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Instrument Set-Up and Adjustment

By the term “set-up” we refer to those parts of the instrument commonly changed or adjusted in the interest of sound or playability. These include the bridge, soundpost, fingerboard, and upper and lower saddles. While the pegs and tailpiece are clearly accessories, the neck and bassbar are elements integral to the instruments structure. Nevertheless, they may occasionally need replacing. Indeed, we do not expect to find an original bassbar or neck on an old instrument.

In this section we outline the basic elements of the set-up. Their relation to each other and to the instruments sound will be gone into more fully when we discuss tonal adjustments. Neither section is to be taken as a do-it-yourself guide; considerable damage can be done very quickly. All instruments, especially fine ones, should be looked at regularly by a qualified Luthier.

Alignment

The upper saddle, fingerboard, bridge, tailpiece, and end-pin should all lie in a straight line down the centre of the instrument. One often finds necks that are set in crooked, fingerboards that list to one side (either cut that way or glued on carelessly), bridges that have slipped one way or another, end pin holes drilled off-centre, and tailguts that lie off to one side of the lower saddle.

Resetting a crooked neck is a fairly major operation. It's easier to move the bridge over a little, but this throws the bridge out of position in relation to the bass bar and soundpost. As the post is more mobile than the bar, you can hazard a guess which tends to get moved to preserve the symmetry.

The result is an apparently workable set-up masking some fundamental problems. These can be brought to light through a methodically made series of measurements, although determining the centre of an instrument of irregular outline and whimsically placed f-holes can involve a certain amount of judgment.

Bassbar

This last reminder of the often extensive bracing found in flat topped instruments strengthens the top while distributing the motions of the left bridge foot over a large area. The bass bar is, like the top, made out of spruce, and a well fitted bar, correctly positioned and of appropriate strength, is the basis of the set-up. Its position can be seen through the left f-hole – but can be changed only by opening the instrument. This is a major operation and should be carried out only when absolutely necessary.

Soundpost

“If I wanted to report here every thought, opinion or intrigue born out of amateur violinmakers' fantasy on the position of the soundpost, my treatise would turn into a collection of gossip”. So wrote the Italian violinmaker Marchi in 1786, and this small piece of wood (“anima” or “soul”, in Italian) remains a focal point for maker and player alike.

The post's uprightness and distance behind the bridge are visible through the right f-hole. The fit on both top and bottom must be perfect, and can be checked with an inspection or dental mirror. A soundpost setter is used for insertion and adjustment; this simple tool leaves a small notch about one-third of the way down the post. This should be centred on the face of the post visible through the right f-hole. If it appears to be twisted off to one side, the post may not be in its intended position. (Note: the post is made of spruce and cut so its grain is at right angles to that of the belly.)

Much harm has been done by well-meaning musicians and amateur makers attempting to adjust the soundpost. Slight changes in the relationship between bassbar, bridge, and soundpost are the principal means by which tonal adjustments are affected. The outer edge of the bassbar is usually positioned just inside the outer edge of the left foot of the bridge. The post is then positioned an equal distance inside the right foot. Ideally, this symmetry will give a good balance between the instrument's high and low registers.

The distance of the soundpost behind the bridge determines the flexibility of the coupling between these two. This directly affects the freedom, power and focus of the sound. As a starting point, the soundpost is placed behind the bridge at a distance about equal to the thickness of the top in that area. For structural reasons it is not placed much further back; this can lead to distortion of the top. If an instrument sounds tight, the post may be too close to the bridge. Conversely, a flabby, unfocused quality can indicate too great a distance.

The overall length of the soundpost is at least as important as its position. It is cut slightly longer than the distance between the top and the back. This extra length creates a slight upward pressure on the top, counteracting the downward pressure of the bridge. The ideal length for the post will vary with seasonal changes in the plates. It may also vary with a change in the post's position within the instrument.

If the soundpost falls over when an instrument is unstrung, the post may be either too short or in the wrong place. The power and response of the instrument can then be helped by a longer soundpost. If exaggerated, the quality of the sound will suffer. An overly tight post is difficult to adjust and may eventually distort the plates, especially the top in the area of the right f-hole. It may also crack the top.

Where only a small change in post length is required, it can be simulated by moving slightly the bottom of the post toward or away from the center of the instrument. The arching of the back accounts for the resulting increase or decrease in tightness of the post. A large movement will obviously leave the post at an angle, and thus not fitting properly. However, this adjustment is most useful for small seasonal adjustments and for predicting the effects of an actual change in soundpost length.

Note: the string tension is always relaxed before the post is adjusted. Serious damage to the top, in the form of pitting of the wood, or worse yet, a soundpost crack, can be the result of clumsy soundpost work. This work should be done by professionals!

The most suitable post position for an instrument is best arrived at in small increments, giving the instrument a chance to play in after each adjustment. When a satisfactory adjustment is found, it is recommended that the position of the bridge and post be marked. There are unobtrusive means of doing this, and it enables quick repositioning in case of an accident. It also gives the maker a point of reference while fine adjustments are being carried out.

