

In Search of the Right Mortising Technique

Five strategies from hand tools to expensive machines for cutting fast, easy and accurate mortises

BY STROTHER PURDY



MAN OR MACHINE

Everyone can find a way to cut mortises well, whether through improving skills or finding a better tool. Some prefer the quiet approach of the chisel (above), and others go for the fast and furious router (right). Other good options include the drill-press-and-chisel approach, hollow-chisel-mortise machines and dedicated slot mortisers.



The first mortise I cut looked as though a miniature dynamite charge had been set off inside the board. Splinters pointed out of the hole in every direction. Inside, my chisel had mashed out nooks, crannies and side passages instead of cutting the straight, flat and square hole I intended. It was plain to see that I had not been born with the skills to chop mortises by hand.

For a while I contemplated buying my way out of learning this skill. Though a good craftsman never blames his tools, I reasoned, a smart one tries to use the best one for the job. My tool wish list, however, was long and underfunded. A jointer and a planer had higher priority than a plunge router or a hollow-chisel mortiser.

In time I learned to cut mortises by hand with reasonable speed and pretty good results. It took a while, but I found I enjoyed the work. The mortises didn't look too hot, but the assembled joint eventually hid them from discerning eyes. I did wonder how strong they were. I knew that yellow glue did not hold across or fill gaps. This told me the uneven fit of my mortise-and-tenon joints couldn't be very strong. Sure, they held together when I tried to pull them apart, but I had no way to test them for the years of use and abuse I wanted them to withstand. It was time to find out how well the mortise had to fit the tenon to stay together and then learn how to cut them that way.

Good design, fit and glue make strong mortises

I asked Carl Swensson, a woodworker with more than common knowledge about joinery, what made a mortise-and-tenon joint strong. His lengthy reply, which lasted several days, was both enlightening and frustrating.

Boiled down, a strong joint is the product of balanced design (so that one member isn't stronger than the other), an accurate fit and a good glue bond. Everybody knows that glue will make a joint stronger. Swensson was the first who could tell me why. When a joint is under stress, the glue bond spreads it across the cheeks of the mortise and tenon. In a joint without glue, such as one that's only pegged or wedged, the stress will concentrate along edges and at points. This means that the fit must be tight in these places. In a glue joint, the fit is still important, but the accuracy and quality of the glue surfaces are crucial.

To find out more about glue bonds and their requirements, I spoke with Mike Witte, a technical manager at Franklin International. He sent me several manuals about glue, which I read in spite of the great risk of falling asleep. To bond at their full strength, almost all glues need a smooth-but-unburnished surface, free of loose fibers, because glue needs to pene-

trate a few thousandths of an inch into intact wood. If the surface is burnished—by a dull router bit, for example—the glue can't seep into the pores and has little grip. If the surface is covered with loose fibers, such as a dull chisel might leave, the glue attaches to the loose fibers and not the joint walls. The lesson here is that sharp tools increase joint strength.

Witte confirmed a sobering rule about glue joints: For the glue to do its job, the gap between mortise and tenon should not exceed 0.005 in. This sounded like something I'd need a computer numerically controlled (CNC) router to achieve. However, the way to get these kinds of tolerances really isn't by measuring but by feel. If a mortise and a tenon go together easily, don't need to be hammered home, yet don't come apart without effort, Witte claims they'll be within 0.005 in. apart (see the box below).

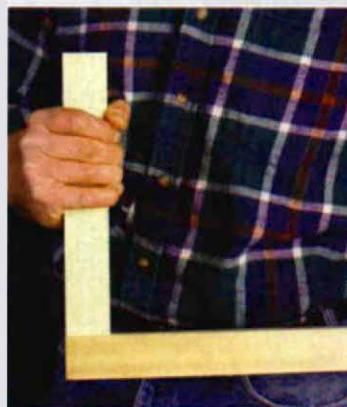
Use chisels for low-cost but high-skill mortising

Chisels are the ubiquitous mortising tool. Everybody has them, but many woodworkers don't use them because they re-

What makes a good mortise?

