THE VIBRATING STRING LENGTH OF TODAY'S VIOLIN.

Christian Urbita.

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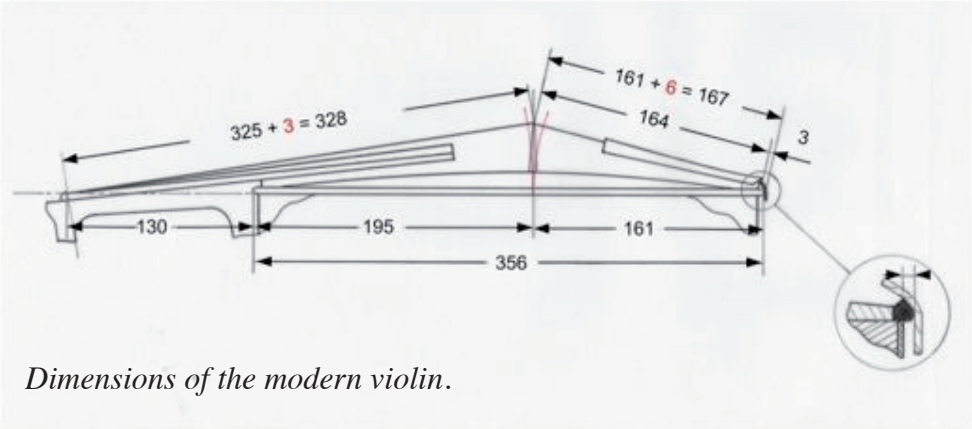
The research made by musicologists has led musicians towards a new way of interpreting Baroque music and a strong belief in period instruments. For the luthier this approach is very interesting but impairing, as the term "baroque violin" means very little. In fact the dimensions of the instruments and the length of the stop have seen many changes from the creation of the violin in the 16th century up until the 18th century. Thus Andrea AMATI's violin the Charles IX has a table stop of 186mm on a body length of 340.5mm; Nicolas AMATI's Alard (1649) a table stop of 195mm for a body length of 350mm; Antonio STRADIVARI'S Capriani (1683) a stop of 188mm for a body length of 339mm and a neck (original) measuring 124mm; STRADIVARI'S' Messiah (1716) a table stop of 195mm, a body length of 356mm and a neck (original) of 120mm. All these instruments belong to the HILL COLLECTION in the ASHMOLEAN MUSEUM, Oxford. These differences may well be due to the evolution in playing techniques.

Today we could say, with some exaggeration, that we find ourselves in a paradoxical situation: the great romantic concertos are performed on modified old instruments and the baroque works on modern instruments with a "baroque set-up".

In actual fact, the violin, since the 19th century, has never been thought of as a whole and in particular we have not really taken into consideration the changes made by Guarneri. Now it seems to me that it is by drawing inspiration from the violins of Guarneri, who was, we should not forget, the last great creator- and not by copying- that now it is possible to create a violin which will adapt to the playing technique of today's musicians and at the same time preserve the qualities of the baroque violin.

If we study the stops of the violins of the great masters, we realize the complexity of their work. It is progressively, in feeling my way, by trial and error, that I have succeeded in establishing a neck model which seems to me to be in harmony with the violin as a whole and meets the demands of today's musicians.



Dimensions of the modern violin.

In other respects, at the beginning of the 19th particular the Messiah, have served as models for the modern violin. However, as the neck stop was no longer adapted to the playing techniques of the day, the neck has been lengthened. Influenced by Viotti and Lupot, the length of the stop was standardized and fixed at 130mm on the neck side and 195mm on the table side. These measurements were applied to all the instruments made from this period onwards (apart from copies), as well as to baroque instruments which were adapted by changing the neck.

My approach to the different aspects of the violin are based on a methodical and instinctive approach; at this point I should state that the order of my presentation does not necessarily follow the chronological order in my research. This work has sometimes led me to make up to three necks for the same violin. The opinions of the musicians who have tried my violins have caused me moments of pain and even discouragement but their severe and sincere judgements have allowed me to progress and therefore establish the new proportions of the neck, which I propose to you now.

THE TABLE STOP OF GUARNERI'S VIOLINS MAY VARY FROM ONE INSTRUMENT TO ANOTHER BY MORE THAN ONE CENTIMETRE.

