VLN QSTN.1

SOME QUESTIONS CONCERNING THE VIOLIN

Set out below are answers to some questions that a bright and observant student might think to ask his/her teacher but be afraid to because he/she would appear foolish. They are perfectly respectable questions and the answers are not simple. Everything about a violin is important, everything has a purpose and nothing is redundant. Everything including the scroll, fingerboard and tailpiece take part in the vibrations of the instrument. Not everything, however, takes part in the production of sound. Extras, like the chin rest and shoulder rest will change the resonant behaviour of the violin and for this reason should be as light as possible. Baroque players tend not to use them.

Why are there four strings on a violin?

This represents a compromise. Three strings or less would reduce the range although there would be some gain in loudness. Five strings could be tolerated, extending the range to include that of the viola and violin. The body would have to be viola size to enable the air and main body resonances for supporting the two lower strings, to be placed in the correct position. Some instruments have been made in this style. The viola d'Amore played at the chin has 6-7 strings with a like number of sympathetic strings to enhance the sound which was softer than a four string instrument. There is a loss of loudness (about 2dB per string) as the number of strings is increased above four. A change of 3 dB is equivalent to a change in loudness of about a factor of two.

Why are the strings tuned in fifths?

Tuning in fifths is again a compromise. It affords an optimum condition combining the range of the instrument, increased sonority and assistance in intonation, and physical accommodation of the hand. Let me explain.

Using the C major scale as an example, the fourth finger stops the same note on a string as the next higher open string. The first stopped notes on the two lower strings are each an octave below the two upper open strings respectively. The third finger stops notes on the three upper strings that are an octave above the open string immediately below. These combinations with the open strings help with intonation since there is a noticeable increase in the sonority of the note played when these coincidences occur. This remains true if the strings are in tune. Combinations of notes fall under the fingers in higher positions that are familiar in a lower position. To take an example , in third position i.e. with the hand moved up the neck so that first finger falls on the third note of the C major scale on that string, the other three fingers stop the notes of the next higher string beginning with the note of the open string.

Why is the bridge shaped like that?

The bridge is made from a piece of hard maple with the grain run-

ning horizontally. The meoullary rays lie in the plane of the back face which is kept normal to the top plate of the violin while the front face slopes back since the bridge is tapered from the feet to the top. This ensures that the load of the strings on the bridge passes through the area of the feet so that the bridge will not become bent with time.

The bridge top is curved so that each string can be bowed separately.

If an unshaped piece of maple were used for a bridge the sound would be greatly reduced in loudness because of the high impedance, and the upper harmonics would be weak. ?

The cutting of the waist and the heart allows two resonances to appear involving the top part of the bridge, a rocking mode at 3000 Hz and a vertical oscillation at 6000 Hz when the bridge is tested on a solid base. On the more compliant violin they occur at the lower frequencies of 2000 Hz and 4000 Hz respectively. At the higher frequency of 3000 Hz where the ear is most sensitive, the response curve is raised and the sound has increased brilliance.

The bridge has evolved from earlier shapes on the subjective judgment of maker and player as adding to the sound quality. No comparative studies on bridges of different shapes has been done yet to my knowledge.

Why are the sound holes that shape?

Sound holes vary in shape from circular in guitars, through crescent in viols, "flame" or "sword" in the viola d'Amore to f-shape in the violin.
The size (i.e. area) of the ff-holes is related to the air volume in the instrument to place the lowest or Helmholtz air resonance on the lowest or second lowest open string ~~or a semitone lower~~ i.e. C4# on the G string the violin. On the viola this resonance would be at ~~A3#~~ B3 and on the cello at ~~A2~~ B2 on the G string. on the G string

By turning the top of the C-shaped sound hole inwards to form an f-hole the centre region of the violin under the bridge became more compliant. It could oscillate at a greater amplitude and create a louder sound.

