Transportation, protection, and display of our blades are of utmost importance in the fencing and sword collecting communities at large. While there are a wide variety of options available now, they mostly come with some form of sacrifice. PVC functions for the protection aspect but is less aesthetically pleasing, even when wrapped. Leather sheaths can be expensive and don't offer as much rigid protection. Golfclub hard cases are a pretty good compromise for multiple blades, but you still want some internal structure and padding. Pelican style cases are excellent for protection and transportation, but they get expensive quickly as you're extremely limited on the number of blades per case.

I would argue that the ideal storage, transport, and display of blades, even when incorporated with some or all of the other methods, are wood-core scabbards.
A well made scabbard offers rigidity, protects the user from a sharp edge and the blade from external surfaces which could cause damage, and provide an appealing means of wearing the sword when reenacting or between bouts of tournament fencing. Depending on the construction, the scabbard can also be used as an offhand defensive weapon, although historically, this seems most prevalent in later 19th century examples

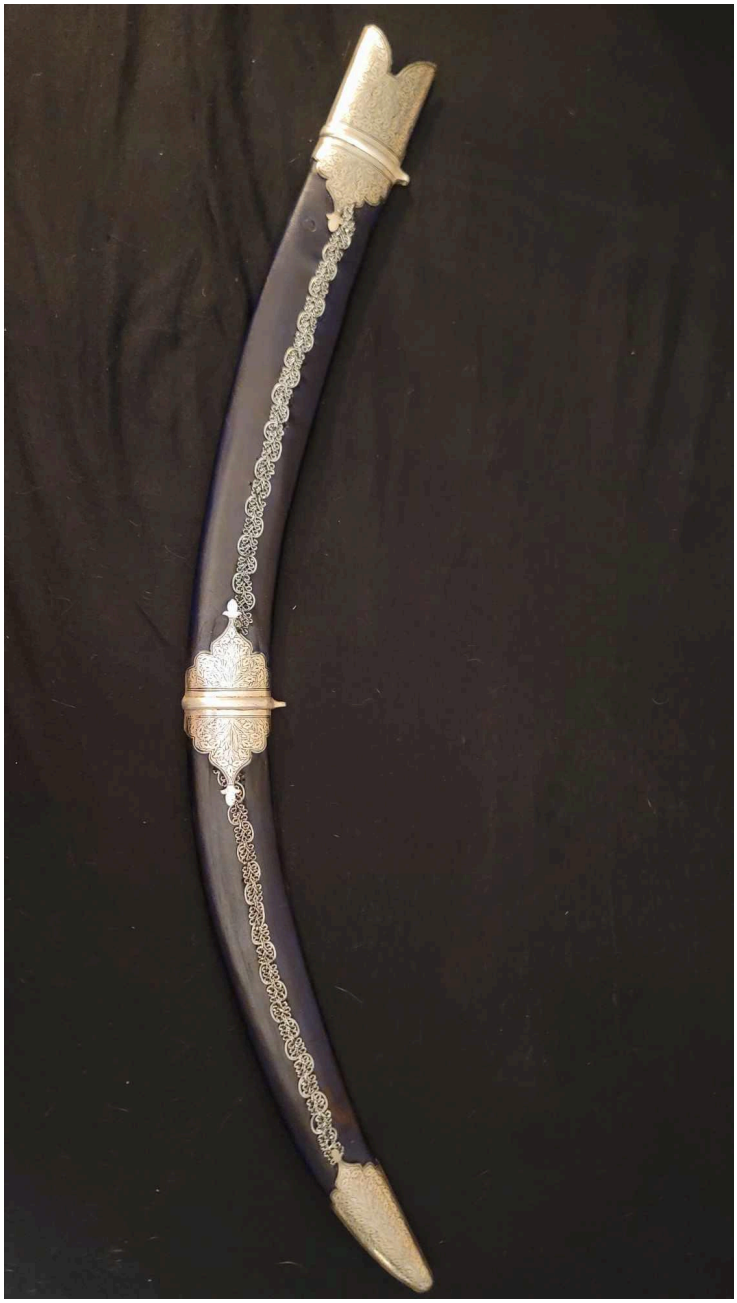

Fig. 1.

(https://hitandnotbehit.files.wordpress.com/2019/02/sabreonfoot_chambon_1911_ptc19.pdf)

scabbards can be stored next to each other in hard cases, displayed alongside blades, and worn as previously discussed.

The tradeoff is that a well made scabbard isn't an off the shelf item, particularly for custom blades. In the case of antique blades, because scabbards are frequently made of organic materials, they are more likely to deteriorate than the blades themselves.

This then, will serve as a guide for sword aficionados to construct a basic wood core scabbard which will protect and house their blades, and the skills herein can be expanded upon with more artistry in the leatherwork such as carving, stamping, and painting, and the addition of metal hardware such as chapes and throats, as well as midbands



Above: a scabbard I made to replace a low quality piece that still had usable hardware. The hardware itself needed only minor modifications to fit the new scabbard. Below: several pieces courtesy of Brian Kunz, DBK Custom Swords & Scabbards. Visit https://www.dbkcustomswords.com/ for the full galleries and more of his amazing work!


Brian Kunz

Here, I'll be focusing on basic construction, tools, materials, and some enhancements that you can use to speed the process, but I will make it as accessible as possible.

