The Stick Chair Book

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A PLACE TO SIT

When I first saw this chair on display at St Fagans National Museum of History in Wales, it was all I could do to keep myself from plopping down into it. Good stick chairs are like that.

PREFACE
COMMONPLACE CHAIRS

There are only a few things more intimate than building a chair for someone. That's because unlike a cabinet, a chest or a set of shelves, a chair doesn't hold possessions. It holds people.

And we want to be held. Every night there's the promise of a chair, a beer and Lead Belly on the record player. So you lean back into the chair's sticks, and they bend slightly around your shoulders. Your thumb rubs the arm, and in time the paint wears through because of this nightly ritual. The through-tenons peek out, and the exposed oak takes on a mellow glow thanks to the oil and dirt from your hands.

Eventually, the chair and you become indistinguishable. You learn to position your body to sit in the chair for long conversations. The chair returns the favor and acts as an unfailing skeleton that holds up your body after a brutal day of work.

In some ways, the relationship is like being married to a tree or a turtle. Stick chairs are designed to outlast us all. And though the chair is in a consensual relationship with you and your posterior/posterity, it also is a permanent reflection of the land it came from.

To be fair, all wooden objects carry the spirit of the forest with them to some degree. But high-style pieces symbolize a triumph of people's ingenuity over the woodlands – the transformation of rough fibers into feats of geometry, symmetry and sheen. The wood traveled across the ocean so it could be cut, laminated, carved, veneered and colored to demonstrate the skill of the maker and the wealth of its owner.

Stick chairs, on the other hand, are a close compromise between nature and the needs of regular people.

The chairs take many of their shapes from humble and local raw materials. The seat's curve might be determined by where the knots and splits were located in the slab on hand. The arm's shape might be determined by how the tree grew. The legs might have a bend to them because they were harvested from the bottom of the tree, where the roots spread out.

Also, stick chairs are ultimately simple in their overall form, with little or no ornamentation. Perhaps this was because the chairs were covered in animal skins or blankets for most of the year. Or the chairs were made by the same hands that might make an ox's yoke or a fencepost.

But there's more to the term "stick chair" than the materials and the form. In my mind, it's about who made the thing.

Stick chairs were, for the most part, made by an amateur or part-time woodworker. The old story is that farmers, carpenters or anyone who did seasonal work would make stick chairs in the off-season for their household or to sell to neighbors. As a result, the chairs were made with simple tools, local materials and basic but sturdy joints.

Another important aspect of stick chairs is that you are unlikely to find two identical examples. And if you did, it's likely the twins would have grown apart. Many of these chairs have been modified and repaired multiple times during the last 200 years. And that's because they were treasured by their owners. Once you examine them closely and see how they were adored, abused, repaired, refinished and reinforced, it's difficult not to fall in love with them.

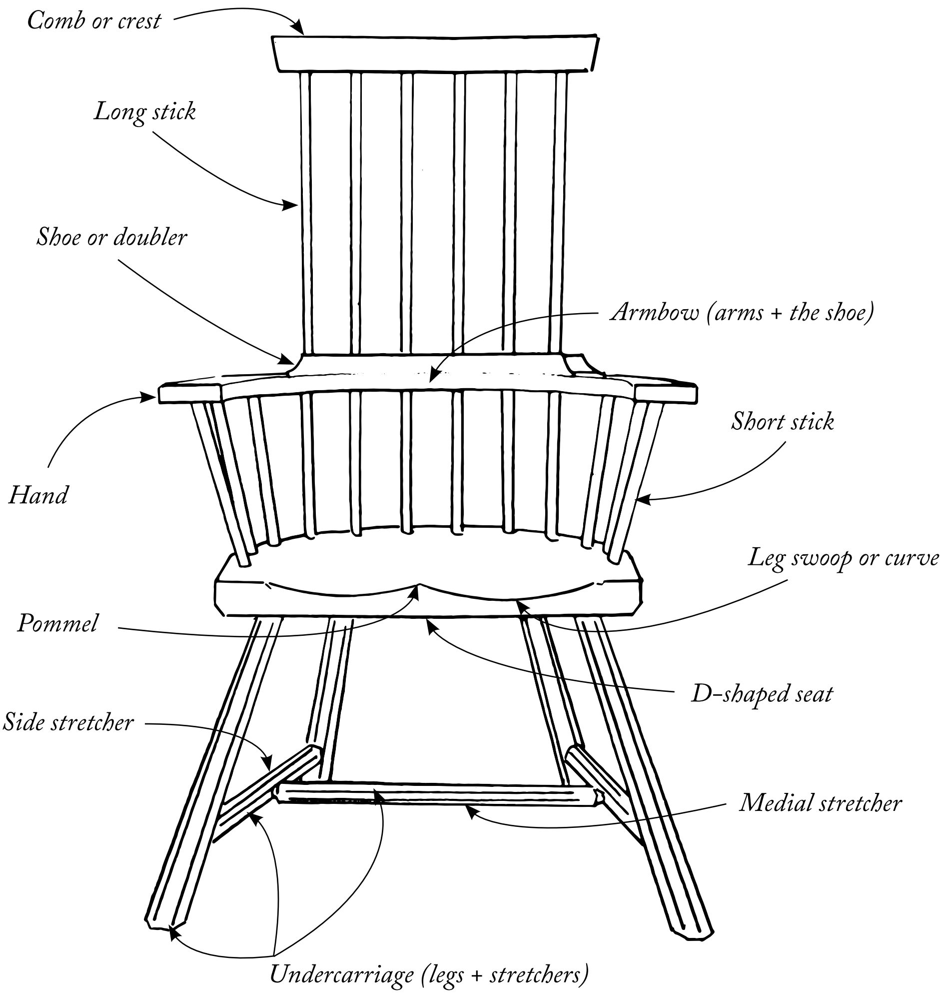
And if you have fallen in love with the way they look, you are probably wondering if these chairs could possibly be comfortable.