The ff-holes have a rounded shape without any notches and so reduce the likelihood of splitting of the top along the grain from these regions. The top plate is usually made a little thicker around the edge of the ff-holes for the same purpose.

What is the effect of the soundpost and bassbar?

The soundpost introduces an asymmetry into the rocking motion induced in the top plate by the bridge. If it were not there, the centre region of the plate between the ff-holes would rock with a

more or less symmetrical motion with little sound output. The soundpost effectively immobilises the right foot of the bridge causing this central region to rock about it as fulcrum. This causes a larger area of the top plate to move in phase with a consequent greater sound output. The bassbar helps to extend the size of this area.

The soundpost has two other allied functions. Because it is a little behind the foot of the bridge, the motion due to higher harmonics is transferred to the top by this foot. The soundpost also transmits the reaction to the rocking motion from the bridge to the back which enhances the breathing action of the violin. (Since writing this I have realised it is wrong.)
The bassbar has another function in restoring the plate tuning which is lost when the sound holes are cut.

What is the effect of the mute?

The ebony mute that clips on the top of the bridge increases the mass of this part and thus lowers the resonance frequencies of the bridge. With the correct increase in mass the lower resonance frequency will be relocated to around 1500 Hz and a soft nasal sound will result. There will be a loss in loudness due to the increased impedance of the bridge with the mute attached.

A quite heavy mute (brass) has been used by violinists so they can practice in hotel rooms.

Why is the violin that size and shape?

The size of the instrument is related to the tonal range which is in the upper register of the human voice. and can be held at the shoulder by the average sized adult human.
The string length is first chosen so that adjacent notes have about one finger spacing between them. The violin body length is related to this being 3/5 of the string length from the upper edge to the bridge line leaving the length of the neck at 2/5 of the string length. The length of the body is a little more than the length of the string. The size and shape were originally set by a geometrical construction. The length of the body from the upper edge to the bridge line is called the Diapason or Stop.

The shape is governed by the need to have maximum area for sound radiation compatible with the volume needed to place the air resonance at or slightly below the second lowest open string. There is another resonance also used to amplify the lower notes on the violin and that is the first top plate resonance which excites the first higher air mode which occurs on or slightly above the second open string. The optimum rib height of about 30mm has also to be accommodated in arriving at the optimum air volume. The body length appears to be related to the frequency of the first higher air mode or resonance. The main body resonance is now thought to be an octave above the main or Helmholtz air resonance.

The indented C-bouts allow access to the first and fourth strings.

The plates are arched to increase their stiffness so that the plate frequencies can be kept high while the thickness of the plates and hence the weight can be made as low as possible without loss of strength for resisting the forces placed on the instrument by the string tension.

Are the plates bent into their convex shape?

In handcrafted instruments the plates are carved from solid wood that has been joined down the centre by gluing two pieces together. Sometimes one piece is used for the back.

Why is the varnish orange, red or brown?

This probably has to do with the transparency of early colouring agents that could be dissolved in linseed oil or spirits of wine. Naturally occurring resins do not seem to come in colours lower in the spectrum than yellow. There are vegetable dyes but these do not seem to have been used in varnish for either furniture or musical instruments. There is also the element of taste which seems to have been set early in the history of varnishing.

Why do you use rosin?

Without some way of increasing the friction between the bowhair and the violin string the hair would slip over the string surface and no sound would be produced.

Rosin is a brittle solid derived from the distillation of Larch Turpentine and is left as a residue when the Oil of Turpentine is distilled off. It has a melting point at about 95C.

The action of the rosin is thought to be that with the movement of the bow the rosin fuses, resolidifies and subsequently breaks giving rise to the increased friction that is essential.

What does the purfling do?

The purfling clearly defines the edge of the instrument by outlining it in a distinctive manner. It also strengthens the edge which is particularly useful in the top where it reduces the tendency for cracks to run in from the edge along the grain.

The purfling consists of three strips of wood, two black and one white, set in a channel about half the thickness of the plate in depth. The purfling is glued in place.