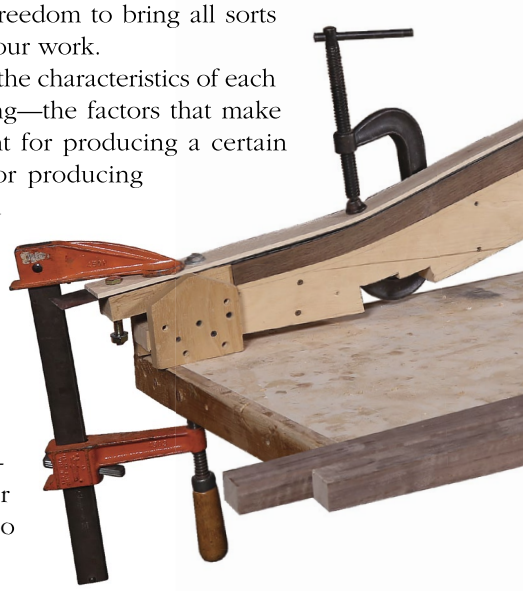
Creating Curves

Learn when it's best to saw, steam-bend, or laminate

BY BRIAN BOGGS

A straight line is a wasted opportunity. I love that quote from the furniture maker Jere Osgood, a wizard with curves. It's been curves and their sculptural relationships that have kept me so enthusiastic about furniture design for more than three decades. Curves move and flow and add life to a piece. And, yes, they add technical challenges. A mastery of curves is vital for a chairmaker, but it is also a great boon for the maker of casework and tables. There are three chief ways to get the curve you want: sawing, laminating, and steam-bending. Each of these methods has an important place in my designs. Sometimes all three are called for in a single chair. Understanding the benefits and limitations of each method and knowing which one to use in each new situation will give you the freedom to bring all sorts of curves into your work.

Here, I'll lay out the characteristics of each approach to bending—the factors that make one method just right for producing a certain curve but all wrong for producing another one. In addition to weighing the factors I describe, you'll want to consider the variables particular to your situation: questions of space, tools, time, and the number of duplicate parts you're making. These factors will also guide your decisions about how to achieve a curve.



Sawn curves

Sawing is the starting place. Even if you've mastered steam-bending and lamination, sawing will often be the default choice for producing a curve in wood. It is the simplest and quickest method, and it requires the least setup. It allows you to make limitless shapes and, unlike steam-bending and lamination, it lets you create different curves on opposing sides of a workpiece. It also enables you to create curves in stock of virtually any thickness—you're limited only by the capacity of the saw you use.

The bandsaw is the primary tool for sawing curves. Depending on the situation and on your tool kit, of course, you might sometimes use a scrollsaw, a saber saw, or a jigsaw instead. But the bandsaw is the workhorse of sawn curves.

Photos: Tim Barnwell (this page); Jonathan Binzen (opposite)

Sawing

ADVANTAGES	REQUIREMENTS	CHALLENGES AND LIMITATIONS
• Fastest, most straightforward method • Works on parts of many sizes and shapes • Can be used with virtually any wood species • Typically requires few if any jigs and minimal setup • Enables you to cut multiple curves on one workpiece • Works with sheet goods	• A bandsaw (or, for smaller curves, a jigsaw or sabersaw) • Tools for fairing sawn surfaces • Solid stock or sheet goods	• Structural problems when curve doesn't follow the grain • Aesthetic problems when curve doesn't follow the grain • Can be wasteful of material • Sawn surfaces often require cleanup with router, files and rasps, sandpaper, etc.