I suppose that by modern La-Z-Boy standards, stick chairs cannot compete. It depends on what your expectations are. I spend about four hours of every day in a stick chair. I drink my morning coffee in an oak stick chair in the kitchen, where I answer my overnight emails and make a list of things to do that day. When I take a break in the workshop, I sit in an Irish Gibson chair with a glass of water and decide if the day's list was too damn long. And at dinner I sit in a green combback chair (the third chair I ever made) as I have every night since 2003. It's not like I have a choice in the matter. Every chair at our dinner table is a stick chair.

Some of them have sheepskins on their seats to make them more comfortable. But all of them are scratched, scuffed and shinier in the places that touch your skin.

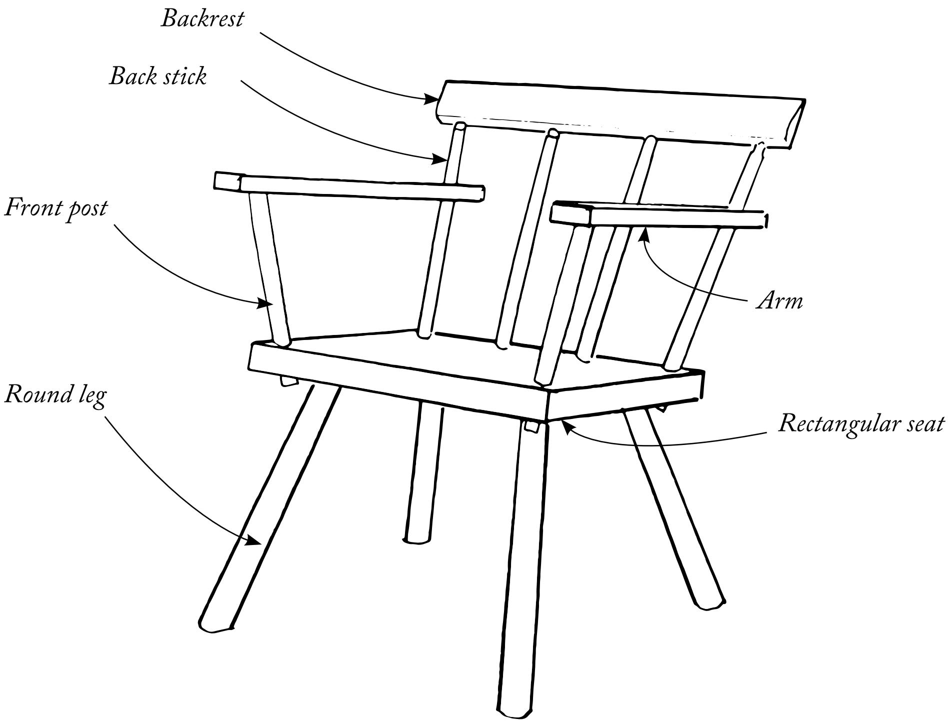
Since I made my first stick chair in 2003, I have learned to make the chairs more comfortable. Also, and this is important, I have learned how to sit in stick chairs and be very content.

So yes, they are comfortable.