In order to clarify this exposé, I would like to state that the table stop is the distance between the top edge of the table and the axis of the bridge. The neck stop is the distance between the top edge of the table and the line of the nut.

The analysis of the original necks and table stops of Stradivari's and Guarneri's instruments allows us to retrace the evolution of the stop.

We notice that in the case of Guarneri the stop on the table side may vary from one instrument to another by up to more than one centimetre. We find a difference of more or less 12mm: for the Dancla of 1727 the stop is 200mm, whereas for the Leduc of 1745 it is 188mm; here we are talking about extreme dimensions, however the majority of his violins have a stop which fluctuates between either 191 and 193mm or 197 and 198mm.

We notice that these differences are not in chronological order, as the Kriesler of 1730 has a stop of 197mm, whereas the Kortschak of 1739 has a stop of 192mm; in 1743 the Cannon has a stop of 197.5mm and the Carrodus 191mm. Therefore it is not an evolution in his research but rather a deliberate choice, the reason of which we have yet to understand.

THE STOP IS DIRECTLY LINKED TO THE LENGTH OF THE BODY.

The modern violin, like many baroque violins –when they are well-proportioned- has a vibrating string length which is twice the distance between the bridge and the lower nut; the angle of the nut allows an adjustment in this ratio. The stop is therefore directly related to the body length.

In Guarneri's instruments, the violins with a stop of 198mm have a body length of roughly 351/352mm; such is the case in the following violins :the Kemp 1738, the Kortschak 1739, the Kochanski 1741, the Lord Wilton 1742. On the other hand, the violins with a stop of 198mm have a body length of 354/355mm: the Heifetz 1740, the Vieuxtemps 1741 and the Cannon 1743. However there are several exceptions: the Sauret 1743(a stop of 196mm for a body length of 351mm) and in particular the Leduc of 1745 (a stop of 17188mm for a body length of 354mm).

The latter was most certainly found after his death, as Guarneri died at the end of 1744. Was this purely an experiment or had he decided to lengthen the neck? It is some time later that Viotti (1755-1824), a contemporary of the luthier Nicolas Lupot (1758-1824), determined the present neck length

Guaneri	Kemp 1738	Kortschak 1739	Kochanski 1741	Lord Wilton 1742
Stop	192,5 mm	192 mm	192 mm	192,5mm
Body	352 mm	352 mm	351,5 mm	352 mm

Average : Stop : 192 mm, Body : 352 mm.

Guaneri	Heifetz 1740	Vieuxtemps 1741	Cannon 1743
Stop	198,5 mm	198 mm	197,5 mm
Body	354 mm	354 mm	354 mm

Average : Stop : 198 mm, Body : 354 mm.

Dancla 1727
Stop : 200
Body : 354

Leduc 1745
Stop : 188
Body : 354

GUARNERI USED THE SAME NECK LENGTH FOR DIFFERENT TABLE STOPS

It is more difficult to know the stop of the original necks, as most of Guarneri's necks were modified during the 19th century; however when the original neck has been preserved, the stop has a more consistent length of 124 or 125mm. Thus the Alard 1742 has a neck length of 124/125mm for a table stop of 193.5mm; the Cannon 1743 also has a neck of 124/125mm for a table stop of 198mm. On the other hand in Stradivari we find a neck measuring 120mm for a stop of 195mm; such is the case of the Messiah 1716: neck 120mm, table 195mm, body 355.5mm and the Lady Blunt 1721: neck 120.5mm, table 195mm, body 355.5mm. In those days the dimensions of the neck differed. As far as Guarneri is concerned, if we take into account the two original necks, we establish the fact that he used the same neck length for different table stops. It is difficult to know whether these choices were connected with his research on sonority or the demands made by the musicians.

Stradivari	Messie 1716	Lady Blunt 1721
Stop	195 mm	195 mm
Body	356 mm	355,5 mm
Neck	120 mm	120,5 mm

Guarneri	Cannon 1743	Alard 1742
Stop	198,5 mm	193,5 mm
Body	354 mm	353,5 mm
Neck	124/125 mm*	124/125 mm*

* Approximation due to the transformation of the original necks.

THE MODERN VIOLIN IS A REPLICA OF THESE TRANSFORMED VIOLINS.

