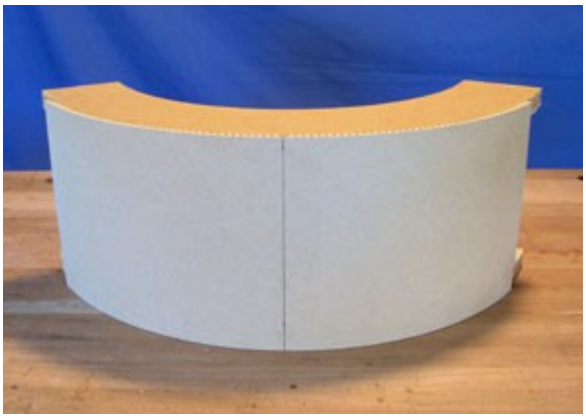
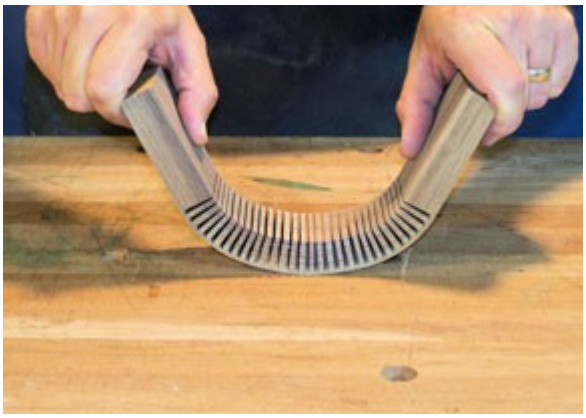
Nature hates straight lines, and as woodworkers we spend a huge amount of time and effort in making things straight. But curves can and should be a large part of your woodworking. There are several methods for forming wood into curves, and the next few blog posts will explore these techniques. We will be looking at simple force bending, kerf bending, lamination and steam bending.

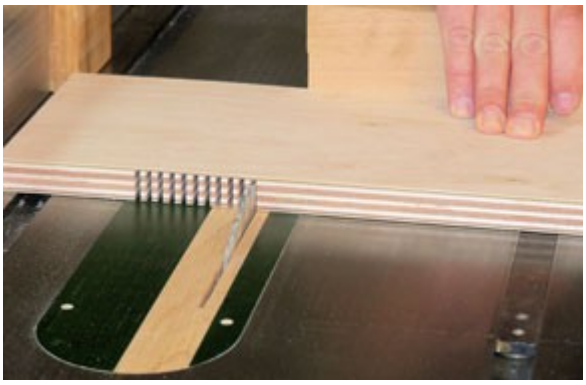
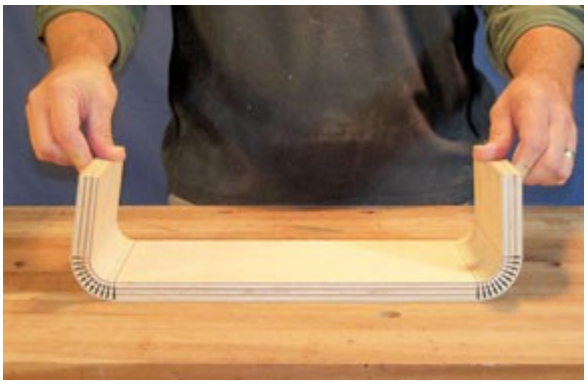



The most basic method is to simply manually bend the wood and attach it to a solid piece to hold the shape. Banding the edge of a curved piece of ply is an excellent example. If the curve is not too tight, and the stick relatively thin, this is easy. It stands to reason that the tighter the curve to be edged, the thinner the stick needs to be to conform to the curve. Veneer can follow a very tight curve, while a 3/4 inch thick piece of oak cannot be flexed much at all. Typically, the part is held to the curve with glue only since piercing the wood with a nail or screw would tend to break it under the bending stress. A good rule of thumb is that if the part can be formed by hand, then a good glue joint should hold it perfectly well. Glue up the mating surfaces and clamp the parts together. To avoid gaps, start clamping from the center and work outward, or from one end to the other. This allows you to work gaps out as you go.


Kerf bending is the process of cutting a number of slots into a piece of material that allow it to bend. Essentially, by kerfing the part, you are making it thinner, so it can be flexed to follow a curve. While this method is not very strong, it does allow for easy forming of wide or tall parts.




Nearly any saw can be used for kerfing. Here I used the table saw, but for very long parts, a radial arm saw is ideal. A circular saw or even a handsaw can do the job too. The trick is to cut most of the way through the material to allow it to bend, but not so much that it becomes too fragile. Keep the kerfs close together and regularly spaced so that the bend is smooth and regular with no flat spots. I have even seen small moldings that were hand kerfed with a fine saw used as trim on antique doors.