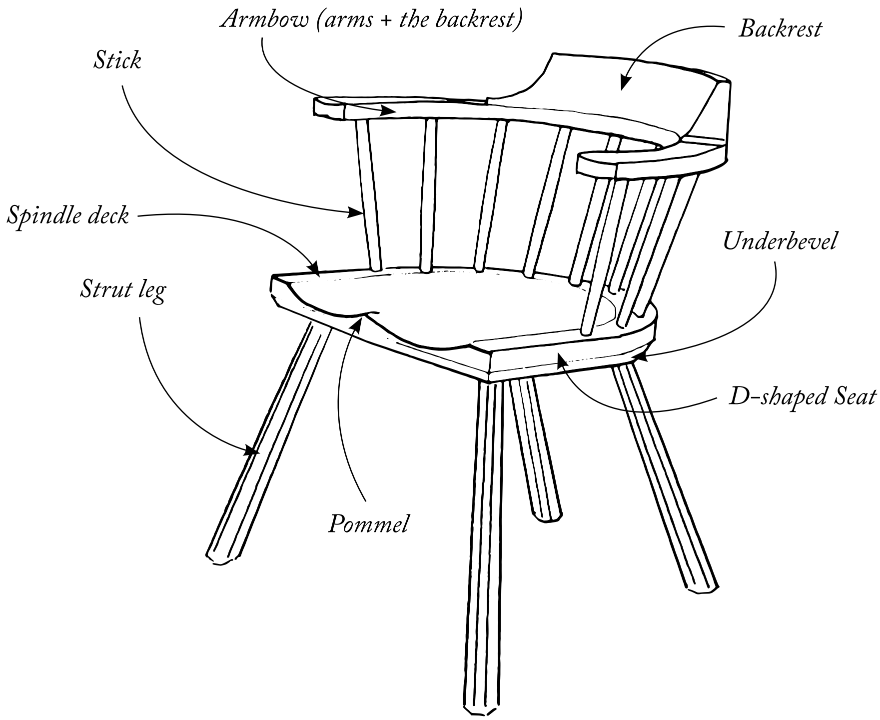
COMB-BACK ANATOMY

If we're going to talk about stick chairs and understand one another, then it's best we use the same words. Most of the parts of stick chairs are named after parts of the human body. The illustrations in this chapter will help you identify the different parts of common stick chairs and the terms used in this book.



ARMCHAIR ANATOMY
A simple Irish chair with sticks that protrude below the seat board. Note that the seat is unsaddled. Note how the piece that joins the back sticks is called a "backrest" and not a "comb."

This book is intended to help you design and build stick chairs for your friends and family. While I offer detailed plans for chairs that I have refined over many years, I also want to show you how almost any stick chair is within your grasp. The chapter on seats shows you how to lay out 14 different seat shapes. The chapter on legs has 16 common forms that can be made with only a couple handplanes. Add those to the 11 different arm shapes, six arm-joinery options, 14 shapes for



LOWBACK ANATOMY

A contemporary lowback with strut legs and shaved sticks.

hands, seven stretcher shapes and 11 combs, and you could make stick chairs your entire life without ever making the same one twice.

If you have avoided chairmaking because of all the specialty tools and techniques, I think you'll find a way forward in this book. I don't own a lot of specialty chairmaking tools. And I don't use a lot of techniques that are particular to chairmaking.

You don't need a shavehorse or steambox to make a chair. You don't need to rive green wood. You don't need a drawknife or a lathe. Please don't get me wrong, all these tools and processes are great, but you don't need them to make a chair.

It's my hope that you will use this book to make a bunch of comfortable chairs using simple tools and basic materials. If you are an experienced woodworker, I think you'll find you already have most of the tools and skills needed to start right away on the chairs in this book. If you are just getting started in the craft, I suggest you first build a three-legged stool with dowels and 2x8 material from the home center. A handsaw, 1" drill bit and block plane can get the job done. Once you make a simple stool, you'll see how making a backstool or armchair requires only a few more holes and sticks. And from there you can make almost any stick chair.

Some of you (like me) will be happy to make these simple stick chairs for the rest of your days. Others will move on to Windsor chairs (the more elaborate cousin of the stick chair) and then make the great leap to the carved frame chairs (Chippendale, baby) that grace the world's museums.

Chairmaking in and of itself is a great tradition. And even if you plan to stay in its lower echelons (I'll be there, and I'll bring the beer and the Lead Belly records), you are still part of a grand lineage of people who see geometry and wood in a slightly different way than the cabinetmakers, turners, marquetarians, joiners and carpenters of the world.

To be fair, all woodworkers are kind of weird. Hell, you can just buy a chair at IKEA for $59. What the heck is wrong with you?

If you can't answer that question, then welcome to the club.

Christopher Schwarz
Covington, Kentucky
February 2021

GUIDED BY EYE

I embrace human variation when making stick chairs. I never intentionally make a leg look wonky. But the slight differences in angles add up to a better chair.

