TEMPLATES AND THE FORM

The shape of the body of the violin is defined by the form. This is certainly not the only way to build a violin. The old English makers started with an outline drawn on the plank for the back, and built upwards from there. The older Dutch and French makers who inlaid their ribs into grooves cut into the back may have been working in the same way. Some violins have obviously been built without a form or defined outline, in the air. Charles Beare suggested that Gaspar Da Salo violas may have had a simple form that held the four corner blocks and defined only the c-bouts, with the outer bouts being made free form to the different sizes. French makers in the late 1800s worked from templates for the top and back, and made the ribs in halves (left and right side) inside of forms that defined the whole outline and corners, too, so that they would fit the top and back shapes already defined by the various templates. German makers in even the recent past used full outside forms. Some modern copyists use full-depth outside forms which allow them to replicate both the front and back outlines of the models they are copying, even when they are distorted and different from each other.

The traditional Cremonese form defines only the bouts, but not the areas which are defined by the blocks, which are shaped however the blocks are shaped and consequently vary from violin to violin. I use the Cremonese method, or at least as much of it as I can decipher and understand, and therefore also use their style of form to make my ribs.

Regardless of the method you choose, you first need to design or steal an outline. There have been many methods suggested over the centuries for drawing an outline, but the only one that satisfies me as being probable for the Cremonese school is the drawing method of Francois Denis, who published an entire book outlining that method a few years ago. If you really want to start from scratch and make your own authentic Cremonese-style outline, I believe this is the way to go.

The other method that has been used for a couple of centuries is to take an outline from an existing violin that you like, and reverse engineer a form from that. This is not a difficult process, but almost invariably results in some inaccuracies and problems. The first source of error is wear; certain areas of the violin you choose will most certainly have become worn and must be reconstructed somehow in the drawing. An unintended result of tracing is the evening out of characteristic lumps and bumps which may well be

diagnostic for the recognition of a given maker's model. To some extent this can be minimized by care and attention. Corners are difficult because they do not follow the ribs precisely, and thus drawing the ribs directly from them will result in something that is not correct. Corners need to be considered separately and drawn out individually. Symmetry is another issue: the original Cremonese makers were not concerned about it; asymmetry, which will always be their in their work, was a natural result of their working method. You can choose to copy their asymmetry, and risk further degrading the model by adding yours on top of that, or you can attempt to create a symmetrical form based on virtually nothing concrete to work from. You cannot, for instance, just take the unworn half of a back and flip it, getting an accurate Cremonese model, because you will not be reverting to the original asymmetry by doing that. You will probably end up with an instrument with squarer or more sloped shoulders than the original model, depending on which asymmetry the side you choose to replicate has, and the rest of the outline will show similar problems. Stradivari c-bouts can be particularly vexing, since one is usually higher than the other, along with the whole rest of the outline being distorted in sort of a parallelogram fashion.

The solutions, then, are to anticipate, refine, redraw and generally correct; to accept quirks as accurately as possible; or to find the most symmetrical example you can by the maker you wish to copy and use that. The choice is yours. If your objective is merely to obtain a plausible outline rather than copy, none of these issues may matter to you.

Since the basic process is not particularly simple to begin with, I will proceed assuming that you have found the perfect violin and wish to copy it as accurately as possible. Any deviations from perfect that your model has will be yours to deal with as you decide.

Tracing

To trace an outline from an existing violin you will need a base to hold the instrument off your bench, an 11x17" pad of heavy drawing paper, a similarly sized and thickness piece of matte board (I use the back from previous pads), and a drafting pencil of the type where a very fine lead projects from a metal snorkel tube, since a normal pencil with an uncovered lead will invariably leave marks on the outline of the violin you are copying. If this isn't an issue, you may find a half-pencil—a pencil cut exactly in half longitudinally —useful for tracing a precise line around the instrument.

Start by roughly tracing a violin outline, any outline, centered on the cardboard, and then mark a guitar-shaped outline about a half inch in from this all around. Next, cut out the guitar-shaped hole. Take one piece of paper, and use clips all around to hold it to the board. This will prevent the paper from slipping when it's pushed around by the violin's arching. Flipping the board over, opening up, cut one long line down the center, almost

from end to end of the opening, and then do the same in each bout, from one side to the other. This is enough to permit the arching to drop into the hole without distorting the paper. You still will need something to rest the board and violin on. In my shop, I rest violins I am working on in a bed made of a piece of soft foam with a similar guitar-shaped outline cut out. Put this, or something similar, under the board and paper, and place the violin on top of the pile.

