materials.

*Score on the back; if the folds
outward, back inside*

To slit materials, the material is folded and the fold is brought to the edge of the bench. With the knuckles off the bench and the blade lying flat, the slitting knife is inserted into the fold. The knife acts like one half of a scissors, the bench being the other half. Instead of pushing directly forward however, which will bunch and tear the material, the knife is used in a circular motion, constantly being drawn back as it advances across the fold. Once the knack is learned, it is an extremely fast, time saving way to rough cut materials. A slit edge also has a softer edge than a finished cut edge, which is often an advantage.

A finished cut is rarely needed but is made when the edge will be visible. A finished cut is made with a straight edge and a knife. The key to a successful clean cut is to keep the weight on the straight edge and not on the knife. If the straight edge slips, the cut is ruined. Plan always to make three cuts (at least) with the knife: the first cut creates the path, the second (or more) does the actual cutting, and the third (or last) cuts the piece free. Trying to cut with only one stroke is usually a mistake: too much pressure is likely to bunch the material, or move the straight edge.

Water cuts that leave a feathered edge of fibers are made with a straight edge and either a water pen (a flow pen using water instead of ink), or a thin brush. The slower the pen or brush moves the wider the water path will be and the longer the resulting feathers. A feathered edge also can be torn by scoring first with a needle or an awl. Both methods are frequently used to create repair tissues. Commonly the desired width is measured off with dividers from the right side, the straight edge is placed on the marks, the line is drawn and the strip torn off. Unfortunately that often results in a badly distorted strip. A better way is to measure off from the left side, cover the strip with the straight edge, and tear the body of the paper from the strip. Exceedingly narrow strips can be successfully torn with this method. Using a piece of heavy glass as a straight edge is convenient as the

width of the strip can be readily seen underneath. In another method, small feathered repair pieces called “worms” can be made by bursting the back edge of a slitting knife through the fold of the repair tissue. A useful collection of worms can be kept handy in a jar! To water tear heavier, handmade papers, create a fold on the tear line, then run the fold through a small puddle of water on the bench. Reverse the fold and repeat as many times as necessary. Tear at the fold line, over the edge of the bench. The feathered tear that results can be made into a false deckle edge by consolidating the feathers with a little paste.

The transmitted light of a light table is useful to tear unusual shaped repair pieces or inlays in light weight papers. A simple, inexpensive light table can be made with two fluorescent under-the-cabinet light fixtures from the hardware store with a sheet of opaque Plexiglas on top of them. On top of the Plexiglas, place first the object, then a protective sheet of Mylar, and finally the paper or repair tissue. A water pen or brush can then easily trace the outline shown by the transmitted light. To tear unusual shaped pieces in heavier papers, the outline can be scored directly in the paper with a bone folder. A damp sponge is passed once or twice over the area leaving water to pool in the scored line. Once the fibers in the line have softened, the piece can be torn free.

Sanding:

After cutting a board, the board edges need to be sanded lightly. Do not round the edges; just remove any lips that have formed in the cutting, and blunt the corners and sharp edges. Three strokes per edge usually suffices. Use a sanding block, sandpaper wrapped around a bone folder, or even a nail file. Work on the bench with the board extended over the edge; never work in the air. Check the profile with a raking light for wear points and be sure that they are removed.

Pasting:

Cooked paste can be stored in the refrigerator for a limited time. Be sure to keep paste covered. Two layers of plastic wrap between the jar and the lid will make opening easy. Decant the amount of paste needed from the mother load so as not to contaminate the rest. Varying the thickness of the paste can give a great deal of control over the amount of adhesion. Depending on what the situation requires, paste can be used thick, or stiff like yogurt, thinner like heavy cream, or quite thin like milk. When diluting thick cooked paste, push it through a sieve or a strainer to remove the lumps first and then work the water in thoroughly with a brush until the paste is uniform, developing a distinctive sheen and “slop-slop” sound. To test the amount of adhesion, paste out a strip of the paper or material in question, fold the two ends back on themselves to form tabs, then fold the entire strip in half on itself. After it has dried, try to pull it apart by the tabs. The strength is determined by whether it separates at the paste level or delaminates the materials.