The first part is material selection. We want to use a wood that will be durable over time, and the first thought might be to go with a hardwood such as oak or hickory because they are rigid but flexible, and impact resistant. This would be a mistake. Most of the hardwoods are high in Quercitannic acid (also known as tannic acid, or tannins), a volatile compound that is naturally occurring in many plants, and gives tartness to some fruits, wines, etc.

https://www.researchgate.net/figure/Acidity-of-different-wood-species_tbl1_281295854

https://www.fs.usda.gov/research/treesearch/40277

For our purposes, when it off-gasses over time, it results in corrosion (rust) to our precious blades. For this reason, woods that are much lower in tannins are traditionally used, particularly poplar in Europe, and magnolia in Japan. These woods have a finer grain structure than woods like pine, and are easier to work than most hardwoods, while still offering the protection and

flexibility we are looking for. Incidentally, poplar is readily available at most construction supply stores.

The next important material is leather, although you could substitute a durable fabric such as denim or another canvas if you are budget conscious and less concerned about tradition. It could then be painted or covered with velvet or some other ornamentation, however, we'll focus on working with leather for the purposes of this article. I get mine from Tandy. It’s best to be able to inspect the piece first so you know that it will have a long straight piece without any cuts or holes, but if you don’t have one locally they do ship. Ideally you’ll want a half hide that has enough material for multiple scabbards. For both economical and ethical reasons, you want to get the most out of your material that you can, so when you’re laying out the pieces on the hide, cut as close to the edges and be conservative with the waste edges around your patterns.

Above: a hide that I purchased online had a large hole out of one side and a small hole in the other, with very irregular sides. It's organic material, so this happens, but this is why it's ideal to select the hide in person.

TOOLS AND MATERIALS:
poplar
leather (vegetable tanned, 2-3 oz)
the blade you're making a scabbard for
pencil
sharpie
leather strips (1/4"-1" wide depending on preference) 4-8oz
shears
xacto knife, razor blade, or scalpel
sandpaper (60-220 grits)
carving blades (knife, rasps, chisels, plane(s))
hand saw
Leather thread
needles
leather punches (awls, squeeze, or comb punches work, but the comb punches with hollowed teeth are ideal.)
wood glue
wood clamps
yard/meter stick with straight edge
cotton daubers
leather dye
leather sheen
lighter
Cyanoacrylate/CA "Super" glue
electrical tape
painters tape
respirator
nitrile gloves
clean water
cut-glove

HELPFUL:
Table Saw
Leather strap cutter
Butcher paper
Router with flat and ball ends
belt grinder (34 grit belt)
drill and screws
flat wood scraps (slightly thinner than your poplar)
skiving knifes
Calipers
FIRST AID KIT

extras:
swivel knife
leather stamps
paints
gold leaf
leather antiquing solution
Chapes, bands, other hardware

First off: you'll be working with sharp tools, so some quick basics. Don't wear gloves with power tools, but do wear an anti-cut glove when using chisels, carving knives, and other sharp tools. Keep bandages, gauze, disinfectant, antibiotic ointment and dermabond (I use super glue, this isn't medical advice, I'm a blacksmith, not a doctor) at hand. You don't want to be digging through drawers or cabinets when you're bleeding. LEARN TO USE THEM. Take a first aid/stop-the-bleed course, or at the very least watch some youtube videos.

https://youtube.com/playlist?list=PLfljAEIO4JvRrcKkRg2Q951vWKrKKHesN&si=h3i4-OFU1yVP4V4o

https://www.youtube.com/watch?v=WGLLXy3AsBQ

Now that the fun disclaimer section is over, let's get on with it:

Wood selection:

Where I'm located, Home Depot or Lowes are the simplest places for me to find Poplar, but basically any hardwood supplier should have it.

You want to pick wood that is straight and flat. look down the edge of each corner of the board (s) and if you're buying two pieces, hold them together so you can be sure they match. While you can technically straighten warped wood, it's easier to buy it straight. Also, avoid boards with knots or cracks as they'll make working more difficult.

If you have a table-saw, buy a piece that is the total thickness you'll need, plus the curf (blade thickness) of the saw blade. This will allow you to rip the material down the length, and have one side thicker than the other, so you only need to carve/route a pocket in one side. (if you're making a scabbard for a fencing blade you'll still need to carve a shallow pocket in the thin side to match, but it still makes sense to have a thick side and a thin side for durability and draw-testing as you work.

If you're housing a rapier without a fencing tip, then two 1/4" pieces will do quite well, however, if you have a fencing tip it will need to be 1/2" minimum per side. The important part

here is that your material have enough room to trace the blade onto and still have room to glue it together.

Above: three stages of tracing and joining the wood for a scabbard with a severe curve. In this case the old low-quality scabbard was used as a template. The hash marks on the joints were used to align during glue-up.

For curved blades, like sabers or scimitars, you may need to glue multiple pieces together, edge-to-edge in order to have the required material to match the curve.

Note: drawing the blade will require the radii of the internal and external curves to match the greatest distance, so if your pocket isn't wide enough, the sword may sit inside it but you'll be unable to sheath or draw it. For this reason, many scabbards for curved blades have a relief slot on the spine, cut so the blade has room to be drawn. More on this later. The important thing is that you select a piece or pieces that are wide enough for the blade, with plenty of room to spare around the edges.