In the 19th century the violin stop became more constant and was fixed at 130mm for the neck side and at 195mm on the table side (the stop of the majority of Stradivari's violins, which corresponds with the average table stop of those of Guarneri between 192 and 198mm), in a ratio of 2 to 3.

(Tolbecque 1903 : *"It is the celebrated violinist Viotti who gave us the formulas of the neck length of today's violin. This resulted in a lengthening of the modern neck by two "lignes" (5 mm) in comparison with the old one and it is this change in the stop which has brought about the reform of so many necks with their heads, which we discovered later on (…). Generally speaking it is to Nicolas Lupot, 1758-1824, that we attribute, if not the discovery, at least the first restoration which consists of adapting a head which is worth preserving to a new neck by means of a graft ").* This choice is accompanied by a thinning of the neck and a modification of the angle of the fingerboard). With one or two exceptions, the old violins have thus been transformed by this new method and the modern violin is a replica of these transformed violins.

In lengthening the neck, by grafting, to 130mm, the luthiers have adapted the violins to the musical technique of their era. Because of this, the instruments of Guarneri have had the bridge moved and systematically adjusted to a stop of 195mm (that of Stradivari). This adaptation, ingenious at that time, has made it possible for these violins to continue to be played. But this method , which became general, does not allow the making of a contemporary violin which prolongs Guarneri's principles.

We know that the length of the vibrating string is fundamental in the conception of the violin and the position of the bridge is determinant in the conception of the arching. So it seemed to me that it was necessary to re-balance the neck and the head in relation to the body of the violin, in other words re-thinking the violin as a whole, taking in the proportions of Guarneri's violins and at the same time adapting them to the playing techniques of today's musicians.

The making of musical instruments has always responded to the musicians' and the composers' demands. So we may assume that it is this evolution in the playing technique (the addition of the 5th position), rather than research into the quality of sound, that has made it necessary to lengthen the neck.

THE IDEAL LENGTH OF THE VIBRATING STRING.

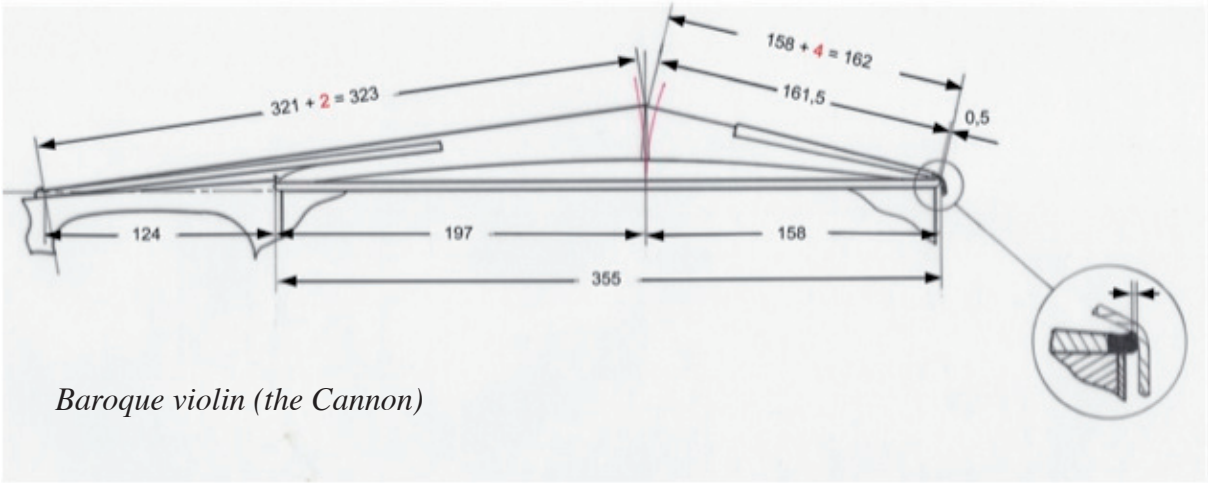
If, as I pointed out above, the majority of Guarneri's instruments had a table stop of 192mm, we can note that the violins which have a longer stop, fluctuating around 198mm, have a vibrating string length close to that of today's violins. This is the case of the Heifetz (1740), with a stop of 198.5mm, the Vieuxtemps (1741), a stop of 198mm and the Cannon (played by Paganini) of 1743, with a stop of 197.5mm.
Thanks to the original necks of the Alard (1742) and the Cannon (1743), we can see that for the stops of respectively 193.6 and 197.5mm the neck length is almost identical, respectively 125 and 124mm.