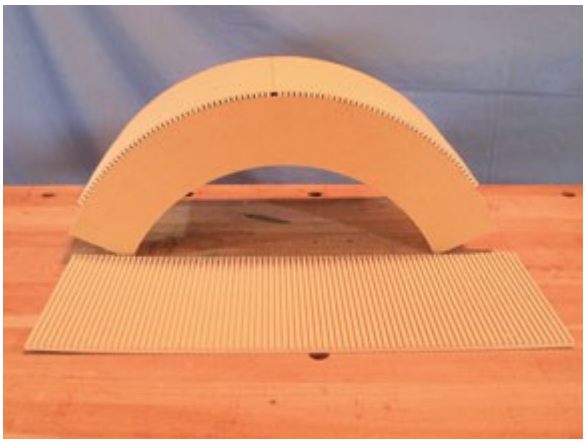



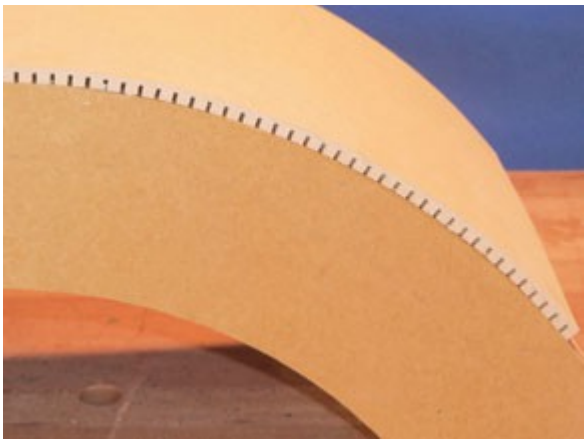
Kerfing allows for bending all sorts of thicknesses of stock, and is especially useful for bending plywood. Note here how I kerfed just the areas that were going to be curved, leaving the flat areas to be attached conventionally.

Stair builders often use this technique for the large "bullnosed" bottom stair on a fancy staircase. Getting the right depth and spacing can be a bit tricky at first, so practice your technique with some scrap material before committing to kerfing your actual parts.

If you do not want to go through the effort of kerfing your own stock, you can purchase kerfed panels that can be cut to size and wrapped around a form. This option is excellent for decorative columns and such. Rockler sells 1/4 inch thick

Neatform sheets for this purpose, and large lumber suppliers typically have 4x8 sheets available of various pre-kerfed materials. Kerfed plywood or MDF faces can be painted or veneered to achieve the final look your project demands.





Practice these bending techniques to get a feel for how they work and might fit into future projects. In the next blog, we will look at laminating thin sheets into permanent curves.

We started this wood bending series exploring simple and kerf bending. In this edition, we look at forming wood parts using thin laminates. As we all know, the thinner the part, the easier it will conform to a curve. Lamination is the process of bending many thin parts together and holding them in the desired shape until the glue between them dries. Once dry, the resulting part will pretty much hold its shape forever. There are two basic ways to clamp the parts while the glue dries; using physical clamps or a vacuum press, and we will look at both methods.

The obvious first step is to prepare the laminations. For this demo, I used a thin rip jig and zero clearance throat plate to cut a number of thin strips for bending. The thickness of the parts is largely determined by your bend. Shallow curves can be made up of fewer, thicker laminations, while tighter curves need more thin laminations. Once the parts are formed, changing the overall thickness will be very difficult, so take the time to figure out the number and thickness of strips needed to make up your part. If you have a drum sander, getting strips resized is pretty easy, but cutting them to the right dimension on the saw is faster.

Once you have the stack ready for bending, you need some sort of form to hold

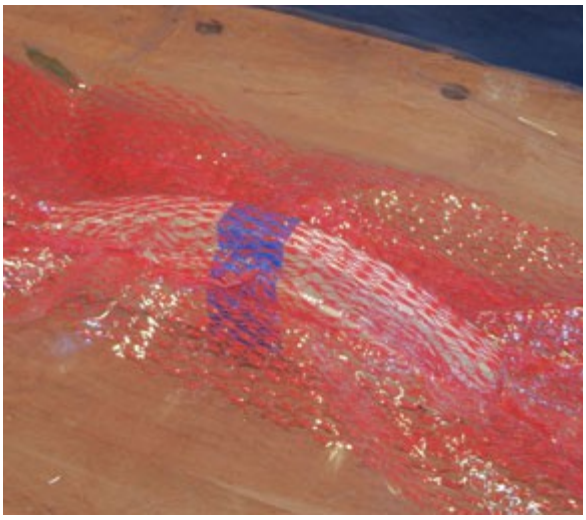
them in shape while the glue dries. Whether using clamps or a vacuum press, your form needs to be pretty strong. A lot of force will be exerted to hold the parts and you do not want your form to fail in the middle of the glue up. When possible, I prefer my forms to be solid wood. Being solid pretty much eliminates the chance of having a form fail. When the form needs to be larger, it can be built up.

A note on form design here: when you unclamp your dried part, it is going to "spring back" a little bit from the stresses in the bent wood. You may need to over-bend your parts to account for this. There is no formula. A few thick laminations will tend to spring more than many thin pieces. With experience you will get the feel for this, but keep it in mind as you work with your first bent parts. Make the radius of your form just an eighth inch or so smaller than you want to final part to be.