LEG-TO-SEAT JOINERY

There are many ways to drill the mortises in the seat for the legs. If you watch historical films of chairmakers, they seem to be guided by nothing more than experience. They know the angles in their bones and simply go for it.

Modern chairmakers, on the other hand, have found ways to use technology to help them teach the craft. Lasers, drilling guides and metal bushings are all part of the tool kit.

I fall between these extremes. Because I build stick chairs, I'm not after space-age perfection. I think stick chairs look better with the slight variations that come from drilling and reaming the mortises freehand. But I also don't want a chair to look like a drunk person who has fallen down the stairs.

Likewise, my approach to the geometry in a stick chair seeks a practical middle path. While I use trigonometric principles to deal with compound joinery, I have found a visual technique that avoids math and numbers altogether.

Lastly, I have tried to devise a way to teach this stuff so that a first-timer can build a nice chair. You won't have to drill 100 holes before you stick the landing.

RAKE & SPLAY

When we talk about chairs, we use words to describe the angles of the legs. When you look at the side of a chair, you are looking at the rake of the legs. The legs can rake forward or backward. Front legs rake forward (usually). Back legs rake backward.

When you look at the front (or back) of a chair, you are observing the splay of the legs. In general, legs splay outward from the seat.

You can use rake and splay to drill the mortises. Here's how I learned to drill compound angles in the early 2000s. Set one bevel for rake (say 6°) and a second bevel for splay (say 4°). Place both bevels on the seat by the mortise. Set the drill bit so it's aligned with both bevels. Drill.

RAKE & SPLAY

The concepts of rake and splay are ideal for talking about chairs. But they aren't ideal for drilling the mortises.

It's a bit like obeying two masters – tricky, but totally do-able.

Here's another way to drill the mortises. Some of the chairmaking books I was reading back then discussed a different way to drill that used "sightlines" and "resultant angles." Drew Langsner's "The Chairmaker's Workshop" offered the best explanation of the technique. After learning that method, I embraced it. And I have found ways to make it simpler for my non-math-oriented brain.

SIGHTLINES & RESULTANTS

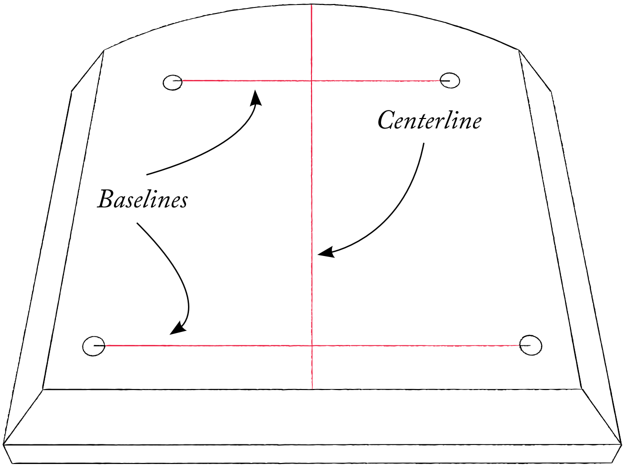
The goal of this method is to remove one of the two masters from the equation. With some simple layout, you can drill and ream the leg mortises by following only one bevel.

Many chair plans provide sightlines and resultant angles for you to use (this book does, too). So first I'll show you how to lay out those on a chair's seat when you are given the sightlines and resultants from a chair plan. And use them to drill the mortises. After you know how to use them, then I'll show you how you can create your own chair designs and devise your own sightlines and resultants (with no math).

LEG-TO-SEAT JOINERY

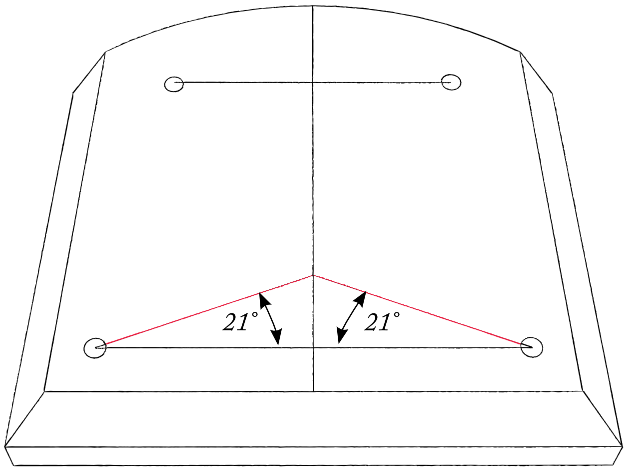
TWO MASTERS

One way to drill compound angles is to use two bevels. One set for rake and the other set for splay. Obey both as you drill.