We see in Guarneri's violins that, although any variations in the neck stop are virtually non-existent, the table stop may vary quite considerably. We may make the assumption that the unvarying length of the neck was directly linked to the way the instruments were played and held.

It therefore seems that the ideal length of the vibrating string fluctuates around 323mm the Cannon has a stop of 197mm and of 124mm, in other words 321mm, to which is added 2mm, in order to obtain the length of the vibrating string; this lengthening is due to the angle of the string in relation to the body employed in the baroque era.

Alard 1742 (Del Gesu)

Cannon 1743 (Del Gesu)

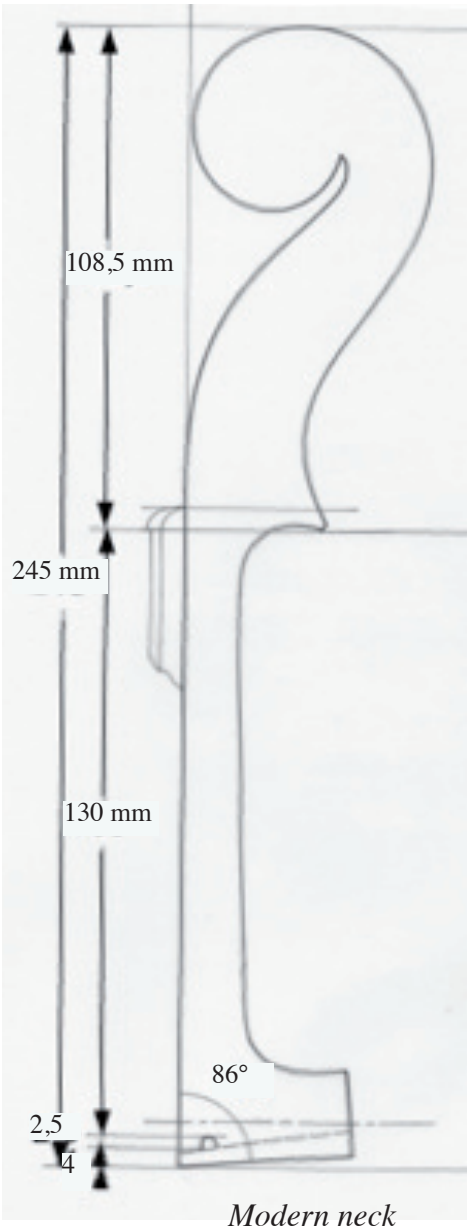


Baroque violin (the Cannon)

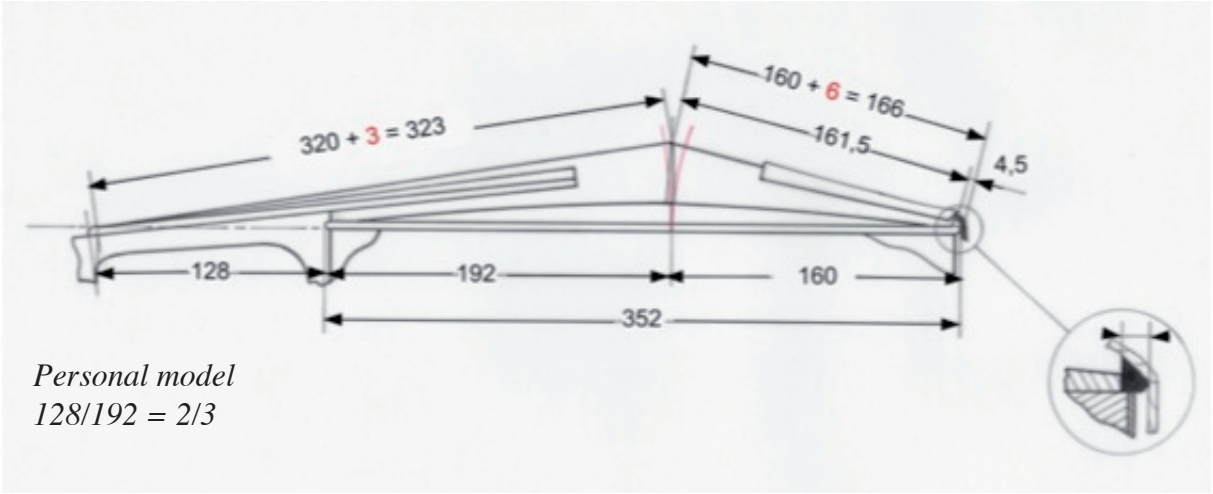
The obvious thing to do is to envisage a new neck, which will allow us to preserve this ideal vibrating string length of 323m. Indeed we have seen that the modern violin has the proportions of 130 and 195mm, a total of 325mm, to which we must add the 3mm of the modern angle of the strings; this gives us a total of 328mm, 5mm too long in comparison with the ideal length.