Bridge

The overall bridge height, which determines the downward force of the strings, tends to be inversely proportional to the height of the arching. The height of the bridge sets the distance of the strings above the fingerboard. Ideally the fingerboard should be adjusted to the correct bridge height, rather than vice-versa. The curve of the top of the bridge is coordinated with that of the fingerboard so that each string is kept at its correct height above the fingerboard. These curves are calculated to give sufficient clearance to the bow between strings, while still allowing for the possibility of playing unbroken chords.

The placement of strings on the bridge is often moved slightly off-centre towards the bass side. This allows the left hand more room on the fingerboard under the top string, thus avoiding a feeling of “falling off” the fingerboard, especially in the higher positions.

It is crucial that the bridge remain in its intended position. A slight jog in any direction may completely upset the carefully calculated relation between fingerboard, bridge, soundpost, and bassbar. A bit of chalk under the feet will help the bridge stay in position, especially on a new instrument with very glossy varnish. It may also change the string length. The bridge feet should fit perfectly, and the back face of the bridge is usually kept at right angles to the plane of the instrument. The resulting slight backward tilt ensures that the force of the strings is taken directly down through the bridge, avoiding any tendency to warp. The strings should rest one-third of their diameter into the notches. The wood under a metal top string needs to be protected by parchment, or a by small inset of bone or ebony.

Bridge Height

When we raise the height of the bridge certain changes in tone colour occur, even though the sum force of the strings on the instrument is not changed. This would be done by raising the tuning, increasing the string length, or by putting on heavier strings which require greater tension to bring them up to pitch. What changes with bridge height is the distribution of force on the instrument; more of it going downward through the bridge and less being absorbed lengthwise via the points of attachment at either end of the instrument. Increasing the height of the lower saddle can reduce the downward force of the strings somewhat, compensating for an overly high bridge. This is appropriate when resetting the neck seems unwarranted.

String Height

The lower strings are higher above the fingerboard than the upper ones. This reflects their greater flexibility to the fingers, and accommodates their wider arc of vibration. If the strings are too low, clarity of sound is affected. The player also misses the “spring” of the string under the fingers. (To sense this, try doing a trill on an unstrung instrument.) Too high a string action creates problems in playability, especially in the high registers. This may be compounded by intonation difficulties since pressing the string down stretches it and raises the pitch slightly. This effect is exaggerated as the distance between string and fingerboard increases.

Playing Angle

On the violin and viola the neck and fingerboard are usually rotated slightly towards the treble side. This favours a slightly lower position of the bow arm. The cut of the bridge follows this rotation, meaning the treble side of the bridge is lowered by a millimetre or so with respect to the bass. An insufficient rotation of the neck may create an uncomfortably high bow arm position when playing on the lower strings. Too great a rotation will leave insufficient clearance for the bow above the C-bout when playing on the top string. This can lead to damage to the wood of the C-bout.

Lower Saddle

This small piece of ebony bears the pressure of the tailgut (tailon). It should be high enough that the tailpiece clears the belly. Too tight a fit of the saddle into the top may cause cracking if the top shrinks slightly. It is preferable to leave a slight gap as a margin of safety. This is equally true for the fit of the neck at the opposite end of the top. These areas are particularly vulnerable as the purfling, with its reinforcing effect, has been interrupted.

Upper Saddle

The upper saddle, or ‘nut’, should keep the strings about one half their diameter above the fingerboard and evenly spaced. The strings rest one third of their diameter into the notches, as at the bridge.

Fingerboard

The length of the fingerboard is 5/6th that of the string length (except in the case of a baroque set-up). The width of the fingerboard at either end has been standardized, though there is some variation to accommodate individual hands.

The precise curvature of the fingerboard is very important to playability, as is the slight scoop along its entire length. This scoop can be seen by pressing a string down at both ends of the fingerboard. A small gap between string and fingerboard should be visible; greatest in the centre and tapering down evenly toward the ends. The scoop should be slightly larger under the lower strings. The sides of the fingerboard are also scooped along their length. By sighting down the fingerboard from a low angle, this becomes visible, as do pits, troughs and unevenness of cut. One can also check that the fingerboard and bridge are correctly aligned.

String Length

The string length, measured from the upper saddle to the bridge, is determined by the length of the neck plus the length of the stop. With the exception of the violin, standardized at 328 mm., the string length can vary a fair amount. What must remain constant is the ratio of neck length to stop, i.e. 2:3 for violins and violas and 7:10 for cellos.

The distance between the bridge and the tailpiece is usually kept at 1/6th of the overall string length. Ignoring the effect of string windings and tuners, this will tune the segment of string behind the bridge to two octaves and a fifth above the open string. An easy way to check this is by plucking them.