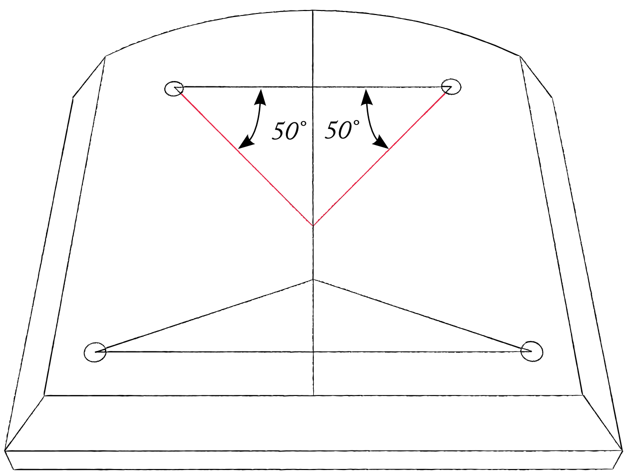
BASELINES & CENTERLINE

Lay out the locations of your leg mortises. Connect the front legs. Then the back legs. A centerline is always helpful.



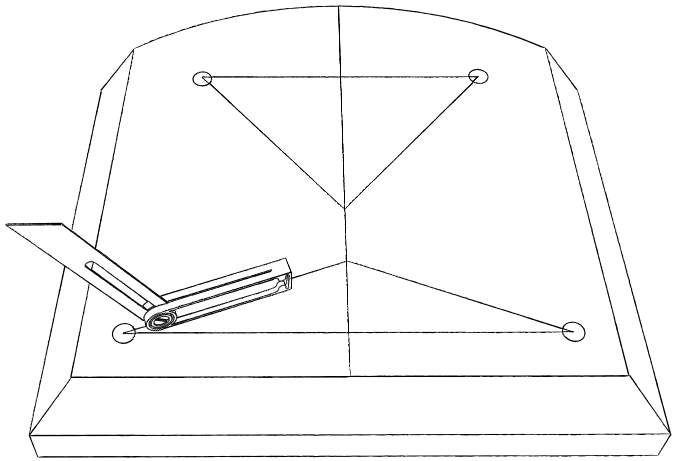
FRONT LEG SIGHTLINES

The sightlines are a certain number of degrees off of the baseline. Here, they are 21°. Note how the centerline confirms the layout.



REAR LEG SIGHTLINES

Repeat the process for the rear leg sightlines. Here they are 50° off of the baseline.



ADD THE RESULTANT

The resultant is 16°. Set a bevel to 16° and place it on the sightline. Follow the blade of the bevel when you drill.

If you have any trepidation, remember this: The last time I took a standardized intelligence test, my math skills were in the 13th percentile (e.g. 87 percent of the population is better at math than I am). So, if I can do this with ease, you absolutely can.

Take a look at the drawings of the underside of a seat. The leg locations are laid out. Draw a line connecting the front legs. Then draw a second line connecting the rear legs. These are called "baselines." I also draw a centerline through the seat blank, which makes life easier, as you'll see shortly.

The sightline is a line that is XX° off of your baselines. So, if the plans say the sightline is 21° for the front legs, then you put your protractor on the baseline and use it to draw a line 21° off your baseline. Do the same with the other front leg (use the centerline to assist you).

If the sightline for the rear legs is say, 50°, repeat the process for the back legs, drawing these lines 50° off the baseline between the back legs. Your seat layout is now complete for drilling.

Now we turn to the resultant angle. Let's say the plans call out a 16° resultant angle for the front legs. Set your sliding bevel to 16°. Place

FOLLOW THE BEVEL

The sliding bevel is the guiding star. Keep the bit parallel and aligned with its blade.

the bevel on the sightline for the front legs by one of the mortises.

You are ready to drill that mortise. Take a drill bit and drill it aligned with the blade of the sliding bevel. Drill (and perhaps ream) the mortises in the seat.

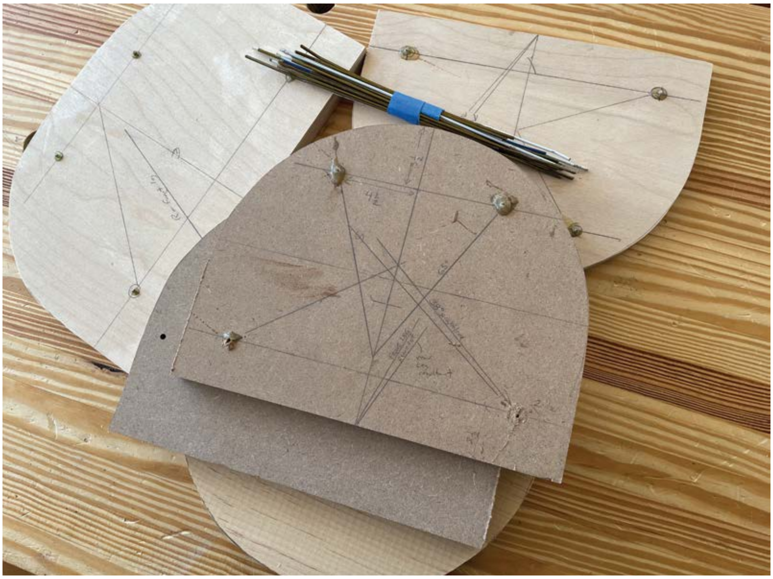
Let's say the resultant angle for the back legs is 26°. Set a sliding bevel for 26°, put it on the sightline for the rear leg and drill a rear leg mortise aligned with the blade of the sliding bevel.