Here the length of the vibrating string is increased, as had been the case of the body length ; we know now that this lengthening of the body was an error; I believe that it is also an error to increase the vibrating string length.

In other words, if we keep the proportions of the Cannon, that is to say 124 + 198mm, we have a neck length which is no longer adapted to the modern violin technique. As the majority of Guarneri's violins have a table stop of 192mm it seemed wiser, to my mind, to maintain this stop. As today's violin has a stop with a proportion of 2/3, it seemed to me important to keep this. Thus the neck should measure 128mm (192x 2/3 = 128mm); this neck is 4mm longer than the baroque neck and 2mm shorter than today's neck. In this case, we find once again the vibrating string length of Guarneri's better violins, this being 192mm + 128mm + 3mm (modern angle) = 323mm. It is important to have both a vibrating string length of 323mm and a stop of a 2/3 ratio. This is not the case of the Leduc, which, in its present state, has a vibrating string length of 323mm (130 + 190 + 3) but its stop is no longer in the ratio 2/3.



Modern neck

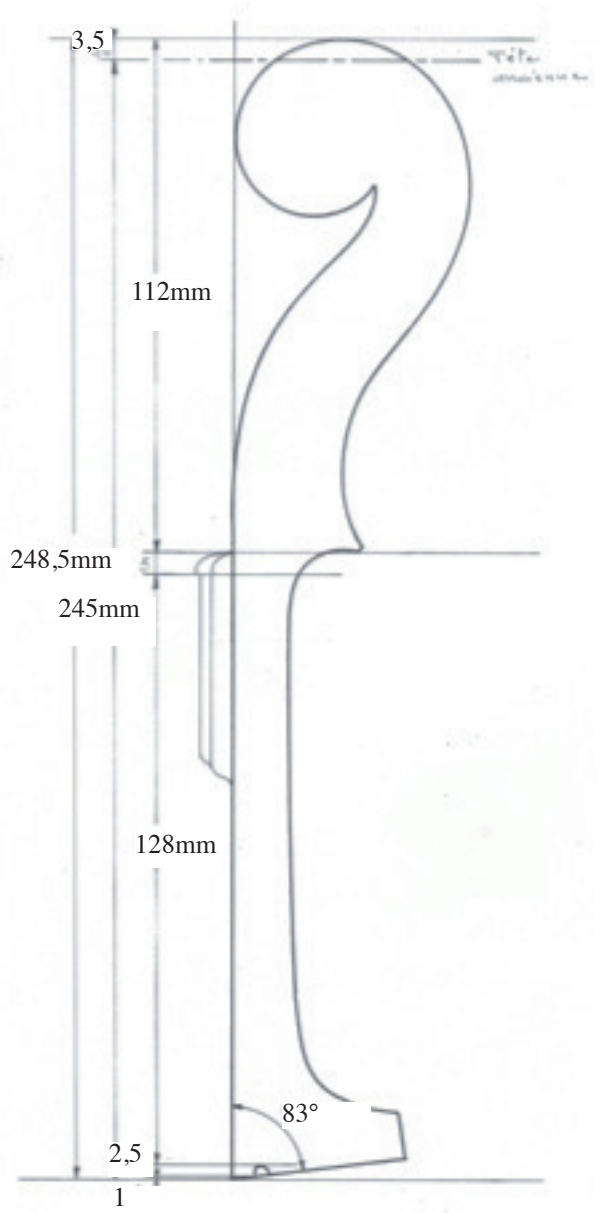


Personal model
128/192 = 2/3

MODIFICATION OF THE HEAD.