That's simple: a clean surface for a strong glue bond and a tight fit with the tenon.

THE FIT SHOULD BE...



Not too tight: If you have to hammer the joint together, it's too tight. You'll likely split the mortise if you tap aggressively.

Not too loose: You shouldn't be able to move the tenon in the mortise at all or feel any back-and-forth movement when you try.

But just right: The tenon should fit into the dry mortise with hand pressure only. It should not come apart easily, and it certainly should be able to withstand gravity. A good fit may even need light mallet taps to drive the joint apart.

FOR A STRONG GLUE BOND, THE MORTISE CHEEKS SHOULD BE...

- flat and smooth, so they meet the tenon evenly.
- unfinished, so the glue can penetrate the mortise cheeks.
- free of loose fibers, which would soak up the glue and not allow it to penetrate solid wood.





MORTISING CHISEL AND Mallet

Brian Boggs chops a mortise in a chair leg. Though it's the slowest way to cut a mortise, he derives great pleasure from chopping precise joints with good tools.



quire superlative skill to handle, and they are slow. I found that the first complaint is a half-truth, and the last is, well, true.

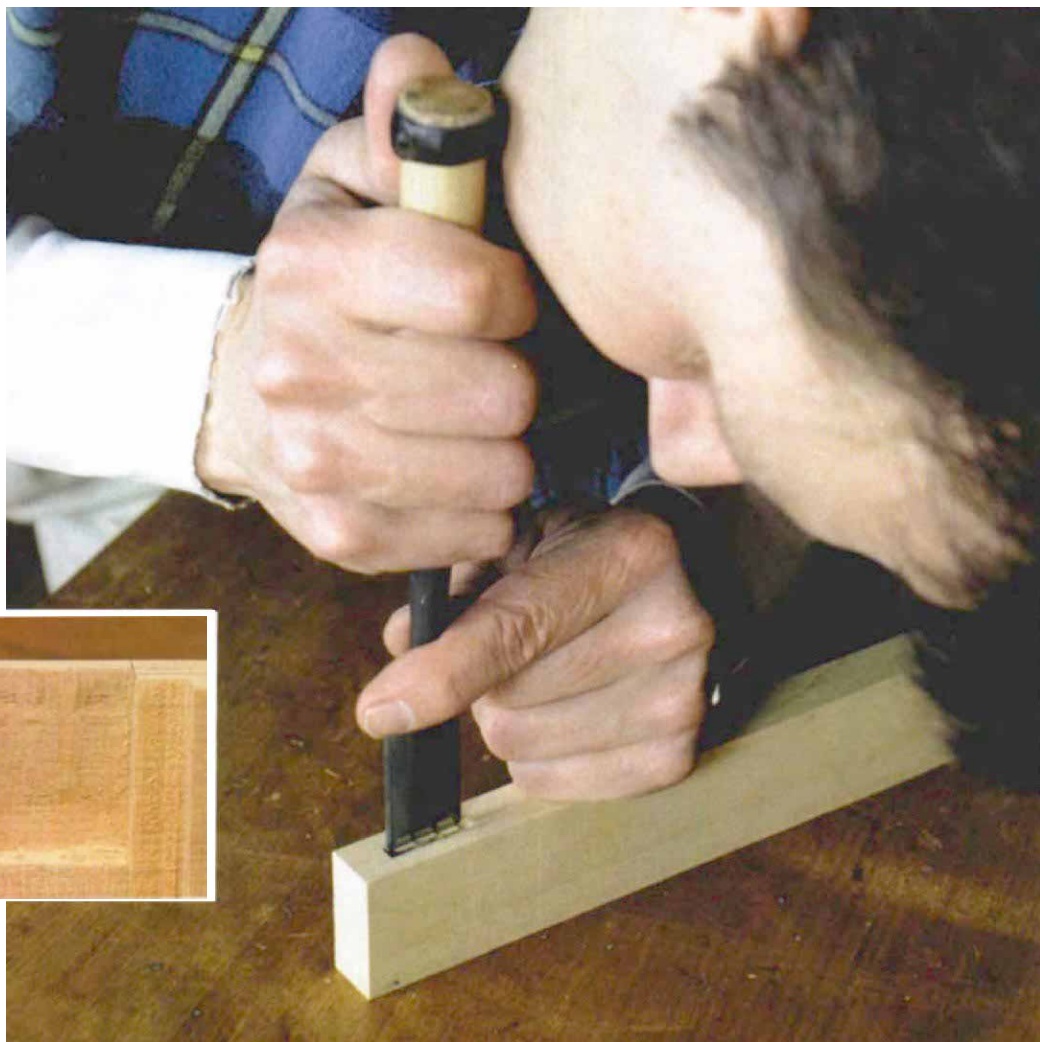
I visited Brian Boggs at his chair shop in Kentucky to see whether the humble mortising chisel and mallet were capable of cutting with the precision that glue manufacturers required. When he greeted me, the fact he held a mortising chisel in one hand and a micrometer in the other answered my question. Boggs' recipe is simple: The quality of the mortise depends largely on how the chisel is tuned. Boggs told of the occasion when a student who could not chop a good mortise borrowed his chisel and had no further problems.