For most purposes, the back is the part to trace, because it will be much less worn and distorted than the top. Find a place for the violin where it feels secure and doesn't rock around. You will need to hold it firmly so that it doesn't move while you're tracing, and I usually push down on the corners or the c-bout. Figure out an angle for the pencil that will trace a line directly under the edge of the violin, and maintain that angle all the way around. Do the outer bouts first, then the c-bouts, and finally, with more care, the corners. If a violin is particularly interesting, I may take several tracings of it.

Sometimes it's possible to trace the purfling, using a sheet of acetate or mylar, with the appropriate hole cut out, suspended over the back. This can be useful for establishing the original line of a very worn edge, but it's not always reliable, either. On some instruments you may find that the purfling wanders around the instrument, and seems to not maintain one distance from the edge. Some later del Gesus do this, for instance.

While I have control over an instrument, I also shoot a full set of photos, the normal set that experts use, of the top and back from straight on, the top and back waist, including corners, and all four sides of the head. It's important that these be shot carefully, a topic which is covered in full in the violin photography section.

In addition to those, I also shoot a picture of each f-hole viewed perpendicularly to the hole, rather than from the front. This is the photo that I use for an f-hole template. Another strategy for f-holes is to take the front view of the waist, print it to the right size to make the c-bouts the correct height, but stretching it horizontally to equal the distance across the minimum width of the c-bout as measured over the arch. This is useful for establishing the proper locations of the holes, and can also be used in a pinch as a template, though the resulting f-holes will have to be modified slightly on the fly on the violin to be really accurate.

You should make sure that you have photos of everything that you might ever want to know about the violin you're copying, including such obscure things as the way the ribs fit the corners, viewed from the bottom of the edge, and details of how the cutting of the f-holes twists through the length of the holes. I also take a lot of measurements of such things as rib heights around the body, edge thicknesses in unworn spots around the edges, the corners, and throughout the c-bouts, and anything else you can think of that you

might not be able to measure later or measure on photos. I also take measurements that will help me print life-size photos as I need them—things like calipered widths and overall dimensions of fs, the scroll, etc.

Making the Templates

Templates for the head and for f-holes are easy to make. I print them to life size, and have them laminated at a copy shop. The head gets cut out with scissors, and the volute punctured through the photo with a marking point. I cut out the f-holes with a knife, just as I would on the real violin.

The body template is more complex. For that you have to draw in the outline of the form manually. Usually the form will be about 3.3mm inside the outline—1.0mm for the ribs, 2.3mm for the overhang. That holds through all of the bouts, but doesn't work in the corners, as you will see. I start with a compass set to 3.3mm and draw a line inside my outline line, very carefully. If you chose a less-than-perfect violin to copy, now is the time to cure worn areas on the outline. You're on your own on this; do it carefully, and make sure that what you end up with looks realistic.

For the corners it's necessary to first lay out the outside of the unworn corner. This means understanding how the wear on the corner occurred, and what the corner looked like before the wear. Pictures can be helpful, as can photos of other violins by the same maker, since makers tend to make the same type of corner through periods of their working life.

Once you've done this, you then to manually draw the ribs within the corner outlines (this is why you shot a photo of this area on the real violin), placing your ribs where the original ones were, including the flat end of the corner if there was one originally. Even in copying, it's best to start with an idea of how the original looked new, and put your own wear on it after making a new violin. Starting right out by copying a worn instrument as a worn copy can result in obvious incoherence, and the corner is one place where this is easy to spot.

Most likely the distance from outline to rib line should widen as you approach the end of the corner, and not evenly on both sides of the corner. For instance, it's normal for the rib coming from the c-bout to follow the corner right up to near the corner's tip, and for in the last couple of millimeters the corner will quickly turn from the rib. In the outer bout part of the corner, it's more normal for the corner to start wandering away from the rib much sooner, and evenly. The distance from the end of the rib to the end of the corner varies from maker to maker, too. Some backwoods makers bring the rib right out to the end of the corner; more normally, it might end 2mm from the end, and on del Gesus the

last 4mm or more of the corner length might be completely unsupported by any rib.