If we wish to preserve the proportions defined by Guarneri, the modifications which have been made to the neck stop entail a modification of the head.

Guarneri, in comparison with Stradivari, has lengthened the heads and neck but at the same time has preserved the same ratio. Their heads vary by an average of respectively 108.5 and 105mm for the neck stop for the first and 120mm for the second; thus 124: 108.5 = 120 :105 = 8/7. As I have lengthened the neck stop from 124 to 128mm, in order to maintain the same ratio as that of the baroque violin, we therefore must apply this ratio to the chosen length of 128mm, which gives us: 128 : 8/7 = 112mm.



Personal neck

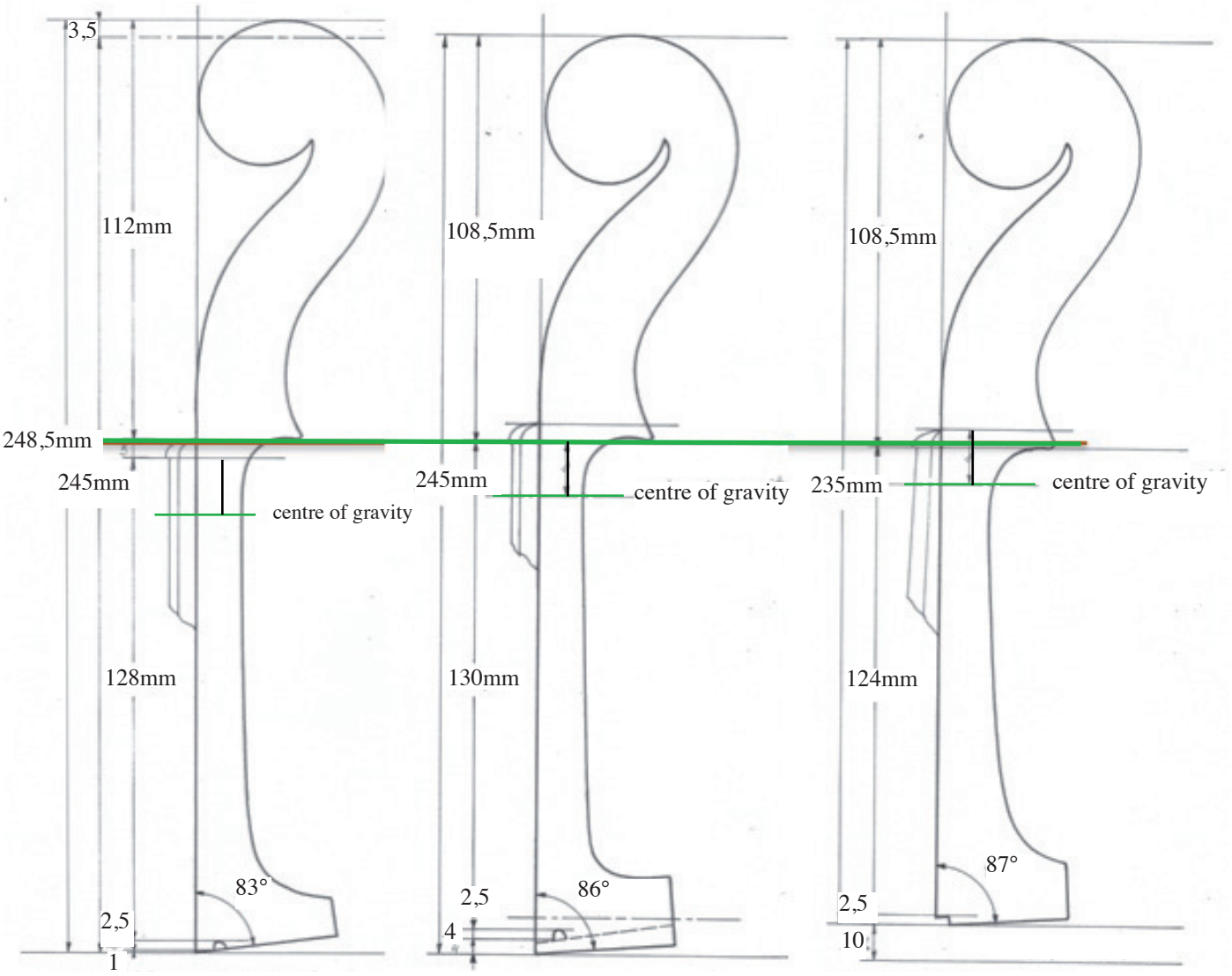
	Stradivari	Guarneri
Head	105 mm	108,5 mm
Stop	120 mm	124 mm
Relation stop/head	120/105 = 8/7	124/108,5 = 8/7

«Guarneri, compared with Stradivari, has lengthened the heads and the necks whilst maintaining the same relationship.»