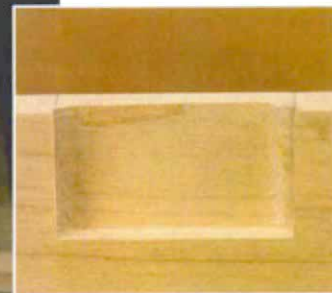
Mortising chisels generally have long, stout blades as thick or thicker than they are wide. This allows them to be hammered aggressively and deeply into hard woods without breaking. Unlike most power tools, few chisels arrive from the factory ready to go. To tune one, use an engineer's square to check the surfaces and a benchstone to make them true. The bottom and sides of the blade must be flat and square (the top of the blade is irrelevant). The cutting edge must be both razor sharp, straight and perpendicular to the sides. If not, the chisel will wander no matter how hard you try to keep it going straight down. Never hone a mortising chisel's edge on a buffing wheel because it will round the corners of the blade, right where it should be sharpest to cut the mortise walls.

Boggs begins a mortise by scoring his layout lines with bench chisels to keep splinters from running. He then removes an even $\frac{1}{16}$ in. depth across the whole mortise. This creates a shoulder for the chisel to register against. The amazing thing is that a well-tuned mortising chisel is almost self-guiding after the first $\frac{1}{16}$ in.

DRILL AND PARING CHISEL

Carl Swensson uses a drill press to quickly hog out the mortise waste (below), then a paring chisel to shave off the ridges left by the twist drill. Easy to see, the ridges make excellent guides for paring the mortise cheeks square and flat.





PLUNGE ROUTER AND JIG

The block-and-clamp jig gives the plunge router a stable base to cut quick and accurate mortises in small pieces.

Chopping down as far as the chisel will go in $\frac{1}{8}$ -in. increments, Boggs travels from one end of the mortise to the other and back again. The chisel's strong bevel breaks out chips as it cuts. Finally, he pares the cheeks lightly with a wide bench chisel.

Carl Swensson also cuts his mortises with chisels, but he begins on the drill press and finishes by paring the cheeks and ends with bench chisels. This method is slightly faster than chopping entirely by hand, but the drill press does take time to set up. Swensson drills a number of non-intersecting holes with a twist drill $\frac{1}{32}$ in. thinner than the mortise is wide. The remaining waste between the drill holes is easily tapped out. The ridges left by the drill help him guide the chisel when paring the mortise walls flat and square (see the bottom photos on the facing page).