Setup:

I find it helpful to have a jig/fixture to work on. I use a 2x4 that is about 3' long. I've screwed some small blocks to the underside to provide a surface to clamp the near edge down to the work bench or table I'm working on so that it runs the length of the work space

Above:For this particular scabbard, I had enough material in the waste zone that I was able to screw it directly to my clamp fixture Below: an older version of the fixture where screws are used to hold the edges in place You can see the hash marks for the material which is to be removed

If you’re just making a scabbard for a knife or dagger, you canl screw down scrap wood blocks to the top, using a straight edge to keep them in line. You want them to be slightly thinner than the half of the scabbard you'll be carving the pocket into. Start with two blocks on the near side, then put your poplar down, and place two more on the far side, snuggly fitted against the poplar so that it doesn't have room to move.

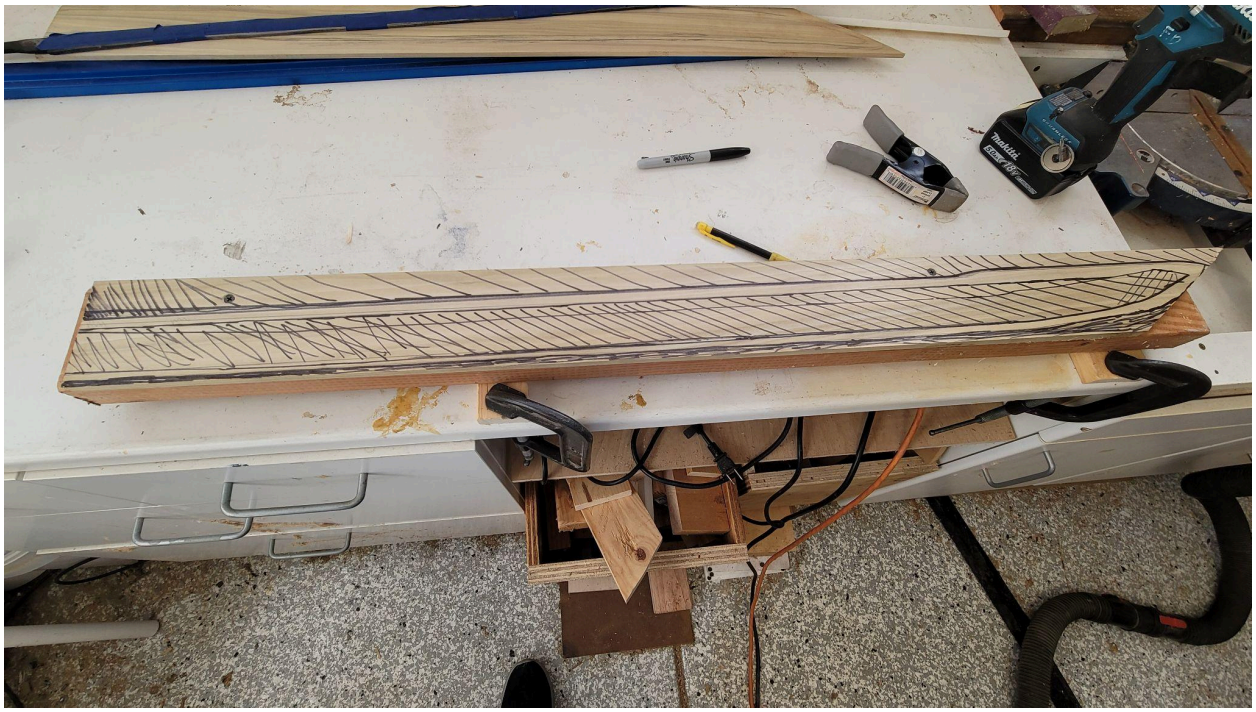
You can then use screws at a slight angle directly into the 2x4 so that the head wedges the poplar down to the 2x4 but doesn't sit proud of the surface. (screw them in just deep enough that the head is providing friction and is halfway down the thickness of the poplar) It shouldn't take more than 4. Working with longer scabbards, you’ll probably have enough material to screw the wood directly down to the fixture. The important thing is that it doesn’t move when you’re carving.

If you're using a router, Your clamps should be positioned so that you have room to work between them without hitting them mid-pass, but if you're carving by hand this is less of an issue (although much more time consuming)

Once your poplar is in the fixture, lay the blade you'll be housing onto it and trace it with your pencil. It may be helpful to remove the hilt, if possible, and/or tape the blade to the poplar with painters tape while you trace. Now decide how much material you want on either side of the edges, (minimum 1/4") and trace that outside your blade pattern.

Next, highlight the inner line with your sharpie. draw from the inside of the pencil mark so that the sharpie is the material you'll be removing. Do the same thing with the outer line. Now draw diagonal hash marks across the material you're removing, staying inside your borders.

This will help you to know exactly what is and isn't supposed to be removed while you work. You can safely remove any material marked with sharpie.



Above: the material inside the unshaded area is where the blade will go, and outside is the waste material which will be removed during the profiling step.

If it's a fencing blade, you'll additionally want to take the widest point of the rubber tip, add 1/8th of an inch to that diameter, and mark that width centered down the length of the poplar. This will be the deepest part of the pocket, and you'll also carve the thin side of the scabbard to match the cross section so the sword has a circular cross-section to be drawn completely from the scabbard. If you have a sword that has a blade wider than the fencing tip, you can set your cut depth on the table saw so that your blade sits flat in an upper channel, and

the deeper pocket for the tip is the only part that needs to be cut on both sides.