THE LENGTH OF THE MODERN NECK RETAINS THE CHARACTERISTICS OF THE BAROQUE VIOLON.

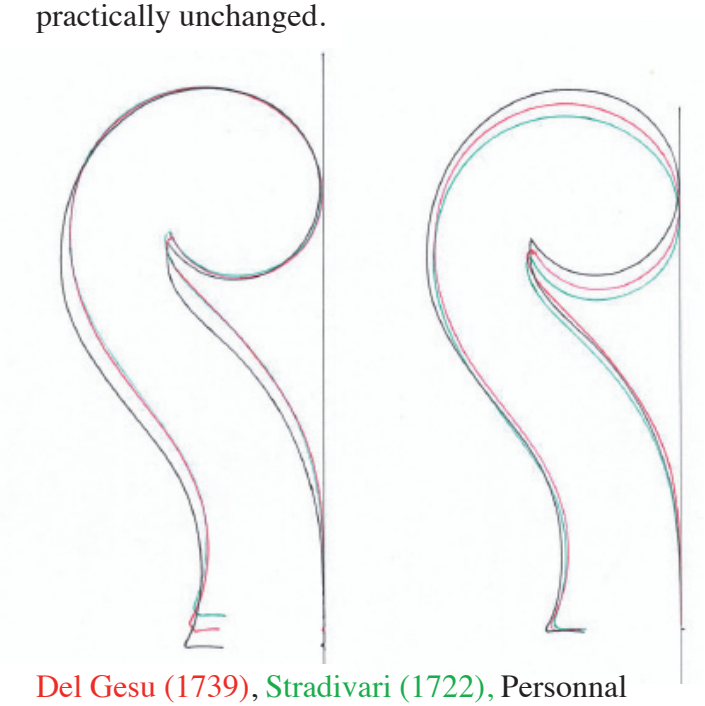
With the adoption of these new measurements of 128mm and 112mm for the head there is also a displacement of the centre of gravity. In order to regain the position of the centre of gravity in the modern violin I have lowered the fingerboard by 5mm, thus allowing more comfort to the musicians when playing in first and half positions. In the case of the modern violin the top of the fingerboard is on a level with the end of the fluting, whereas with this new configuration it is the top nut which is level with the fluting.

I noticed that in this way I was once again using the length of the modern neck and at the same time retaining the characteristics of the baroque violin: the proportions and the vibrating string length. I have lengthened the pegbox, starting at the A string peg, in order to strengthen the sides of the pegbox at the level of this peg, a particularly fragile point in the classical heads.



Personal neck *Modern neck* *Baroque neck*

In order to obtain a head of 112mm, I have lengthened and re-designed the pegbox, the scroll remaining practically unchanged.



Del Gesu (1739), Stradivari (1722), Personnal

THE SIDES OF THE PEGBOX SHOULD BE IN LINE WITH THE FINGERBOARD.

Guarneri made the sides of the pegbox in line with the fingerboard. Thanks to old photos of the Cannon taken before the modifications of the fingerboard (as it was when played by Paganini 1782-1840) we can estimate that the space between the strings was 20mm (it is now 16.5mm) and that the fingerboard measured 26 to 27mm (The Strad article of October 2004). The width of the original fingerboard of Stradivari's Lady Blunt is 26mm. (the angle was 20mm).

In the modern violin the width of the fingerboard measures 23.5mm, with a pegbox measuring 26/27mm, as in the baroque violin. In order to understand the logic behind the baroque violin, I have made the pegbox the same width as the fingerboard, that being 23.5mm.

Reducing the width of the head naturally means a narrowing of the back of the head, which automatically becomes flatter. This is neither for aesthetic reasons nor is it a mere whim but is to maintain the strength of the head at this level.