We'll discuss how to drill and how to ream in a bit. What's important here is to understand how the sightlines and resultants are used.

CREATE YOUR OWN SIGHTLINES & RESULTANTS

After you make a few chairs, you will want to try some different leg angles. You might want to copy the legs in an old chair. Or give your chair a different stance. Perhaps you'd like to try some nearly vertical front legs, like some English Forest chairs. Or maybe you want to experiment with some radical rake and splay for the rear legs.

There are a couple ways to do this. If you know the rake and splay



GROW YOUR OWN CHAIRS
HALF-SCALE MODELS MADE FROM SCRAPS ALLOW YOU TO QUICKLY DETERMINE THE SIGHTLINES AND RESULTANTS WITHOUT MATH.

that you want for your legs, you can use trigonometry to convert that to sightlines and resultants. There are equations, tables and calculators out there to guide you on that math path.

Or you can do it visually and without numbers.

The first step is to make a half-scale model of your chair seat. This takes five minutes. Take a piece of plywood or pine and saw out the seat in half-scale. Drill holes for the mortises and epoxy in snipped-off lengths of wire hangers as legs.

After the epoxy dries, use needlenose pliers to bend the legs. You can use a protractor to dial in the rake and splay if you like. Or you can simply bend the legs until it looks like a chair you want to build. This is how I usually work.

Don't worry about having too much rake or splay. Most people are far too conservative with rake and splay (because they've seen a lot of conservative chairs). If anything, most people put too little rake and

PRETTY-GOOD JOINERY
Drill a countersink for the wire legs. It will fill with epoxy and help hold the legs firm while bending them.

splay to the chair's back legs. And that makes the chair tippy when you lean against the chair's backrest.

Once you have your model made and your legs bent, you can figure out the sightlines and resultants. It's easy. First you need to know one thing. As you move around a chair, there is a position where each leg will appear vertical to both your eye and to a try square.

The photos at right show this.

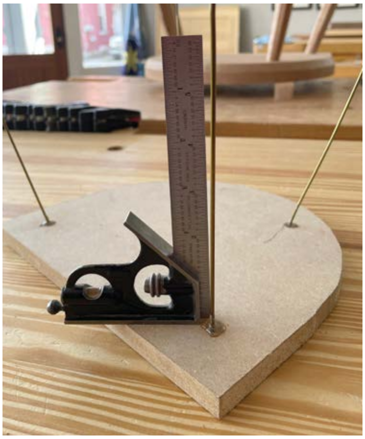
At the moment when the leg appears vertical, freeze your position. If you could shoot a laser line out of your eye and burn it on the chair seat, that 1) would be very cool and you should join the circus and 2) is your sightline.

It's easy to mark the sightline on the seat. Place a ruler on the seat that lines up with the leg and the blade of the try square as shown on the next page. Take a pencil and trace the edge of the ruler. That is your sightline. You can measure it off the baseline if you need to know its number expressed in degrees.

The hard part is over. Take your sliding bevel. Place it on the sight-

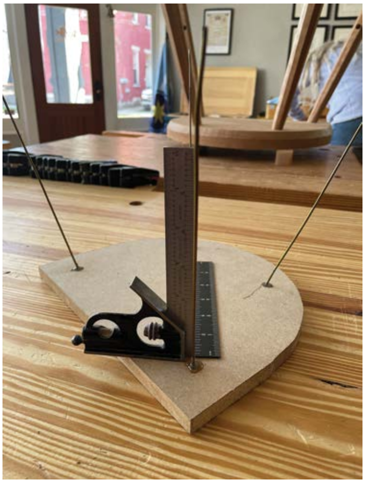
MORE SPLAY

A school protractor and needlenose pliers let you dial in the exact rake and splay.



USE YOUR ILLUSION

There are two points where the square appears 90° to the bent leg. Those positions reveal your sightline.