Above: one of my older fencing scabbards. Note the leather has pulled back from the throat, make sure you leave plenty for it to shrink over time as the leather dries from forming and sewing. I also didn't leave quite as much clearance as I should have, resulting in a more snug fit than ideal. Fencing scabbards for rapier blades are nearly round, due to the tip requirement.

After marking the wood, but before you begin to carve the pocket, you need to profile the outside by removing the material you traced with your outer line and colored in with hash marks. If you're making a scabbard for a curved blade or a strong taper (a lot of material to remove), it will be much easier if you use a saw and chisel. Otherwise you can skip to the next step.

Make cuts down toward your outer line every few inches (not all the way, give yourself ¾" or so) and then use a hammer and chisel to remove the pieces. Place the scabbard on a flat surface with a piece of scrap wood and a cutting mat (or a cutting board you don't mind damaging) that is sturdy enough to hammer against. You'll be keeping the chisel blade perpendicular to the work piece, so you cut straight down. The blade should be placed at the base of a shallow saw-cut and angled so that it points toward the next deepest cut. This will ensure that when you break out a chunk if it cracks along a grain it will crack toward the pieces you're removing and not into the scabbard. On a curved scabbard you want to work from both sides toward the deepest part of the curve in the center.

After they're removed, take the pocket-side to the belt grinder, if available. Make sure to wear a respirator and safety glasses! If you're using a 34 grit belt it will go VERY fast, so don't use a lot of pressure, and take it slow. You can't easily put wood back once it's removed. If you're doing this by hand start with rasps, and progress down through carving knives files,and then move to a hand planer, finishing up with coarse sandpaper.

Once your scabbard is profiled, it's time to cut in the pocket. Using a router, for swords without protective tips, you will simply set your cut depth to the thickness of the blade at its thickest point plus 1/16" for clearance. If you have calipers this is simple to find, but you can also place the router flat on its back, bit up, and lay the sword blade against the bit, then set the depth slightly past the thickest point. If you're carving by hand, you are removing the same wood, but using chisels and a carving knife to cut to depth and hollow the pocket. Use a marking knife (or an x-acto, or box cutter) carefully trace the inner line completely. Start with a shallow cut and then reinforce it with progressively deeper cuts. From there you can cut up to this line from the inside with chisels to give yourself a border to work within. Be gentle as poplar carves easily.

Remove the inner material with chisels or a router, making shallow passes until you reach the required depth for each section of the scabbard. Continuously test the blade's fit by making trial draws. This is where you will find out if you need to cut a relief slot for a curved blade. Mark an inch down from the throat, remove the material so that the pocket is continued to the outside, and try to draw the blade. Remove more material as needed until the blade doesn't bind against the spine of the scabbard. Then sand it so that the transition from the pocket to the spine is blended and at a uniform depth. Once you believe enough material has been removed, secure both halves of the scabbard with electrical tape (or blue tape) to tightly hold both halves of the scabbard together and gently attempt to draw. It can have some retention, especially at

the opening, but you want the draw to be smooth and not forced. If you find it hanging up, mark the spot on the blade where it's sticking (dry erase or painters tape around the blade at the throat of the scabbard) Test the blade in just the pocket-side to see if it still catches; if so, either hollow out the thinner side or make another shallow pass in the pocket-side. Smooth the interior with sandpaper as needed for a clean finish, remembering that any inside blemishes won't be visible once assembled. With practice, your technique will improve. For single edged blades I find it helpful to use a square cutting bit for the spine, and a radiused bit (ball end) for the edge as it makes the fit more appealing.

Above:The test fit is a success! Below:The pocket channel being hollowed. Below: the channel has a taper on the left and a hard wall on the right, contoured to have a more aesthetic fit for the unsharpened spine and sharpened edge)

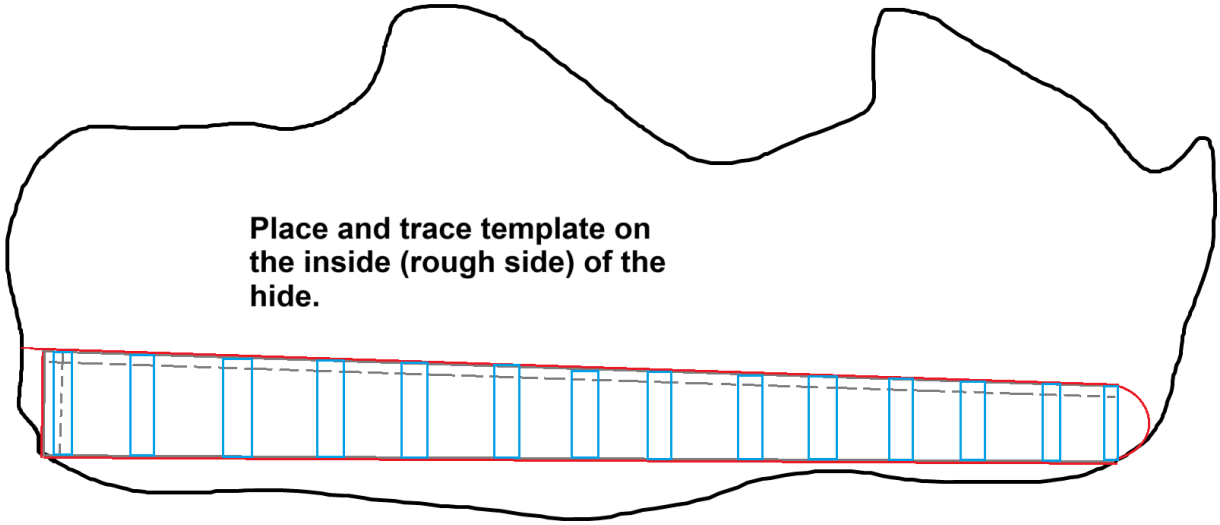
Getting the fit just right can take some time, but it's very much worth it in the long run. Keep in mind that this wood isn't going to be sealed, and as such can swell in the more humid months, so you want it to slide in and out easily with only the slightest amount of retention, or you'll be fighting to draw it later.

