

The Acoustics of Mountain Forests in Early Centuries

or

A Lost Art of Choosing Resonance Wood

There is very general agreement to the fact that wood, as a raw material, has considerable influence on the sound of an instrument made from it. The answer to the question whether, without exception, old instruments sound "much better" than those built in our time, will be agreed on much less generally ; it is subject to a rather personal point of view.

Thus the question arises whether the sound of the early instruments improved in the course of time : that knowledge is beyond the realm of anything that could be proven experimentally. We would also ask how exactly the aging of the wood influences the sound of an instrument being played for decades. Since we cannot prove any statements concerning this last question, instrument builders are free to choose their own opinion or alternate, according to mood, need or whatever, between two options :

Either it can be assumed that historical instruments in general sounded extremely beautiful in earlier times, too ; the role of aging is only secondary.

Or, as is often stated, it is the passing of centuries that is mainly responsible for the quality of sound achieved today.

In the first case, though, we encounter the problem of our modern incompetence : let us grant the subjectivity mentioned above, why, if aging plays just a minor part, are our "copies" not comparable to the original instruments ?

In the second case we could never in our own lifetime enjoy "the best" performance of the copies we build !

40 or 80 years ?

These questions did not arise now. Obviously in earlier times similar experiences seem to have been made, too. An English work on "Natural philosophy", dating from the end of the 17th century, comments on the improvement observed in several lutes, which is there attributed to aging. Robert Boyle mentions in the chapter on the "inner movements" of different kinds of wood some facts which are relevant to our topic. They were communicated to him by experts. He explains first that wood needs several years to achieve firmness and stability. Then he adds : "For ancient musicians and makers of musical instruments declare, that some lutes require forty years to bring to their due tone, if the wood be thick, and other circumstances not very favourable. And I have been inform'd, that there are some famous instruments of the same kind, which, to attain their full seasoning and best sound, require

the space of fourscore years"(1). Eighty years! Considering the average lifetime then, many a maker of lutes may not have known about the highest perfections of his art.

According to Boyle the artistic skill of an instrument builder could not always do without the benefit of time. We can easily imagine that the sound does not profit from wood which is left too thick. What else might the "unfavourable circumstances" be ? Let us assume that they refer to the sounding properties of the wood itself.

If excellent quality of sound is desired the safest method would be to work with well-sounding wood to begin with. Apart from all other considerations good-sounding raw material guarantees more than anything else good-sounding instruments.

We will see from the following quotes that the old masters paid a lot of attention to this thought. They also knew the means by which they could achieve that goal. In this article we will discover a very old method, today seemingly completely forgotten, which allowed an answer to the following question in a simple and matter-of-fact way:

How can we find the "best-sounding" wood ?

What, in other words, were the means at that time to elicit from nature the best sounding wood, namely that which a builder of instruments would desire ?

Again we must take into regard that our forefathers dealt with nature in a different way than we do today. They did not have power tools at their disposal, neither for the cutting nor for the transport of wood. But they had to secure their supply of wood.

Being members of a different civilization they had different means at their disposal. In our case we shall see how cleverly they used gravity, a dominating force then as now. But in the spirit of their time they also knew of simple and meaningful ways to make acoustical estimates. And what is it all about ?