I have matched the button with the end of the fluting; it is therefore the same width but, by doing this, it is flatter than that of the modern violin. This makes position changing easier (the support of the thumb in 5th position) and gives the neck a shape close to that of the baroque violin.

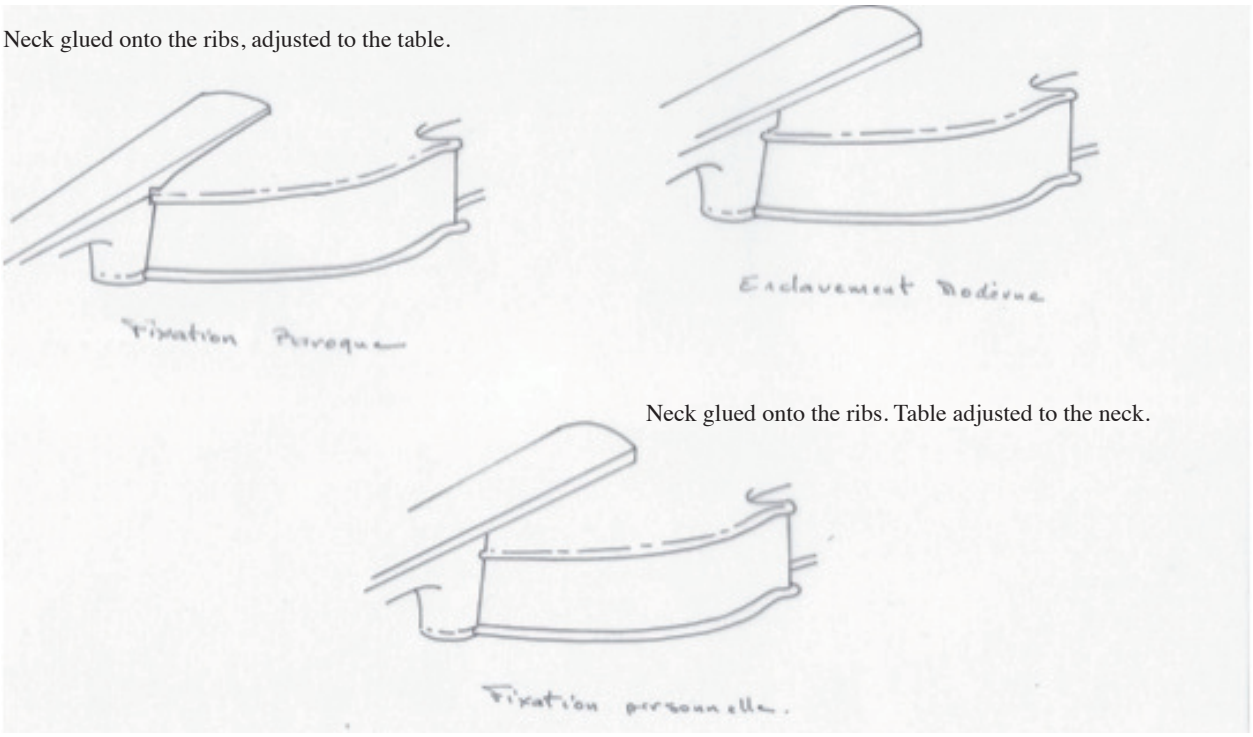
THE CONNEXION BETWEEN THE NECK AND THE BODY IS PARTICULARLY IMPORTANT.

The neck of the baroque violin was glued directly onto the ribs and joined to the body by five pieces of metal, two small hidden pegs and three nails, driven in from the block outwards. The neck of the modern violin is adjusted and glued into a slot in the block.

I am convinced that the connexion between the neck and the body is particularly important. The violin is composed of two very distinct parts : the body and the neck; these two elements should not be set into each other but should be firmly joined together. The join should respect that which had been adopted by the baroque luthiers. The nails are not only for fixing the neck to the body (it would hold without the nails) but they also allow a strong connexion between the two parts, which ensures the vibrations to pass from one to another.

«The nails are used not only to fix the neck to the body but they also allow a strong join between the two parts which insures the transmission of the vibrations.»

Neck wedged in the block and in the table.



Christian Urbita.

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Loic Le Canu
Livre Guarneri del Gesu de Peter Biddulph.

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