The next step after the profile and pocketing are finished is to contour the outside of it. Your walls are going to be thin, but you want to avoid breaking through, so go slowly and keep feeling the thickness with your fingers inside and out. I find that the best way to do this is to start with the pocket half, at the throat of the scabbard, and get the cross section of the profile that I want, repeat on the tip, keeping the exterior at a gentle curve that comes to a rounded edge at the widest part. Once this is done, I'll take electrical tape or painters tape, and tape both halves together in the middle in several spots. Then I'll match the curve on the thin side of the scabbard and make sure that the joint is a graceful transition. Once the tip and throat are fully shaped, I tape these tightly so that the two pieces won't move. If you're worried that you'll break through you can fully grind down the pocket side to shape, then do the tip and throat of the thin side, and tape them together at that point.

If you do break through, all hope isn't lost. There's a neat trick with baking soda and super glue that instantly cures into a hard plastic, and if you really want to reinforce it, you can tape some paper towel or gauze to the outside to match the curve, then sprinkle baking soda on the inside and use high viscosity CA glue to bond it. You can layer it with paper or gauze if you really need to build up material, but if it's a small hole you don't need to do much. Remember that the whole thing will be wrapped in leather, and as long as your woodwork is smooth it won't be noticeable once the leather is sewn on. Once the repair is complete, sand it gently until it matches the curve, and finish shaping. (This repair works on anything that CA bonds to, and is a great way to get some more life out of broken tools, toys, projects, etc.)

Once you've profiled the outside, have a good fit inside, and completed the shaping, it's time for a final fit test under compression, and then glue-up. I've tried several methods, and the one that works best is CA glue with accelerator. It's always best to wipe down the mating surfaces with a solvent like isopropyl alcohol prior to gluing just to ensure that there aren't any substances that will inhibit adhesion. This is more important for woods higher in natural oils, but still good for poplar. Apply glue to one side and accelerator to the other. Try to keep the glue toward the outside of the joint so that when it's compressed it will not bead up inside. This is less of an issue with CA than with epoxy, but accelerator makes CA have more expanding properties, and so it can occasionally cause fitment issues if there is too much inside the pocket. Make sure the edges are aligned, and put a band of electrical tape at the throat, tip, and center. Wipe up any glue that squeezes out, and then add a good spiral of tape the entire length keeping moderate compression, and leave it for 5 minutes.

During this time it can be helpful to lay out a length of butcher paper (or newspaper if that's what you have). This will be used to lay out the rough shape of our leather. We want enough room to work with so that we don't come up short and have uncovered bits, but we want to waste as little leather as possible. You want about ¼" more around the edges than you think you'll need. The leather will stretch when we get it wet, but it will also shrink when it dries, particularly once dies with solvents have been applied. Place the scabbard inside-up on top of the paper (if you're wearing the scabbard, the inside is the side that is against your body.) It's a good idea to mark the inside at this point. It's less important if it's a straight blade, particularly one with a double edge, but it can still matter. Fold one edge of the paper up around the scabbard and use blue tape to hold it ¼" past the center-line. Follow this all the way down the scabbard. If the scabbard is curved, make paper bands about an inch wide and space them evenly every few inches, with the same ½" extra overlap. Once you have them all the way to the tip, you can place them on your larger piece of paper, "rolling" the curve of the scabbard from throat to tip to maintain the spacing. Tape them to the edge of the paper the entire length, and then lay a straight edge along them and trace the far ends of the bands. You can then cut out your template and verify that the overlap is consistent along the length of the scabbard before laying it out on the leather. You want to place the template in such a way that you will get the most out of your hide. If it's a shorter scabbard, you can sometimes place it on narrow or irregular parts of the hide and save the nicer long and wide parts for larger projects. You can use the long narrow strips of waste like the one in the diagram for the straps and risers later on. Once you've verified the template one last time and have it laid out, I recommend using tape and binder clips to hold it in place and use a sharpie to make dots around the edge and then ideally using a straight edge to cut against, cut out the template on a cutting mat, or use shears if that's what you have.