The laminate parts need glue between each layer, and to be clamped to the form before the glue dries. If you are using yellow glue, this does not leave a lot of time. I have found that a mix of 1 part water to 4 parts glue spreads quick, leaves a thinner glue layer which squeezes out less, and gives more open time, all without risking the glue bond.

For this curved apron, I used a form built up from two plywood faces with blocking in between. Clamp the strips to your form in the center and work out to the ends, keeping the work tight to the form. Have lots of clamps on hand, you won't have a lot of working time after gluing all the pieces. Having the form open in the center allows the clamps to stay perpendicular to the arc. Let the parts set over night.

A solid form was used for vacuum clamping this small part. Clamping in a vacuum press applies a surprising amount of pressure evenly across the entire part. When set up right, there will be no gaps in the lamination. With vacuum clamping your form needs to be exceptionally strong or it is likely to crush and ruin your glue up. Vacuum clamping is especially useful for wide parts like curved doors where it is difficult to properly clamp in the center of the part. Many lumber suppliers will sell pretty wide stock already cut into thin pieces that are meant for laminating.



Clamping up simple, fairly shallow curves is a great way to start out and adds a whole new dimension to your woodworking. So far, we have been working with simple forms, but two-part forms can be useful as well.

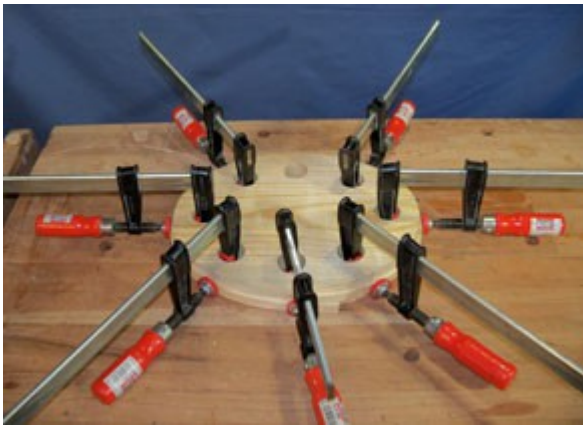
If you do not have lots of clamps in your shop, a two sided form can effectively clamp up a laminated stack using only a few bar clamps. Two part forms are also essential when your laminated part needs reversing curves.

So far in this series we have looked at simple wood bending in thin stock or with kerf cuts, and forming bent wood parts through laminating thin strips together on a form. In this final installment, we will discuss steam bending wood. Steaming actually changes the cellular structure of wood to make it more pliable. As the wood cools and dries clamped to a form, it very quickly regains most of its original stiffness, but in the shape of the form.

Steaming wood for bending requires having some form of steam generator and a container to steam the wood in. Up until recently, this largely meant building your own, but now complete steam generators are available that you can add to a shop-built steam box.

Wood selection is very important for successful steam bending. Air dried lumber is much easier to bend than kiln dried. Kiln dried lumber can be used, but needs to steam longer. Soaking it water overnight also helps a great deal. Certain species of wood bend much easier than others as well. Essentially, the more open the grain, the easier it steams which makes sense as the steam can penetrate the open pores more easily. Of common woods, white oak is best, followed by red oak and beech. You can find an excellent write up on steam bending basics here, and there are many good books and DVDs on the subject available as well.

Stock preparation for bending is no different than any other woodworking project. Your parts should be planed to thickness and ripped to width. Generally, it is difficult to figure exact length around curves, so crosscut parts long to be trimmed after bending. The parts are placed in the steam box insuring that there is space between them for the steam to circulate, then the steam generator is turned on. On average, you want to steam for one hour for each inch of thickness. I found that with kiln dried wood, and since it was cold outside my shop (you do not really want to have steam and water inside with your tools) I let the system run for about an hour to get everything fully warmed, then refilled the water tank and steamed the parts for an hour.



As you would expect, very thin parts, like the pieces that form the embroidery hoop, soften pretty quickly and thicker parts will take more time. Make sure that you have everything ready before removing the parts from the steam box. They will cool very quickly, so have all your clamps at hand. Parts that are ready to bend will be very hot and wet! Gloves are a necessity. Get the parts right to the form and force them into position quickly. Add clamps as needed to hold the wood tight to the form. They need to remain held in position to fully cool and dry, overnight at least.

As with other laminate bending, there will be some "spring back" when the parts are unclamped. Note how the form for the carry all

handle over bends the part by 10 degrees on each side. When released, the handle sprang back to a nearly perfect 90 degrees on each side, but over a couple days opened up a bit more. The embroidery hoops spring back even more, but the inner hoop will be joined into a closed part and the outer hoop will get hardware to make it into a clamp, so this is less of a concern.

Obviously, a blog is not the best place to learn all there is to know about bending wood, but we hope that this series has given you ideas and inspiration to try using wood forming techniques to enhance your projects. Learning more through reading and practice can open up a lot of new possibilities for your woodworking enjoyment.