GET THE RULER IN LINE

Put a ruler on the model and line it up with the leg and the blade of the square. Now you can draw the sightline on the model.

line you just drew. Tilt the tool's blade until it is parallel to the wire hanger leg. Lock the sliding bevel. That is the resultant. You can use a protractor to give numbers to these lines (for example, sightline: 23° and resultant: 16°). Or you can use your sliding bevel and record them as lines on a board – no numbers necessary.

We'll get into a deeper discussion of chair design later in the book.

LEG MORTISES: TAPERS OR CYLINDERS?

About 100 percent of the vernacular chairs I've encountered have cylindrical mortises for the legs (typically made with an auger) with matching cylindrical tenons. If you want to build vernacular chairs using the original tools (or if you cannot afford a reamer and/or tapered tenon cutter) then cylindrical mortises are the way to go. End of story.

Cylindrical joints are plenty strong. I have seen chairs and stools last 300 years with this joint. You don't need a lot of tools to make the joint. You can have a very thick tenon (such as 1" in diameter), which is ideal for legs that don't have stretchers (what some people call "strut"

THE RESULT

Set a sliding bevel on the sightline and show it to the wire leg. That is the resultant. Now you know everything you need to drill the mortises in the seat.

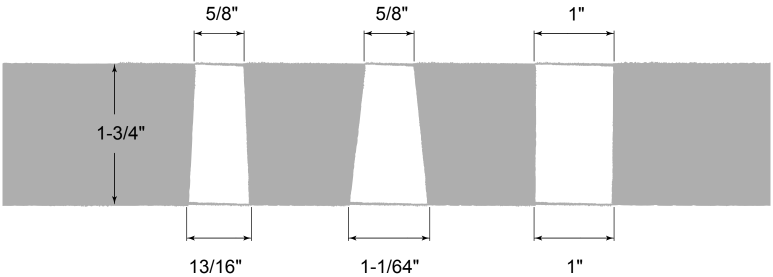
legs). Making cylindrical mortises is fast.

One downside is that you get only one chance to hit the correct angle for the mortise in the seat. If you drill the mortise off by 2°, you either have to live with the error, or plug the hole and move your mortise over (I have seen this approach in old chairs). From a pure engineering point of view, the cylindrical glue joint is not quite as strong as a tapered mortise-and-tenon's glue joint. But that's just on paper and is an unanswerable debate in chairmakers' barrooms and bathrooms.

A tapered mortise-and-tenon joint is more common in manufactured Forest chairs and handmade chairs made by professional chairmakers. The mortise is cone-shaped, and the tenon matches it. When well-made, these joints fit tight, even without glue. Plus, the more you sit on the chair, the tighter the joint becomes.

GOOD TENONS

All of these tenons are on leftover legs from the last year or so. All them are strong enough for a stick chair.



UNDERSTANDING TAPERS

In a typical 1-3/4"-thick seat, a 6° taper with a 5/8" pilot isn't the right choice for a chair with strut legs (left). Two solutions are a 12.8° taper (middle) or a 1" cylindrical mortise (right).

The major advantage to the tapered joint, in my view, is that the mortise is more forgiving to cut. If you bore the initial mortise at the wrong angle, you can correct it when reaming. The reamer allows you to sneak up on the correct angle.

One downside to the joint is the additional tools required. You need a reamer and a tapered tenon cutter. Their shapes need to match exactly. Commercial examples of these tools come with different "included angles," anywhere from 6° to 12.8°. I've used both and both work well. The nice thing about the 6° tools is you don't have to ream away as much wood as with the 12.8° tools. And when you are reaming oak, you feel every shaving.

The second downside to a tapered joint is that the tenon will likely be smaller as it enters the seat of the chair. With a 6° reamer and a 5/8" hole, you will end up with a 13/16"-diameter tenon as it enters a 1-3/4"-thick seat. With a 12.8° reamer, the hole will be a bit more than 1". If your chair has stretchers, then the 6° reamer is just fine with a 5/8" pilot hole.

But for a strut-leg chair (no stretchers), it's weak. For strut legs you have three choices: 1) Use the 12.8° reamer 2) Use a 1"-diameter cylindrical mortise 3) Use the 6° reamer but with a 3/4" pilot hole (instead of 5/8").

AUGERS BIG & SMALL
A Scotch-eye auger (above) is powered by a broomstick. More traditional augers (below) can be used in a brace or electric drill.

DO YOU NEED A BACKING BLOCK?

When I drill the mortises for my legs, I always use a backing piece of wood to prevent spelching on the exit hole. This is likely overkill if you are going to saddle the seat. Any spelching (aka blow-out) will likely be removed by the saddling process.

But I still use a backing board (usually just a thin piece of plywood). Why? I have created some almost-Olympic spelching in my day. And sacrificing a piece of Crap-Ply™ is a small price to pay for the occasional seat with deep spelching.