It's rewarding work, but cutting mortises by hand is slow and tedious. Chisels do have one important advantage over all other mortising tools, though, and that's their versatility. You can chop or pare a mortise of any size and shape anywhere on any piece of wood, which isn't always true of power tools.

Plunge routers cut fast, simple and precise mortises

The router is to the woodshop what the microwave is to the kitchen. The two are fast, efficient and versatile tools, but I always

have a lurking suspicion they're bad for my health. The plunge router, however, is considered by many woodworkers to be one of the most useful tools for mortising.

Jeff Miller, a Chicago furniture maker and instructor, claims to have spent years sorting out the plunge router for mortising. It plunges accurately enough but doesn't move from side to side without help. It's also a top-heavy tool and needs a stable platform to ride on. The key to mortising small parts accurately with a plunge router, Miller found, was a simple, stable and versatile jig to guide it—just a large block with clamps attached (see the photo above). The clamps hold the workpiece parallel to and even with the top of the block. The router rides on the block, and its fence registers on the opposite edge of the block.

For work that doesn't fit in the jig, the plunge router makes the journey to the workpiece with ease. John McAlevey, a Maine woodworker, uses a plunge router with a fence or a template to cut mortises that would be difficult with any other tool except a chisel and mallet.

Routers are capable of very smooth cuts, but not without some technique. They're light-duty tools, and even the monstrous 3-hp plunge routers need to be handled carefully and used gently. The jig or platform must be rigid to keep the router from wobbling. A



HOLLOW-CHISEL MORTISER

A drill press that cuts square holes? Faster than a plunge router, hollow-chisel mortisers don't produce much dust or noise, and they leave the mortise ends automatically squared up.

bit plunged too fast or, without wood on all sides will cut gouges down the mortise cheeks. Probably the best technique is to remove the waste in horizontal increments of $\frac{1}{32}$ in., moving the router slowly from end to end. An unstable jig or moving too fast will cause the bit to wander and cut steps in the mortise cheeks. An alternative is to plunge all the way down at either end of the mortise first. Then remove the waste in the middle. Both techniques will cut very clean mortises.

The price for the plunge router's speed is noise and dust—I frankly don't enjoy using routers. They screech loudly and produce volumes of fine dust. Safety goggles, hearing protectors and a good-quality dust mask help, but I dislike working in sensory deprivation gear, unable to hear the phone ring or see my work through the dust and scratches on my goggles. Nonetheless, I have to admit the speed of the router trumps its disadvantages. I watched McAlevey cut 14 mortises with a router in the time Carl Swensson cut three by hand.

Drilling square holes: hollow-chisel mortisers

A dedicated hollow-chisel mortiser is a peculiar and wonderful tool, thereby typically English. In a nutshell, it's a specialized drill press with a hollow and square chisel mounted around an auger bit. A quill feed plunges the spinning bit and hollow chisel into the workpiece, in effect drilling a hole and paring it square simultane-

ously. A series of these cuts produces a typical rectangular mortise.

Nial Barrett, a woodworker in upstate New York, owns a small one he's found to be a great mortising tool (see the photo at left). It's reasonably quiet, fast, makes chips not dust and cuts square holes. With a price of about \$300, it might seem the perfect mortising tool. However, these advantages come with a few problems. The drill-press-style setup limits the size of the workpiece to about 6 in. high. The workpiece must be rectangular in cross section, or it will be difficult to clamp firmly to the machine. The smaller-sized bits ($\frac{1}{4}$ in. and $\frac{3}{8}$ in.) heat up and burn or crack easily if misused. Finally, even when well-tuned, hollow chisels produce a moderately rough cut (see the inset photo at left).

Barrett does not see the roughness as a problem, and he points out that he's never had a joint fail. I checked with another hollow chisel user, Tom Stangeland, a woodworker in Washington state, who agreed. It's a point well taken: After all, the perfect mortise is simply one that stays mated to its tenon. If the hollow-chisel mortiser cuts well enough, then it cuts perfectly well.

