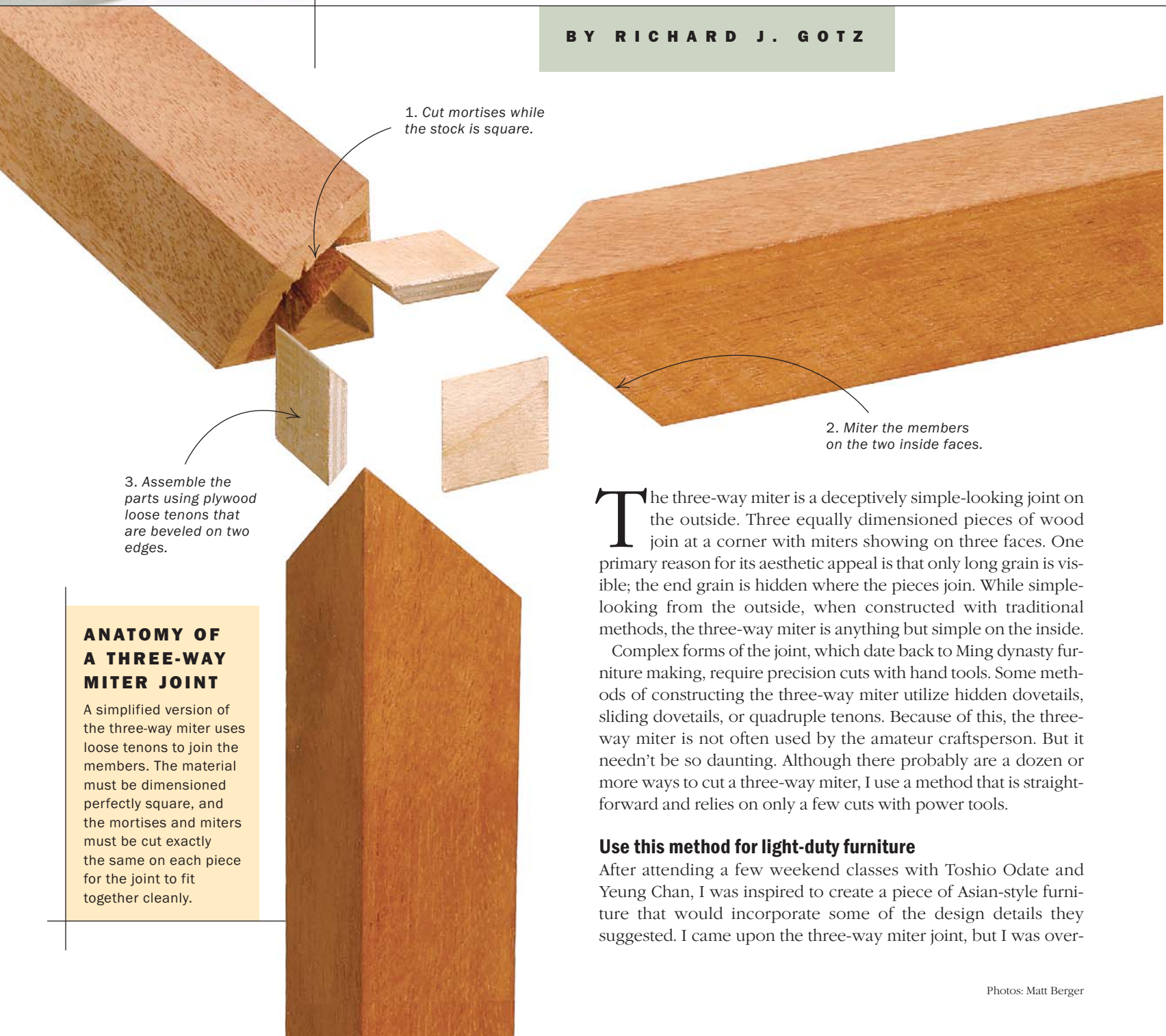
Simplified Three-Way Miter

A modern approach to a traditional Chinese joint creates striking corners on small tables and stands

BY RICHARD J. GOTZ



ANATOMY OF A THREE-WAY MITER JOINT

A simplified version of the three-way miter uses loose tenons to join the members. The material must be dimensioned perfectly square, and the mortises and miters must be cut exactly the same on each piece for the joint to fit together cleanly.

The three-way miter is a deceptively simple-looking joint on the outside. Three equally dimensioned pieces of wood join at a corner with miters showing on three faces. One primary reason for its aesthetic appeal is that only long grain is visible; the end grain is hidden where the pieces join. While simple-looking from the outside, when constructed with traditional methods, the three-way miter is anything but simple on the inside.