Steam-bending

ADVANTAGES	REQUIREMENTS	CHALLENGES AND LIMITATIONS
• Perfect grain continuity along the bend is great structurally and an aesthetic boon • More resilient than parts sawn to a curve • Economical use of stock • Once the bending forms and steambox are built, it's the most efficient of time and material • Parts can be fully shaped without glueline issues	• Steambox • Bending forms • Air-dried, straight-grained solid stock • Knowing each species' steamability and amount of springback • Plenty of clamps	• Steepest learning curve • Springback can vary from part to part even with stock from same source • If improperly set or cured, workpiece can move • Ability to bend varies greatly between species • Expect breakage • Difficult or impossible to bend pieces too wide, too thick, too long, or too short

Bent lamination

ADVANTAGES	REQUIREMENTS	CHALLENGES AND LIMITATIONS
• Grain continuity is a structural advantage • Any species can be used • Virtually no springback • Bends are consistent from part to part • Strongest, most stable • For cost-efficiency, can combine show laminates with cheaper interior ones • Can create tapered curve by tapering the laminates	• Laminates cut from solid wood • Shopsawn laminates require a bandsaw and access to a thickness sander • Bending molds, or forms • Understanding glues and gluing suitable to the species and use • Powerful clamps	• Significant waste and work required to generate shopsawn laminates • Visible gluelines on edges of finished workpiece • Not possible to sculpt finished piece without cutting through outer laminate, exposing wide gluelines

TRESTLE TABLE

This table features bandsawn curves on all its parts, from foot to top.

*Stretcher can be **sawn** because the curve is relatively gentle. Boggs found a board with naturally arched grain to follow the curve. Also, the part is massive enough that solid wood will provide plenty of strength; the higher strength-to-weight ratio provided by bent lamination wasn't needed.*

*Foot, post, and top rail must be **sawn**, since opposing sides are shaped differently.*

Limitations and challenges— The key limitation when you saw curves in solid wood is grain continuity. To put it bluntly, short grain is the curse of the sawn curve. For both structural integrity and aesthetic appeal, it's always best to have the long grain of the workpiece follow the curve as much as possible—or at least not to fight it too fiercely. The tighter the curve's radius, the more likely you are to create a structural or visual problem. You'll need to design parts and orient them on the raw stock to minimize short grain and take advantage of any natural curve in the grain.

BEREA LADDERBACK

The rocker combines steam-bent back posts and back slats with sawn arms and rockers.

*Slats are **bandsawn** to perimeter shape, then **steam-bent**. Boggs steamed them because it's simple and it avoids gluelines; they could be laminated instead if he wanted a highly figured show veneer and didn't mind gluelines on the edge.*

*Rear posts are **steam-bent**. They couldn't be laminated because they are shaped to a flat on the front (beginning above the second slat), which would expose wide gluelines.*

*Rockers are **bandsawn** to shape. For these narrow, Shaker-style rockers, neither steaming nor lamination is practical.*

Bent-lamination

A curve made by bent lamination will be the strongest and most stable of all the choices. It allows the thinnest, lightest option for creating a strong part. And it produces a workpiece with grain that follows the curve completely. That fact, combined with the multitude of face-grain glue joints, gives a laminated part its great strength. Unlike steam-bent parts, laminated ones experience virtually no springback when you take them out of their forms. Most bent laminations are made with laminates of a constant thickness, but you can also create curved workpieces that are tapered in thickness by gluing up tapered laminates.

Bent lamination will work with virtually any wood, and for most shops it is simpler and easier than steaming, since the steambox and steam-bending forms are more time-consuming to make than the forms needed for lamination. Lamination also makes more sense whenever

Photos: Louis Cahill (top); Michael Traister (bottom)

you have limited access to air-dried, straight-grained wood—required for steam-bending—or when you are working with tropical woods, which typically don't steam-bend well but do fine in bent lamination.

Limitations and challenges—Bent-lamination depends entirely on glue bonds for its structural integrity. Successful bends require accurately machined laminates, uniform pressure throughout the bend, and a full understanding of the glue.

Although bent-lamination produces a part of maximum strength, it does so at the cost of many exposed gluelines, which can detract visually from the piece. A number of variables affect the visibility of the gluelines—the grain of the wood, the thickness of the laminates, and the color contrast between the hardened glue and the wood. Also, cutting into the face of a bent-laminated workpiece risks exposing the gluelines—sometimes creating an ugly wide stripe—so makers generally avoid shaping the outside laminations. Shaping is typically restricted to cutting into the edges, or tapering the laminates individually.

CRESCENT TABLE

The pedestal is composed of four bent-laminated curves. The top is plywood, bandsawn to shape and veneered with curly maple.