Fittings

These include the pegs, tailpiece, chinrest, and endpin, all of which are usually matched in terms of style, colour and material. The most common woods used are ebony, boxwood and rosewood. All of these work well; boxwood is the softest of the three but is sought after for its close-grained creamy texture, and the rich red-brown colour it takes on with staining.

Some colours go better with one violin than another: Ultimately, the selection of fittings is a question of taste. With the possible exception of the tailpiece, (which does play some role in transmitting vibrations from the strings to the body of the instrument) the choice of fittings has little effect on the sound of the instrument. It will affect the overall weight though, and therefore the feel of the instrument. Some fittings such as Wittner type tailpieces do have minimal tonal effects, but the benefits generally outweigh the problems. However most purists believe that the only string needing an adjuster is the most treble string (E in the case of violin). This can cause problems when tuning steel strings however, especially for newer players. Some of these problems can be reduced with the use of a Pusch type tailpiece, which is made from the various woods that normal tailpiece are made from. These tailpieces give the advantage of a degree of fine tuning, but without really any tonal variation.

Pegs and Pegbox

Pegs come in a variety of designs, from the intricately carved to the rather simple. The violinmaker turns down the shank of the peg to match exactly the taper created by the tool used when reaming the peghole. However, as wood shrinks more in one direction than the other, the pegs and their holes may become slightly oval in shape. This occurs with seasonal changes in humidity, and more gradually over the years. It explains why well fitted pegs may cease to turn smoothly. The problem is of course compounded if the pegs are not fitted well in the first place.

Badly fitted pegs lead the player to forcing them into their peg holes in an attempt to get them to hold. This not only makes tuning the instrument frustrating; it is one of the principal causes of cracks in the peg box.

The application of a small amount of peg paste will allow the pegs to turn more smoothly. These compounds are available commercially.

When the string is brought up to pitch, the final turn of the peg should bring the string close to or flush against the pegbox wall. This ensures that the string tension will tend to pull the peg inwards, helping it hold more securely.

Should the position of the head of the peg tuning the top string of a violin or viola interfere with the left hand while playing in low positions, its angle of rotation can be changed by loosening the string and reinserting it a few millimetres more or less into the hole in the peg.

Some things to watch for: A narrow pegbox leaves little room for string clearance. Check that the outer strings aren't rubbing against the pegbox walls. This problem can be difficult to achieve in some instruments, as we have already said above that the last turn of the string should bring the string close to, or flush to the pegbox wall. A degree of common sense therefore needs to be adopted, obviously if the pressure is high against the pegbox wall, the string life will be shortened by the friction during adjustment, and of course the varnish could be damaged. Good layout of the pegholes avoids having the strings touching other pegs, thus creating problems of string breakage and difficulty with tuning.

Chinrest

The comfort of the individual musician is of course the overriding factor in the selection of a chinrest. An over the tailpiece model is ideally recommended. With this design the endblock sustains the pressure exerted by the chinrest clamps. When this pressure is brought to bear on an unsupported area of the ribs, it will eventually distort them, along with the plates. However whilst this factor might be ideal from a design point of view, it does not take into effect the comfort of playing, and holding the instrument under the chin with as little effort as possible. Choose your chinrest with care, remember we are always prepared to send out a selection for you to try in order to assist in selecting the best for your needs. Also be prepared to change chin rests as your body/chin shape changes over time. If you are able to visit us, you can always try a much larger selection that we could send. We always have at least 20 variants, but please be warned that different manufacturers chin rests of a particular type will not necessarily be the same size and exact shape. There unfortunately are no specific designh parameters set for chin rests. For example a plastic Teka chinrest is completely different in size and shape to a wood (ebony etc.) chinrest

Standards

Generations of workshop and playing experience have led to a high degree of standardization of set-ups. This uniformity allows the player to move easily from one instrument to another. There is room within these standards accommodate individual instruments, physiques and playing styles. Be wary of unusual adjustments where their use seems unwarranted. While meeting the demands of some particular musician, they may fail to respect the long term well being of the instrument. Please remember that when you own an old and/or valuable instrument, in reality you are only the custodian for the period that it is yours, and you have a duty to respect and protect it!

Tonal Adjustments

Given that an instrument is in a good state of repair, the procedure for optimizing its sound begins with an analysis of the existing set-up. This is followed by any basic changes thought necessary, after which ever finer adjustments are made until both maker and player are satisfied. The selection of strings offers a whole range of possibilities, and it is interesting to see how much changing one string effects the sound and response of the others. Numerous subtle changes can be affected by very slight alterations in the cut, placement and materials of the set-up. Even the type of wood used for the tailpiece can have a surprising effect on the sound. After years of study, experimentation and dedication to the art, an intuitive sense of how to get the best from an instrument comes to the violinmaker, just as it does to the musician. If you are lucky enough to upgrade your instrument, you might well find that the strings you just loved on your previous instrument, really don’t work on the new one. There are too many variables to cover in this document, but please look at the `Choosing the right strings for you Instrument’ document, and hopefully that may either help or of course totally confuse you!