The pasting out of materials is usually done with a round brush in the western tradition. Be sure to wet the brush thoroughly before using so that the paste will not wick up into the handle where it is difficult to remove. Charge or fill the interior of the brush with paste, scraping the excess off the exterior. With one hand, steady the paper and with the

other, spread the paste with regular fanning strokes of the brush. Always brush from the center outward, off the edge. The brush should be rotated between strokes (rolled in the hand) to deliver a new load each time. Traditionally the pasting is done twice: the first time to let the paste soak in to expand and relax the paper, the second time to leave the adhesive layer. In dryer conditions, or if less adhesion and stiffness is desired, the papers can be dampened and relaxed with a water brush or sponge first before the paste layer is added. Paper should always be used in a fully expanded and relaxed state. If it curls uncontrollably initially, it (or the corners) can be folded over on itself temporarily, paste side to paste side. Cloth especially curls badly initially and needs to be restrained until it has relaxed. It is extremely important that as thin a layer of paste as possible be left. Thick layers of paste result in ridges and pockets of paste that are unsightly and cause unwanted stiffness and warping. The Japanese pasting tradition uses flat brushes: after the paste is spread, the brushes are used to squeegee off the excess. Excess paste can also be stripped off by rubbing a waste sheet down on the area and then peeling it off.

Special pasting techniques are needed for different situations. To tip sheets, a narrow strip of paste along one side of each sheet is needed. Before pasting, roll the group of sheets up together, which automatically staggers the ends. The regularly spaced sheets are then held, lain on the bench and pasted, each acting as a protection sheet for the next. To deliver a thick bead of adhesive along one edge of a board, useful in assembling boxes for instance, scrape the side of a well pasted brush diagonally down along the edge of the board. To attach trays to their bases, again in box making, do not paste the entire bottom of the tray. The expansion will make good contact almost impossible to achieve. Instead, paste the edges of the bottom of the tray and stipple or crosshatch the rest to avoid overall expansion. Afterward, if the corners of the trays are still not well adhered, a sanded piece of Mylar can act as a thin paste brush to slip under more adhesive. To paste water torn repair strips is a special situation: they are pasted with a transfer method as pasting them with a brush would lose the feathers. Brush out the paste smoothly on a hard surface such as a lithographic stone, a piece of marble or etched (sandblasted) glass, or even a counter top. Drop the repair strip on it. A thin layer of stiff paste can be transferred this way. If a second layer is needed, the strip can be picked up and laid down a second time in a fresh area. As the feathers tend to hold excessive paste, be sure to blot the excess off once the strip is in place. This transfer method is useful in a number of other situations as well, such as pasting labels and bookplates.

Laminating:

When two similar papers are being laminated together, both need to be relaxed, either with water or paste, before they are adhered. The pasted layer is usually left flat on the surface and the second layer laid on top of it, working either from a corner or from an edge. To help in the positioning, thin materials often need to be carried on a support such as a piece of Mylar. With large sheets, a wand such as a wooden ruler can act as a train bearer on one side while the other side is being laid down.

Good contact is imperative for good adhesion. Rub down the surface in a fanning motion from the center out with the palm of the hand initially, then use the flat side of a bone folder in a circular motion – through a protection sheet if the material is delicate. Using

too much pressure initially is likely to move the paste around and cause ridges and lumps. Freshly pasted papers are very sensitive and easily pick up fingernail marks and bone folder impressions. Again, use a raking light for spotting air bubbles, paste pockets, and other blemishes that should be immediately worked out with a bone folder. A quick nip in the press (1 - 10 seconds or longer, depending on the weight of the materials) is often useful, however too much pressure for too long may cause the paste to strike through to the surface.

The topic of laminating materials together immediately brings up the question of "pull", which can be a problem, especially when the two materials are different. The amount of pull is determined by the type and the weight of materials being laminated together. As explained previously, paper will invariably pull cloth due to their different inherent properties. Also, thinner papers will invariably pull thicker papers. The thinner paper expands more with moisture and subsequently contracts more as it dries. The general rule is: the thinner the paper, the more the pull, and conversely, the thicker the paper, the less the pull. To counteract the pull, another balancing sheet needs to be laminated to the other side. For instance when building laminated boards for a binding, the center sheet is often a thin board to which additional boards are laminated on either side until the desired thickness is reached. Laminated boards are always stronger and more stable.

Traditionally boards have also been lined on both sides with a pasted paper that wraps around the spine edge. The pasted paper balances and strengthens the board, keeping it from splitting at the spine edge. It also stabilizes the board as the paste acts as a layer of size to block subsequent moisture and minimize expansion and contraction. Properly balanced boards can be stood in a T formation and allowed to air dry with good results. Of course boards can also be deliberately warped and pulled to meet special requirements, as they often are for book covers.