After you've drawn the rib outline, next draw the inside of the rib, one mm inside that, including the tapered miter at the corner. When you've done this, you should see that the end of the corner (what you've drawn with your inner line is the outline of the corner block) is much shorter than it would have been had you simply tried to follow the outline 3.3mm inside. There's an important point in this, and that is that when you're taking outlines and making forms without thinking there's a tendency for things to grow. If you're dealing with negative things like f-holes, they'll get smaller. On your scroll, the line you trace of your template will unavoidably fall very slightly away from the template, and when you cut it out, you will probably, for safety, leave just a thread of pencil, making the head even bigger. On the f-holes the opposite will happen, and the f-hole will end up slightly smaller and thinner in the stems. In the c-bouts, the distance between the corners will become smaller. If you're aware of this all the way through the process you can adjust as you go along, be sure that you measure and cut away the extra, and think of this as a little extra margin for you to use to get things right when you cut it away.

There are common errors to make that you should try to avoid. Some even have national tendencies, for whatever reason, and become clues regarding a violin's origins. The first big error is to iron out the little rough transitional spots that make an outline look as if it was drafted. Cremonese violin outlines are clearly generated from a series of circles, and classical Cremonese violins have in common distortions where the various circles that make up the outline meet. These spots are the widest point of the upper and lower bouts, where the bout curve turns from convex to concave into the corners, and just on either side of the end blocks.

The first junction is seen as a very slight flatness at the widest spots. It's so subtle that you might think it came from habitually resting the violin on its edges, but this shape exists in the purfling, too. Look more closely and you will see that the curves immediately above and below the widest spots of the bouts are not the same. The change from convex to concave is usually negotiated in a the clean joining of two tangent circles in the upper bout, but in the lower there is often a slight flat spot between the bout and the corner. French makers smoothed this (upper and lower corners, both) into a serpentine curve. Some later Neapolitan Gagliano family makers accented the curve just before it turns, giving the lower bout noticeable exaggerated "hips", and later Milanese makers accented the flatness, resulting in very flat areas above and below the upper and lower corners, with a tight curve on the outer side of the corner often being the result (Landolfi is the best example of this, and his heads show the same problem, having uncomfortable straight areas in the middle of the pegbox outline). English makers and some production-oriented French ones often turned into the corners in too tight a curve at the last possible

moment, resulting in small pointy corners that appear to be tacked on to a guitar shape almost as an afterthought.

Another trouble spot is where the inner circles of the corners meet the larger circle that defines most of the c-bout. The upper corners are problematic because they are built by small circles, and where they join the larger circle of the main part of the c-bout they have to meet and blend in a transition that is more difficult than with the larger circles and softer curves of the outer bouts. This is always a rough spot for the builder, and individual makers handle. . . or don't handle. . . this spot variously well in ways that become characteristics of their work. For example, through time Stradivari successively enlarged the circle into the upper corners, changing gradually from the more C-like center bout of the Amatis into his characteristic D-bout, which in some violins becomes quite extreme.

The English type of corner comes from not drawing out the corner layout properly, resulting in too tight of a radius for the outside of the corner blocks, which becomes tighter when the rib is added, and even tighter when the margin reduces the radius of the circle further. The curve leading through the outside of the corners of Cremonese violins is often quite gentle and natural, but still obviously constructed entirely from circular sections.

The circles at the top and bottom of Cremonese outlines define the blocks, and a bit of the outline on either side. These change constantly from violin to violin, being areas not defined by the form, but usually there's an unmistakable bump where the top and bottom circles join the one that form the bouts. If there is an immediately-recognizable Cremonese tag, this might be it, with the flat-topped outline that often is the result.

When you have your outline perfected, with wear corrected as best you can, and the corners drawn in properly, the inside line represents the true outside of the form, or of the blocks, where they fall on the form. It is from this drawing that you make the template you will use.

I like Formica ™ as a template material. It's durable, but easier to cut than metal, and you can pick it up at cabinet shops in the sizes you'll need for free, as cut-offs from cabinet jobs. It saws with a band saw, and filing it doesn't damage your files as filing metal does. Sheet metal is also used, and I've taken to using laminated paper (the drawing, laminated at a copy shop) for myself, since it's easy to use for one-off models. If you are using a hard material rather than laminating, you need to attach your drawing to the material. Spray adhesive works, but the drawing will tend to peel when you need it the most, filing in the details. Instead, I use super glue, lots of it, squeegeed out to the edges under the drawing. It hardens the paper, and is permanent. When the drawing is on the template, cut

and file precisely to the inside of your line (remember how things tend to grow!), with a band saw and files, or with metal, probably tin snips followed by power sanders and files.

Be as accurate as possible; considering how many generations from the original concept your violin will be, it's a wonder that it will look like a violin at all. Stradivari's drawing>his template>his form>his ribs>his outline>your tracing>your drawing>your ribs>your outline—that's eight generations removed from the original drawing. If there's just 0.1mm of error in each step, you could build up 0.8mm of error . . . in either direction, for a possible window of 1.6mm, which is a huge amount. Good luck!