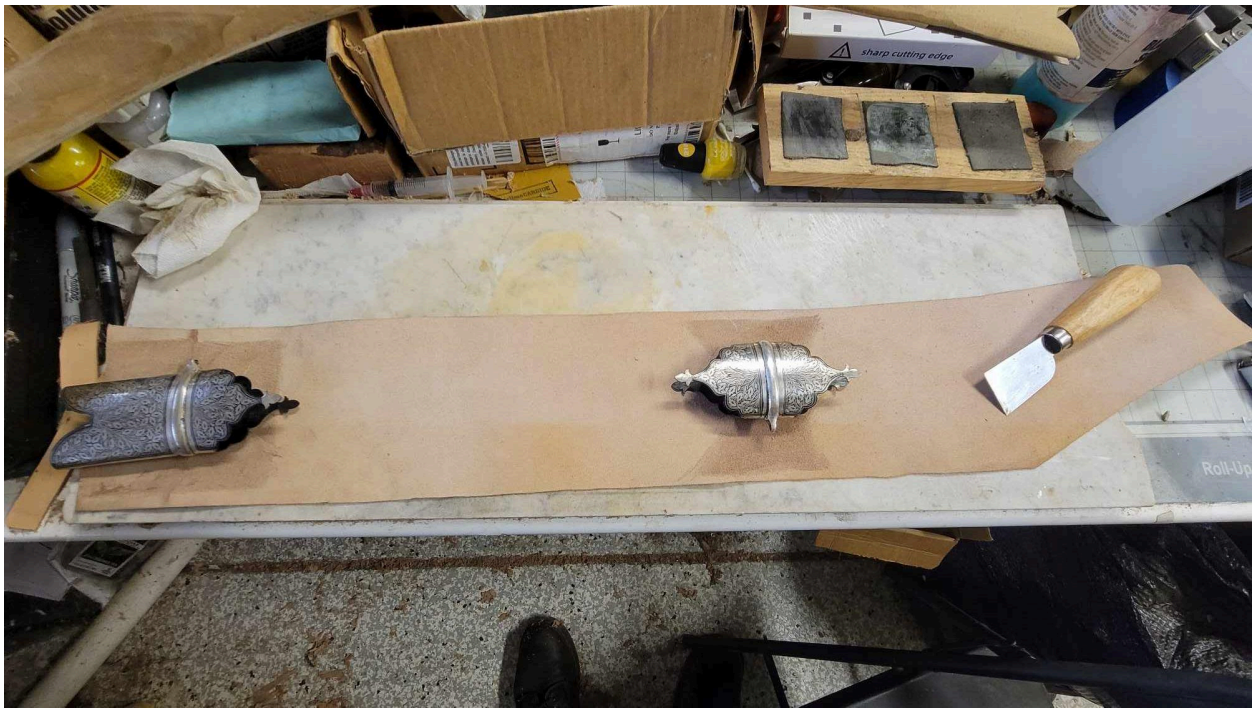
Cut Lines
Paper Template (dashed is overlap)
Paper Bands (curved or odd shapes only)
Hide (place template so that you waste as little as possible around the edges. keep scraps of a useable size)

Now you're at the point where you want to add risers, backing for any 3d sculpting, and skive the back of the scabbard anywhere you'll be adding metal hardware (throat, chape, bands, etc.)

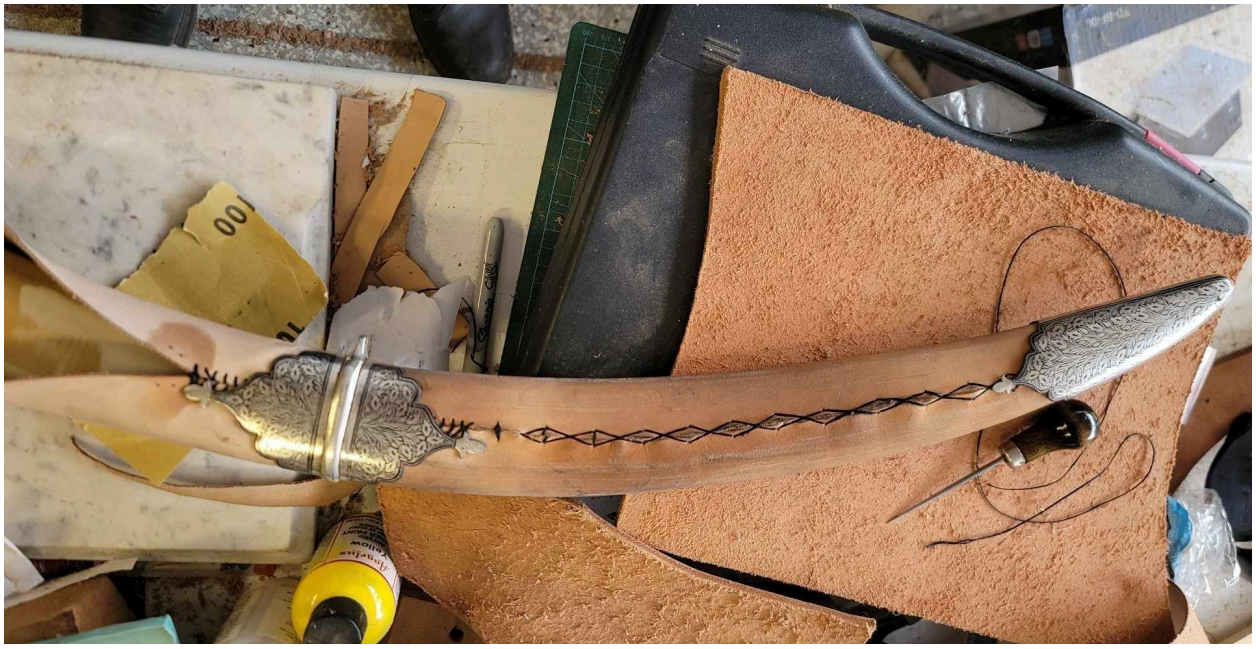
It can be helpful to add a thin coating of spray-on varnish to the wood because when you're wet stitching the wood can swell a bit if water soaks in, but this is purely optional. Wax is also a

suitable alternative, but be aware that it can cause staining of the leather when it heats up, if you aren't dying the leather a dark color or painting it with an opaque finish.