Drying:

A great many of the difficulties that occur in working with paste, paper and cloth develop during the drying stage: warping, pulling, cockling, and rippling. In order to successfully dry materials flat, it is helpful to understand the drying process. A damp sheet of paper (or board) lying on a surface eventually will dry with a concave curve. Viewed in profile, the moisture in the sheet gradually migrates from the underside to the upper side where it evaporates. Consequently the underside dries first, in a slightly expanded state, and the upper side dries last, continuing to contract, pulling and drawing the sheet into a concave curve. The general rule is: a sheet curls toward the side that dries last. Similarly, when viewed across the sheet, the edges of the sheet that are exposed to more air dry first in a slightly expanded state, and the center of the sheet that is damper dries last, contracting, pulling and forcing the edges to cockle. All of these warping and cockling problems come from differential, preferential drying, i.e. one area drying and setting before another. The solution is to create a drying microclimate that forces the moisture to dissipate and equilibrate throughout the sheet before it evaporates, so that the sheet dries uniformly while being held in a flat, two dimensional plane.

Drying procedures can be divided into two types: unrestrained drying and restrained drying. Unrestrained drying is simply air drying, which is often not only the easiest but

the best. Let the material (specifically the adhesive layer) air dry completely, accepting some warp and pull and cockling, then humidify it in a humidity pack or chamber (a double garbage can works well), then press and dry. Once the paste adhesive has dried and bonded, it can be dampened and/or humidified without the bonds breaking. For example, feathered repair strips once in place should be air dried first, then dampened with a water brush to relax them before pressing. If pressed wet, the feathers tend to stick. Restrained drying generally is drying in a press or under a board with weights, using wicking materials to remove the moisture. Another form of restrained drying is the Japanese technique of “stretch drying”, often used to line materials. The sheet and the lining material, cut several inches larger than the sheet, are dampened and relaxed. The lining material is pasted out and the sheet laid on it. Then both are turned over and laid face down onto a drying board or other firm surface, with a paper tab inserted under the pasted margin for later access with a spatula. The stretched lining material on the outside dries taught first and restrains the inner sheet as it dries. Another version of that technique is called “friction mounting.” The sheet and lining material are dampened and laid face down on the board, the edges of the mounting material are turned back, pasted, and then put down. When dry, they can be removed from the drying board and peeled apart as they are held only by friction and no adhesive. If laminated sheets are too stiff when dry, they can be softened by the nice Japanese technique of beading. A coil of uniform sized beads (under the palm of the hand) is rolled around and across the paper: it breaks up the stiffness without delaminating the papers. To avoid burnishing, work through a protection paper.

The common bookbinding solution to drying, “put it in a press until it is dry”, needs some qualification. The press’s pressure indeed holds the material in a flat, two dimensional plane but it does not do the drying. The press creates a microclimate but no drying occurs unless an absorbent wicking material is included. The wicking material - blotters, cardboard, paper felts, or even old blankets (the original paper felts) - is actually providing a layer of air that needs to be changed regularly as it becomes saturated with moisture. It is useful to think in terms of three changes – perhaps at 1/2 an hour, two hours, and overnight – depending on the materials and the amount of moisture involved. Eventually the moisture in the microclimate will be in equilibrium with the ambient moisture in the room. At that point, the item will have set, will be relatively stable and is considered dry. If something feels warm to the touch, it is dry; if it feels cool to the touch, it is still evaporating and damp.

Conclusion:

The recent popularity of non-adhesive binding structures has brought to light many interesting structures that are dependent primarily on mechanical means of attachment rather than on adhesive. Their wide appeal may come from a reluctance to deal with the problems – primarily of expansion and contraction - inherent in working with adhesives. Traditional binding structures, however, invariably involve adhesives. Knowing the techniques of how properly to work with adhesives is fundamental to traditional binding and opens up a world of possibilities. Indeed folding, cutting, pasting, and drying are all skills that are a necessary part of every binder’s repertoire.

In the end, working successfully with paste, paper and cloth requires judgement, a judgement that comes from experience and an acquired understanding of the potential of the materials. But it starts with a basic knowledge of the tools and techniques available and needed to reach that end. What lies in between is a lot of practice, and some experimentation. Every book – every project – is an adventure with lessons to be learned. The materials themselves are the ultimate teachers. If the current book or project turns out in the end not to be quite perfect, then there is always the possibility – and hope – that the next one will be. Working with paste, paper and cloth is always a challenge, but with practice, also a pleasure.