DRILL A CYLINDRICAL MORTISE

A typical leg mortise for a cylindrical tenon is 1" in diameter, though I have seen them as large as 1-1/2". Most electric drills and human arms can power a 1" auger through oak without too much trouble.

BIG MORTISE

Some stick chairs have huge mortises. For me, a 1-1/2" mortise requires a corded drill with a side handle.

You might be surprised how much more difficult 1-1/2" is than 1". If you are going big, I recommend an old-fashioned T-auger or one of the Scotch-eye augers intended for bushcraft.

Drilling a cylindrical mortise requires focus. You get one shot to get it right. Most augers have a lead screw. Put the lead screw where the mortise should go. Vertical is fine – you want to just start the lead screw in the wood so it doesn't scoot around. Turn the drill a few rotations so the lead screw pierces the wood a bit (about 1/8" deep is good).

Now bring the sliding bevel up toward the auger. Tilt the auger to the correct resultant angle and put the bevel up close to the flutes of the auger. Tape the sliding bevel to the sightline if you like. Now slowly – slowly – rotate the auger until the cutting spurs along its rim contact the wood. The auger will want to bump out of position when the spurs hit the wood. Let them cut, then reposition the auger in line with the sliding bevel.

After that, it's on you to keep the auger in line with the blade of the sliding bevel. Drill until you cut through the seat. Be ready to accept your errors, be they slight or unsightly.

WHERE IS PARALLEL?

When reaming, you need to sight the bevel against the drill's chuck. To make life easier, you can tape a straight stick to the body of the drill to align the tool with the bevel.

MAKE A TAPERED MORTISE

A tapered mortise is created in two steps. First you drill a hole (usually 5/8") through the seat. Then you use a reamer to open up the hole and create the tapered shape. The good news is that a reamer can correct (significantly) a poorly drilled hole. The bad news: You need to learn to use a reamer.

First drill a 5/8" hole through the seat as described above.

ELECTRIC REAMING

If you are using a reamer in an electric drill, here's how to go about it. You still can use the sliding bevel to guide you, but the bevel needs to be sighted against the drill's chuck. Set the drill to the lowest speed and disengage the drill's clutch (if it has one). I think of the almost-rhyming mantra: Low and slow reams the hole.

REAM, LEAN & CHECK

If your dummy leg doesn’t line up with the bevel, you need to make a correction. Here, I had to lean the drill back toward me to get the leg in the desired position.

Lightly touch the reamer to the rim of the hole (don't read this out loud to your children; I am embarrassed to write it). Pull the trigger on the drill and plunge forward. The reamer will cut quickly at first and slow significantly within a second or two. Stop reaming.

You need a "dummy leg" to gauge your reaming skills. (Why? Your legs are probably tapered.) My dummy leg is a 1"-diameter dowel that has a tapered tenon cut on its end. Make one with your tapered tenon cutter. You could also use a scrap octagonal leg for this. Mark one facet for sighting against so all your legs are consistent.

Pull the reamer out of the hole and insert the dummy leg. Slide the sliding bevel up toward the dummy leg to see how you did. Likely you are off by a little. Left, right, forward, back.

Let's say you need to tilt the reamer forward to correct things. Here's what I do. First, push the reamer firmly into the hole so it is seated. Get into position to ream. Pull the reamer out of the hole about 1/16" and tilt it forward so the reamer contacts the hole at two points. Pull the trigger on the drill and plunge down and forward. Let the reamer cut for a second or two and release the trigger.

The reamer is a scraper. If you let the reamer spin for more than a couple seconds, the reamer will clog, and it will stop cutting. Then the reamer will burnish the hole, which makes it difficult to ream some more. Also good to know: glue beads up on a burnished surface.

The routine is: Short burst. Check your work. Clear the reamer. Adjust. Short burst. Check your work and clear the reamer. Adjust.

Try to ream all the holes in the legs to the same depth. I shoot for the point where the reamer fills the 5/8" hole on the topside of the seat. If you have to go a little deeper, that's OK.

The first chair is a bit stressful. But after a few, you will like the fact that you can control the reamer and get the legs where you want them.

REAM WITH A HAND REAMER

Hand-powered reamers work much the same way as the drill-powered reamer. But there are some advantages. First, the hand reamers don't remove a lot of material, so it's a bit of an easier process.

The steps are the same. Drill the hole. Ream it until the reamer clogs. Pull the reamer out, clear the shavings and check your work with a dummy leg (or check it against a large sliding bevel). Adjust. Ream. Check your work.

NOT MUCH DIFFERENT

Reaming by hand works just like doing it with a drill. Cut for a few seconds, clear the shavings and check your work.