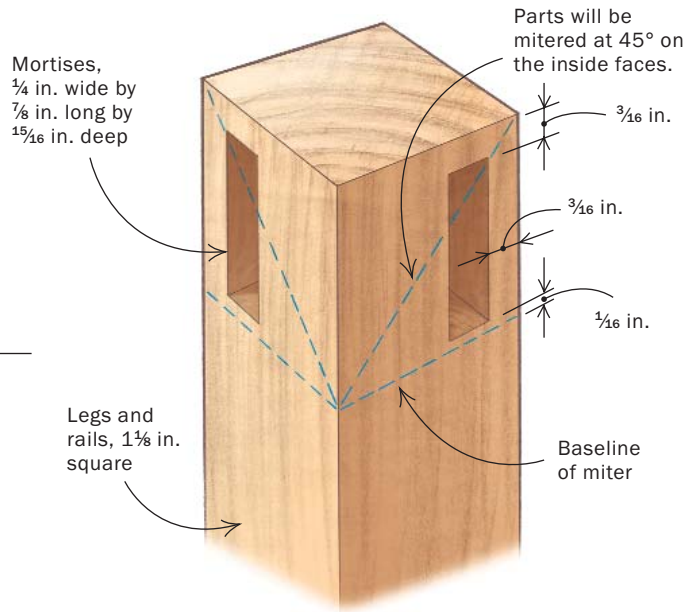
Complex forms of the joint, which date back to Ming dynasty furniture making, require precision cuts with hand tools. Some methods of constructing the three-way miter utilize hidden dovetails, sliding dovetails, or quadruple tenons. Because of this, the three-way miter is not often used by the amateur craftsperson. But it needn't be so daunting. Although there probably are a dozen or more ways to cut a three-way miter, I use a method that is straightforward and relies on only a few cuts with power tools.

Use this method for light-duty furniture

After attending a few weekend classes with Toshio Odate and Yeung Chan, I was inspired to create a piece of Asian-style furniture that would incorporate some of the design details they suggested. I came upon the three-way miter joint, but I was over-

Photos: Matt Berger

MORTISES BEFORE MITERS



Accurate mortises with one setup. *Take your time when setting up the hollow-chisel mortiser. One fence setting can be used to cut all of the mortises in the table.*

Cut one end of the mortise on each piece. *With the stop block and fence set on the hollow-chisel mortiser, use a spacer block to guide the first cut for the mortise.*

Remove the spacer block to cut the other end of the mortise. *Once both ends of the mortise have been cut, nibble away at the remaining material.*

whelmed with the elaborate techniques involved. Just in drawing the traditional method of construction, the joint was a humbling experience; I could only imagine how difficult it would be to cut it with a handsaw and chisel.

I decided to forgo the most elaborate forms of the three-way miter for a modern method. I tried a couple described in books by Chan and Gary Rogowski, but they required several different settings on the tablesaw, with each pass needing readjustment of the miter gauge, fence, or blade height. It was clear that achieving a tight fit with either method was going to require great precision in my setup. Any inaccuracy multiplies with subsequent readjustments and cuts.

To reduce the chance of inaccuracy, I decided it would be necessary to reduce the number of individual cuts. I landed on a method in which all of the mortises are cut with one fence setting on a hollow-chisel mortiser; all of the miters are cut with one setting on the tablesaw; and loose tenons are used to join the pieces. Furthermore, the four rails and four legs that make up the basic table all are produced with the same series of cuts.

The strength of the three-way miter using this method, for the most part, relies on the loose tenons. Because the mitered surfaces of the rails and legs may not provide an adequate bond, be careful how you plan to use this joint. I would recommend it for light-duty use only. Aprons or stretchers will increase the strength, as will larger tenons.

Legs and rails must be equal in width and thickness

Depending on the project you take on, your material can be any thickness and length. But for the basic table pictured in this article, I chose to make the legs and rails 1⅛ in. square. Starting with 6/4 lumber, mill the rough stock to size with a jointer, planer, and tablesaw. The thickness and width of each piece must be equal for the joint to assemble correctly, so my final step was to run each piece through the planer on its face and edge.

When you finish dimensioning each piece, you should have four equally sized legs and four rails. One pair of rails determines the table width; the other pair determines the table depth.

All of the mortises are identical

On the end of each leg where it meets the rails, cut two adjacent mortises. In addition, each rail will have two adjacent mortises cut at both ends. I used a hollow-chisel mortiser for this operation. However, if you don't have a hollow-chisel mortiser, you can

Drawing: Chuck Lockhart

MITERS MUST BE ACCURATE

Butt the workpiece against a stop block. *Position the stop block so that the sawblade cuts right to the corner of the workpiece. Be sure you don't cut past the corner line. The first miter is cut with the workpiece held so that one mortise is facing the blade and the other is facing the surface of the tablesaw.*

rough-cut the mortises with a drill press and carve them clean with a chisel.

Set up the hollow-chisel mortiser with a ¼-in. bit so that it cuts 3⁄16 in. from the fence. You can set the fence-to-bit distance by holding a 3⁄16-in. drill bit in between. Cut the adjacent mortises with the outside faces of the legs and rails registered off the fence. This will require that half of the mortises be cut with the material sticking out to the left of the bit and half with the material sticking out to the right. For each orientation (left facing and right facing), set a stop block 3⁄16 in. from the bit to cut one end of the mortise. A spacer block is used to set up the cut in the other end of the mortise. The spacer block is equal to the length of the mortise (⅞ in.), less the width of the hollow chisel. Once both ends of the mortise have been cut, remove the remaining material in between.