Industrial advantages: dedicated slot mortiser

Dedicated slot mortisers are industrial-grade machines with many advantages over the router and the commercial milling jigs. Slot mortisers have a horizontal drill-style head that slides forward and back, giving the cutter a plunging action. With all other methods, the piece stands still and the cutting tool moves. With slot mortisers, the workpiece is mounted on a sliding table that moves laterally to the head. This table can also be adjusted in height.

Slot mortisers cut very smooth, very accurate mortises even faster than a router (see the inset photo on the facing page). They are surprisingly quiet—quieter than hollow-chisel mortisers—and produce chips not dust. They're made to withstand years of abuse without a whimper. And they're capable of almost any size or type of mortise in a workpiece that will fit on their bed. Maybe this is why I found, without looking very hard, several one-man shop owners who shelled out several thousand dollars to buy one. In the long term, the machines are simply worth it. Chris Becksvoort doesn't regret a penny he spent on his slot mortiser.

Besides using his slot mortiser for all the common mortises,

Router milling Jigs

A huge number of commercial jigs are available for the router, ranging from the simplest subbase to elaborate computer numerically controlled (CNC) rigs for the most ambitious hobbyist. Among them are a few interesting machines designed to turn the router into an all-purpose production milling tool. I'll call them router milling jigs for lack of a better term. They have names like Matchmaker, Mill-Right and Multirouter. I've had the pleasure to see the Multirouter in action cutting mortises.

The Multirouter isn't hard to describe: It's a router jig gone mad (see the photo at right). There are more levers, knobs,



DEDICATED SLOT MORTISER

Chris Becksvoort cuts a slot for a mortise lock in a finished door. Unlike a router, a dedicated slot mortiser is quiet and a simple pleasure to use.



Becksvoort uses his for end boring bedposts, lock holes in finished doors (see the photo above) and even cutting sliding dovetails in the bases of Shaker candle stands (a long story and a complex jig). Good technique is similar to routing a mortise, with one exception. To get the very best cut, Becksvoort raises the table a hair, recuts one face, then flips the workpiece and cuts the opposite face.

And the right tool is...

With the dedicated slot mortiser, I found a compromise of speed, noise and dust production that I really liked. The stumbling block, of course, is the price. Until I win the lottery, I'll putter along with

my chisels, paying more attention to the sharpness of my tools and the fit of my joints. Chisels are hard to beat for their affordability and sheer pleasure of craftsmanship. Although this is my solution to making strong joints, I know much depends on personal preferences, so I don't necessarily recommend this route. I can make sacrifices of speed and ease to avoid noise and dust because I don't run a professional shop. If I did, I might get a plunge router or maybe a hollow-chisel mortiser. Unfortunately, each person I approached might have convinced me his tools and techniques were best, if I hadn't seen all the others.

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stops, setscrews, tables and fences than any healthy woodworker should be asked to handle. But talking with Peter Turner, a Maine woodworker, made the jig seem devilishly easy to use.

The machine houses a standard fixed-base router in a frame that raises and lowers on linear bearings. The workpiece is clamped on a platform that moves from side to side and in and out. The platform also tilts, making angled work possible. It can cut mortises, tenons, dovetails, box joints and anything in-between.

The great advantage of the machine is its speed in cutting more than a few mortises. The initial setup takes a while,

but the adjustment for each operation is minimal. Once running, it can cut mortises in 15 seconds and tenons in less than 10. If you blink, you miss the process. Piles of parts for large casework can be milled in minutes. And the quality of the cut is excellent, though no better than any well-jigged router.

The main limitation is the price of the machine. Turner admits that he was not able to afford a new one, which costs about \$2,300. But a bit of luck threw an inexpensive used one his way. He bought the machine with a friend, reducing his investment to a fraction of the cost of a new one. —S.P.