Making the Form

At this point you have another choice to make. If you are making a precise copy, you will want to use the full template. If you are just making a violin, there are advantages to a half template. This helps assure symmetry, since it's flipped to make either side of the violin form. If you want to use a half template, choose the better side of your full template, strike a center line exactly down the middle (measure the centers of all three bouts to find this), and saw off the half you won't be using about 25mm from the centerline. You need the centerline completely intact on the half you'll be using because you will be using locating pins placed in holes on the centerline to line the template up on the form. At the ends of the half template you can cut to the centerline—a straight diagonal cut will do it.

Prepare wood for the form. Half-inch hardwood plywood works, or you can take some softer hardwood like poplar or walnut milled to about 13mm thick. You need a piece this thing because the whole rib set, including linings, will be glued up on this form. At the thinnest, the violin is 30mm deep. Linings take up about 16mm of that, leaving just 14mm height of bare rib exposed to the inside, the space for the form. Pick a piece large enough—probably around 8.25" wide and 15" long—and mark a centerline corresponding to the template's up the center.

Line up the template on this line, and clamp it down. Then drill two 1/8" holes through the template and the form, together, on the centerline, about 30mm from each end of the template. Place pins in these holes (I use drill bits) and remove the clamps. Trace the half template on the form wood with a sharp marking point or knife cut, flip the template over and do the same for the other half of the outline. Flip the mold over, and do the same on that side. Saw and plane or file off all of the extra outside the scribe, and finish precisely to that line, on both sides. I find a flat finger plane particularly useful for cutting precisely to the line in the outer bouts, and a knife works well for the c-bouts. Cut accurately to the line; if the line is correct, you may have bumps, but they will be the bumps of the original, which should be preserved for an accurate model.

Mark off spaces for the corner blocks and end blocks, saw them out, and finish those openings square to the faces of the form.

The hole in the form for upper block should be 55mm wide, and 15 mm deep at either end. The lower block should be 50mm by 13mm. The spaces for the corner blocks need to end in specific spots: the horizontal lines determining the upper and lower boundaries of the corners should be at the tips of the corners and 25mm above or below. The vertical boundary lines should, again, be even with the tips of the corners and 15mm inside, but shouldn't be precisely parallel with the center—they should tip inwards into the c-bouts at about a five-degree angle, as in the photos. As you will see later, this makes removing the ribs from the form easier.

Finally, saw out a box in the middle of the form, about 60mm wide and 240mm long. This gives room for clamps later when clamping in the blocks or clamping the ribs to the blocks. The form is now done. If you want, write something on it to remind you what it is, and when you did it. You can varnish the whole thing with one or two coats of the varnish of your choice, except in the rebates where the blocks will be glued. This isn't decorative—it will help prevent the ribs from sticking to the form later.

Developing Arching

Makers generally develop their own form for the arch. Some of this is philosophical and conscious, but because of the arching's indefinite shape, a lot of it comes down to the personal preference of the maker's eye and the choices he makes to satisfy that aesthetic. I have watched makers who start making a precise copy drift back to their own "traditional" shapes within a few instruments when working on a new model. It seems to be unavoidable, if you're working by eye.

The other method, working with arching templates, is often deprecated as being mechanical, but I believe it has a few definite advantages. The most basic one is that templates make it possible for a maker to do things repeatably. This is a small thing, but important if one wishes to develop in an orderly way. Second, though, it permits you to do things that have to possibility of being better than your eye can discriminate at the moment, and can lead you into developing a better eye. If you believe arching is important for tone, and I do, then accurately copying the arch of a violin that you like for tonal reasons is one of the more important parts of the copying process. Finally, I find it hard to believe that while the development of the various shapes of the violin all show the evidence of concrete drafting and design, they would have chosen to "wing it" on the arch. That the arch is defined was finally explained by Quentin Playfair, who promoted the idea that most Cremonese cross arches are based on a curtate cycloid shape, and

indeed they do turn out to be that.

From a structural and tonal point I find this plausible because it unifies the important vibrational shapes of the top and back: no matter how wide the outline is, nor how high—and these vary throughout the violin—there is a definite mathematical consistency and connection throughout the back if curtate cycloids are used to define the shape. They do not work, however, for the long archings, which appear to be based on different principles.

I have a lot more to say about this, and perhaps the best thing to do is hold off on making arching templates until the actual work on this commences, at which point all of the aspects of choosing and designing archings will be discussed in a better context.