A skiving knife is like a leather chisel used for scraping material off the back side to make it thinner. It's also used along the edges of some pieces so that the overall thickness appears to be less than it is, or to give it a tendency to fold in a specific spot. It's best to have a hard and flat surface like marble, granite, or glass to work against. Hold the leather tightly stretched and push or pull the blade with the bevel resting against the rough inside of the leather at an angle that "sets" the depth of the cut. The more extreme the angle of the tool (higher pitch) the deeper the cut will be and the thinner the resulting leather will be. Some skiving knives have specialty feet on one or both sides of the blade to make it easier to take edge cuts at a set depth, and some blades are wider and used for thinning the entirety of a piece of leather. Practicing this technique is a great use for small scraps of leather you would otherwise throw away. Your skiving blades should always be sharpened and honed to a razor edge, and they will almost all be single bevel which means you ONLY want to sharpen the side that is already beveled and leaving one side flat, like a chisel, instead of sharpening both toward the center like a western kitchen knife. Carefully check them for knicks and dull spots before you begin skiving, or you can catch and tear your leather.



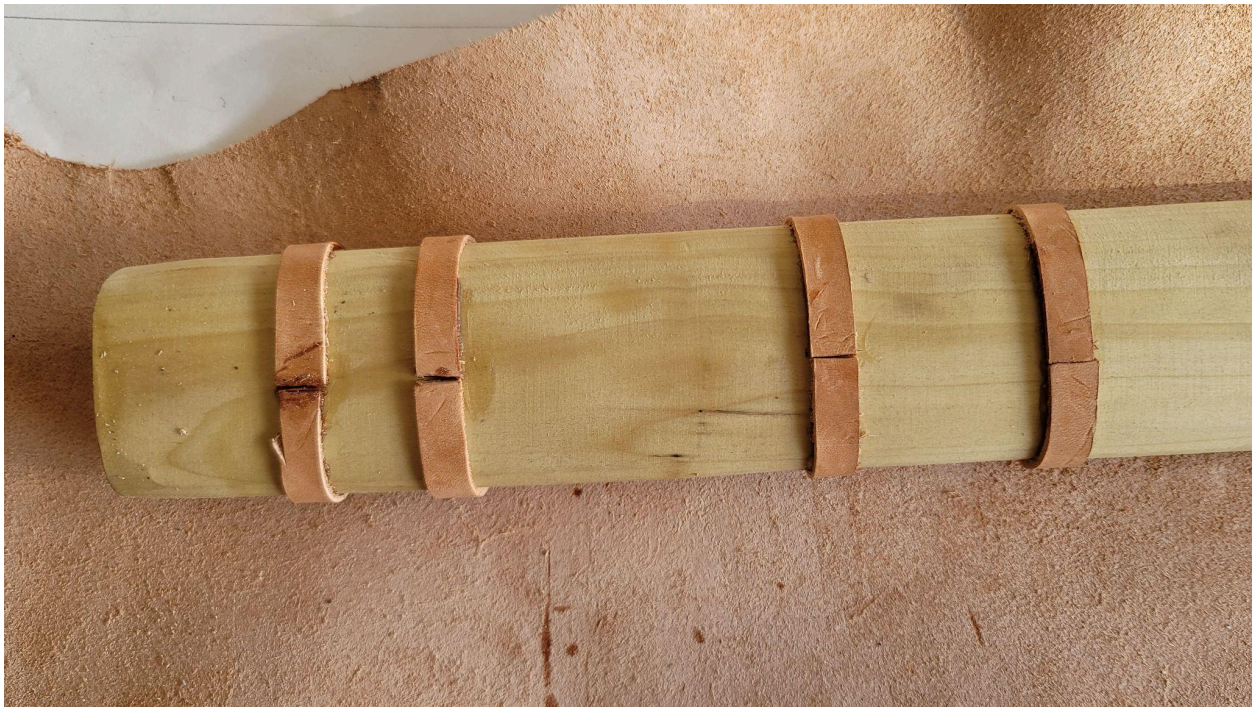
Above: the darker portions of the leather have been skived thinner where the hardware will sit over the top to ensure that they will fit. Below: leather under the hardware needs to be stitched before final installation.



This is a painstaking process because the leather needs to be thin enough that the hardware can be installed and the leather will slip over the scabbard, but not so thin that it will tear while you're stretching the leather over it. In the case of a center band, you will need to stitch the portion that will be covered prior to final installation. Sew it over the scabbard and then remove it. Slip the hardware over the leather "sleeve" and then gently slide it back over the scabbard to the final resting spot. You may need to alternate sanding the wood thinner, carefully skiving more material, and may even consider using neatsfoot oil or another leather conditioner with some slip to it as a lubricant to assist. It should be very snug.