At this point, you can use a smoothing plane to remove any marks on the surfaces of the legs and rails. It's best to do this before you cut the miters so as not to damage the fragile corners.

Precise miters create a tight-fitting joint

For the four mitered corners of the table to be assembled absolutely square, it is paramount that you cut the miters exactly 45°—no more, no less. I chose to cut the miters with a miter gauge set at 90° and the tablesaw blade at 45°.

Make practice cuts with scrapwood before cutting into your project material. To test for square, cut two miters, place them together, and measure the 90° angle with an accurate square. If there is any discernible gap, adjust your sawblade and try again.

The miters are cut on each face where you already have cut the mortises. That means the legs will have two adjacent mitered sides, and the rails will have four miters (two on each end).

When cutting the adjacent miters, make the first cut with the material positioned so that one mortise is facing the surface of the tablesaw and one mortise is facing the blade. To cut the adjacent miter, rotate the workpiece forward so that the mortise that was facing the surface of the tablesaw is now facing the fence of the miter gauge. Beware of flying debris produced by this second cut. The small, pyramid-shaped cutoff has a tendency to ricochet off the blade unless you pass the material slowly across it.

Rotate the workpiece to cut the adjacent miter. *The mortise that was facing the surface of the tablesaw should be facing the miter gauge on the second cut.*

Once both miters have been cut, flip the workpiece and make the same two cuts on the opposite end. Always use a stop block to position the workpiece for each cut. I also glue 180-grit sandpaper to the face of the miter gauge to prevent the workpiece from slipping.

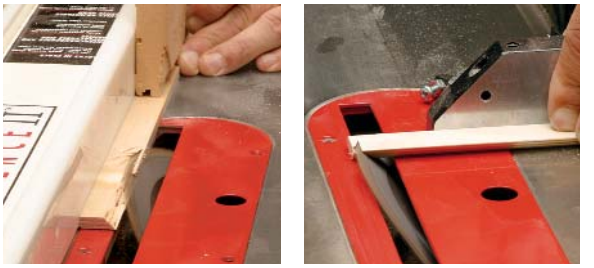
Mitered loose tenons increase the gluing surface

To produce a stable and strong joint, I make loose tenons from Baltic birch plywood. I increase the gluing surface of the tenons by mitering two of their edges.

Starting with ½-in.-thick plywood, rip several 12-in.-long pieces at ⅞ in. wide. Next, bring them down to the thickness of the mortises so that they fit just right—not too tight and not too loose. You

can do this on a tablesaw or planer. It's a good idea to cut these strips ahead of time because the subsequent cuts are made with the tablesaw blade set to 45°. Because you just cut the miters at that angle, you don't have to reset the sawblade.

Cut one edge of the plywood strip to 45°. Then crosscut each end of the strip with the blade still at 45°. With both ends mitered, cut one tenon from each end of the strip on a radial-arm saw or miter saw. Continue the process of mitering the ends and then chopping them to size until all 12 tenons have been cut. Cutting small pieces with power tools generally is a dangerous process, so use extreme caution.



Cut the tenons from a long strip of material. *Cut a bevel along one edge of the tenon stock. Then bevel one end and crosscut to length.*

After the tenons have been cut, arrange all of the legs and rails in the same orientation. Glue one tenon into each end of the rails and one tenon into the mitered end of the legs, making sure that the tenons are fully seated in the mortises. If not, they will prevent the joint from closing all the way. Also, all of the tenons should be glued into corresponding mortises. I chose to glue them into the mortise on the right side as I'm looking at the two mortises straight on.

Assembly requires two stages

Before gluing up the table, verify that the four legs and four rails are ready and oriented correctly. If you plan to incorporate aprons into the design, have them ready as well. Mark all of the pieces, then dry-fit them together. Once you are satisfied with the dry-fit, proceed with the glue-up.

Glue up two full sides of the table separately, let them set, and then join the two sides by gluing the two final rails in place. I use a frame clamp to glue one full side with a spacer set between the bottom of the legs to prevent them from bowing inward.

It would be nice if the clamps were transparent to detect any gaps in the miters, but you'll have to trust the part of the joint that is visible. If you have carefully cut the miters to 45° and aligned the mortises, the actual glue-up should go without incident. □

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FOUR STEPS TO ASSEMBLY

Begin by gluing one tenon into each of the mitered ends (1). Gotz chose the mortise on the right. Then, using a frame clamp, glue one full side of the table (2). Fit a spacer block at the foot of the table to prevent the legs from bowing inward during glue-up. Fit the two remaining rails into the joint (3). If the tenons fit tightly, this may require moderate force. Finally, clamp the table for final glue-up (4). If necessary, use spacer blocks on the foot end of the table to prevent the legs from bowing.