*Legs are **laminated**, and their sides are skinned with veneer after lamination. Steaming these legs would be possible on a smaller base, but impractical on a larger one because the parts are so hefty and the curve is so tight.*

The four legs are joined in miters that are tricky to cut and fit; bent lamination, by producing parts with identical curves, makes the joinery less challenging. Steamed parts, with their springback, would not be as consistent. Sawing the legs would not be advisable, as it would produce very weak parts due to grain runout.

Steam-bending

Steam-bending is my favorite way to produce curved parts. The wood grain follows every curve and has a perfectly natural appearance; the steam-bent part has no gluelines to cope with, so it can be shaped after steaming. If I'm making multiples, steaming is typically my first choice. Economy has a lot to do with this, as a steam-bent part is almost always quicker and less expensive to reproduce once the steamer is built and the forms are made.

Not all steam-bending requires complex forms. While I might invest a lot of time making a production leg-bending form, I can bend slats for fanback chairs with no form at all—just a bar clamp. I can make fine adjustments to the shape at assembly, either cold or with a heat gun.

OUTDOOR ROCKER

Built of mahogany, this chair relies on lamination for its rockers and back slats, sawn curves elsewhere.

*Back slats are **laminated** instead of steamed to produce consistent curves that line up precisely. Steaming would not have been a good choice anyway, because the chair is made of mahogany, which suits the outdoors, but doesn't steam well.*

*Seat slats are sawn. First, their sides (which taper) are **bandsawn**; then all five slats are placed on a carriage and have their front and back end curves sawn as a group.*

*Rockers are also a **lamination**. For an indoor chair, Boggs would usually saw these rockers. But sawing would expose a lot of end grain underneath, not a good thing in an outdoor piece, and would waste a lot of mahogany. Lamination is also a good choice because it produces identically curved rockers.*

Photos: Kevin Barnes (top); Tim Barnwell (bottom)

SUNNIVA SWING

Bent lamination produces the long, sweeping curves in the stand and the swing. The slats, too, are laminated.

*The back slats and seat slats are **bent laminations.** Boggs stacked them and bent four at a time. They could have been steamed, but given the variation in springback with steamed parts it would have been difficult to get the slats to line up perfectly.*

*The arm stumps are **bandsawn.** They could have been made with a tapered lamination, but sawing from solid wood, which is far simpler, is plenty strong since the part is so massive.*

*The big bowed parts are **bent laminations.** Lamination enables Boggs to bend far longer and stouter parts than he could by steam-bending. Also, the piece is mahogany, which works fine for lamination but doesn't steam-bend well.*

Limitations and challenges— Successful steam-bending requires an understanding of the specific wood species you want to bend. You need to heat the wood just enough to achieve maximum plasticity without weakening it too much, and the bending forms need to be made with each species' springback tendencies considered. Also, there are many species—especially tropical ones—that simply don't steam-bend well.

There's a learning curve with each new shape, jig, and species. And until you have worked out these issues, there is bound to be some breakage—consider it a small fee for mastering the process. □

Brian Boggs, who first appeared in Fine Woodworking *in issue #48, builds furniture in Asheville, N.C.*

*Crest rail and lower back rail are both **steamed**, allowing maximum shaping while avoiding gluelines.*

*Back slats are **laminated** to achieve consistent curves. Also, because he inserts the back slats only after the back frame is glued up, Boggs needs the slats to bend without breaking, which thin bent-laminated parts will. If he steamed the slats, they'd have to be thicker for strength, and he would lose some to breakage.*

*Arms and arm stumps are sculpted on the **bandsaw.***

*Rear legs are **steamed**, creating parts that are strong and can be shaped after bending, with grain that follows the curves and is free of gluelines. Steamed parts are also more flexible than laminated parts of the same thickness. The balance of flexibility and clean shaping made steaming the best choice.*

SCULPTED FANBACK ARMCHAIR

This recent chair utilizes all three approaches, employing bent lamination, steam-bending, and sawing.

Photos: Tim Barnwell (top); Kevin Barnes (bottom)