Risers are bands of leather underneath the leather wrap that give a raised portion which serves as a retention point for belts.I use a strap cutter to keep them the same width. If i'm making a belt for the sword then I choose the width of that first, and set the riser spacing accordingly. Otherwise I set it to a standard like 1.5" or 2". It's best to choose how you will be wearing the blade prior to positioning risers. Some scabbards have offset mount points, and others, like rapiers, often use a "frog" that hangs from the belt, with straps and buckles that hold the scabbard in place. The mode of attachment is often dependent on the style of sword and the

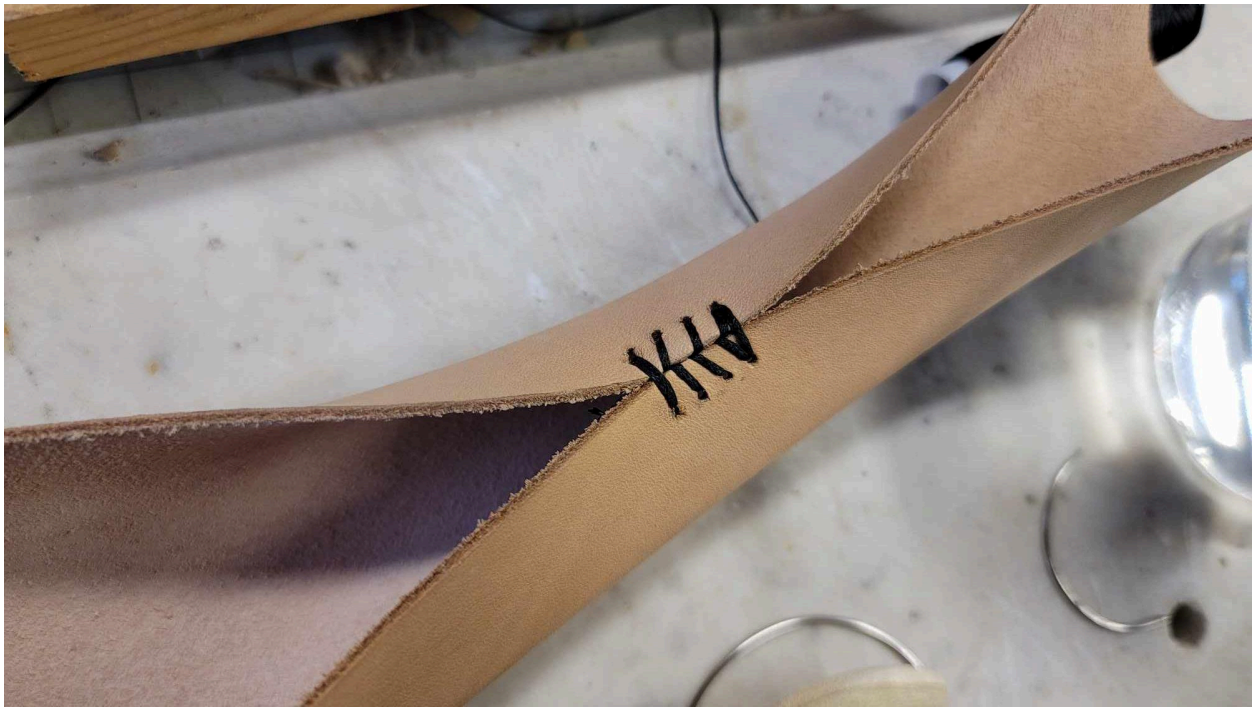
culture around wearing a specific blade, but the choices are ultimately up to you.



Above: riser bands cut and glued to the wood. Below: the risers with the belt in place:

Above: an offset sword belt and scabbard. Below: a scabbard in a frog

I generally start my stitching at the tip of the sword, although as I mentioned before, if there is hardware in the middle of the scabbard this should be accommodated for. The first inch or so should be tighter , then you can switch to a longer “cross” style stitch and lock them with a short stitch every few crosses. I pre-punch holes for the tight stitches and use an awl to poke them as I go for the longer ones as I’m doing more stretching here. This is much less time consuming and gives you space to trim the excess leather as you go. You want it to butt tightly and even slightly overlap as you will be stitching it wet and it will shrink later. Use a cotton dobber and clean water to keep the few inches you’re currently working on well saturated.



Above: starting toward the tip locks in the final position of the scabbard as it can't be pushed deeper than the taper will allow. Below: examples of wide/long, and narrow/short stitching.

NOTE: Reminder that you want the stitching to be on the INSIDE of the scabbard. It's embarrassing to be done sewing only to realize you've put the stitching on the outside of the scabbard. If you DO make this mistake you have options, like covering it with ornamental trim. Also I find it best to sew toward the tip from the starting stitches LAST, as I can trim as I go and still have enough leather to fully cover the tip. This is less important if you have a chape that will cover the terminus of your stitching, but it's still best practice.

Once you've stitched the leather all the way, you can install the remaining hardware if present. Be sure to debur any edges that may sit against your stitching. You don't want sharp edges to cut your threads after all your hard work. 5 minute epoxy works well for this, but if you want to use more traditional adhesives like hide glue you can.

You can now use your cotton dauber again to wet any areas that need further forming or tooling (around risers, any ornamental decoration, etc.) It's best to use pressure and roll the tools onto the leather and **NOT** a mallet when forming against a wood scabbard, because it's thin. If you're more experienced you can do your layout and then tool the leather before sewing it on, but if you're not careful your tooling will be deformed when you stretch the leather and/or the positioning may be off, so I prefer to tool it once it's sewn on. You can use a pencil to lightly mark the leather for designs, (do this dry). After ornamentation, let the scabbard dry and then apply your dye or paint, gold paint or gilding, and your surface coat. (I like super sheen).

Above: the scabbard still hasn't fully shrunk, but the tooling is complete. Below: the fit is much better once the leather has fully dried and shrunk. Gold paint has been rubbed into the tooling to give contrast and legibility.

I hope this has served as a thorough introduction and guide as well as an inspiration for you to embark on the rewarding process of housing your sword collection!