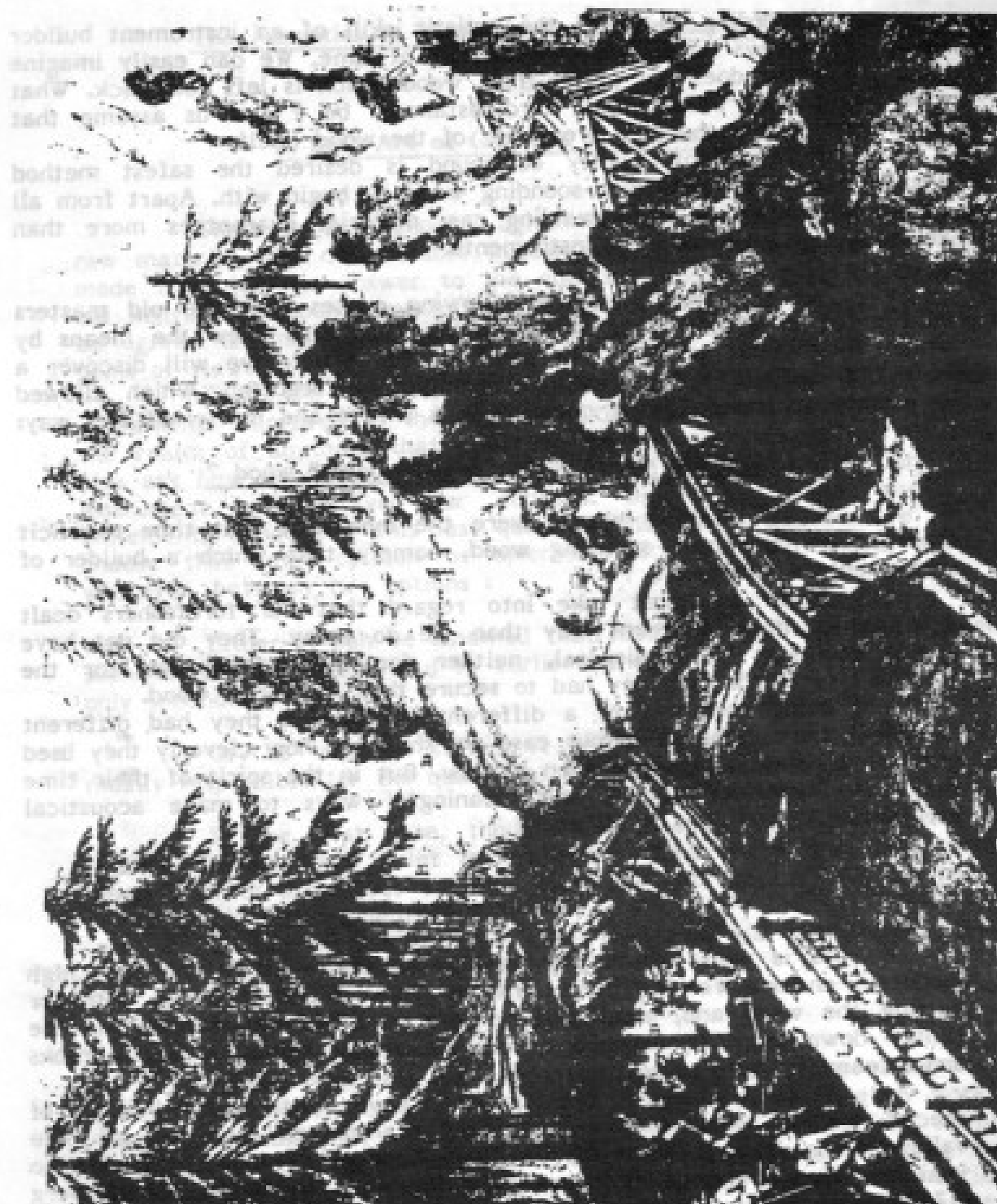
Timber slides

As is well known, the best resonance wood is found in high mountain chains. Working conditions are most difficult there, both for cutting the wood and, what will concern us here, for transporting the timber down from an exposed or remote origin; slopes, valleys, brooks and streamlets have to be mastered.

At some places in the Alps men have mastered the building of special tracks; round timber is thereby transported from far-off side valleys to a lake if it is to be floated or to a road accessible to vehicles. They were called "Sovenda". Figure 1, by J. R. Schellenberg (1782), gives a detailed view of such a construction (2). [s. next page]

For miles on end the timber would slide down with great noise. The whole thing rather resembles a kind of giant xylophone, and this our ancestors knew how to profit from. From the experience of generations had resulted the knowledge of "hearing" the differences between the different kinds of wood while listening to the sound of its sliding down. The difference could even be attributed to morphological

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differences. Thus a certain kind of spruce would generally sound much better than other sliding wood. These more "gifted" conifers are still today known as "hazel spruce".

Much has been written in our century about "Wimmerholz"(3). We shall see how easily our forefathers could recognize it. A hundred years ago a Journal for forestry ("Centralblatt für das gesamte Forstwesen") knew about it : "If timber is transported via slides, the timber sliding over the frozen ground, stones or other timber, any hazel spruce is recognizable from its bright, singing, long vibrating tone"(4).

The author of that quotation is not just given to revelry, but referring to experiences of his own. "Anyone who has ever been near to a timber slide while it was being used has noticed a remarkable difference in the sound of the sliding timber ; thus this effect cannot be doubted"(4). Since, as far as I know, such slides are no longer in use we cannot test this statement. As interesting as such an experiment would be, it is hindered by our degree of civilization. Forest paths cannot be used for acoustical tests ; the sound of the timber is overwhelmed by the sound of the motors ; timber is dammed to silence. Let Nature speak !

Returning to our eyewitness and to the quieter woods of the past we encounter an Italian trader : "There is no doubt about the fact that this "singing timber" has always been in demand and that it achieved a good price. In former times I had more than one occasion to convince myself. If for example in Carinthia timber had been prepared for transport, an Italian gentleman would show up, settle himself nearby and listen attentively to the sound of the thundering timber. Whenever timber passed by that caused the air to vibrate his face lighted and he told his servant to mark it. He recognized the sound from a great distance. Often he would sit there and wait for hundreds of rumbling timber to pass. As soon as the singing sound was heard he would be looking for the "singer" and found it at once. The higher and longer the sound, the more he liked it. Thus he would often wait for his "singers" for many days"(4).

This is a beautiful example of the old type of "hunting economy", where patient humans could listen to nature and patiently wait till the desired raw material was found. In the same patient way they searched for other material, too, for example for the special ore needed for some specific metallic artefact (swords and so on).

This article intends neither to instill or nourish a longing for the "good old times" nor to imply that we, seeing ourselves as dwarfs, could not build as good instruments since we have to do without the help of giant slides. All we wanted to show in this communication was that the old masters had means available that we today do not know about or cannot afford. And that, again, does not imply that we could not reach our present aim with our own means.

Finally we return to the Carinthian Alps and to the middle of the last century : "When the timber was delivered the marked timber would be gathered and transported to Italy via the Plöcken, then still a usable pass, where it would be used for the building of string instruments. This gentleman, too, insisted that the timber belonged to the 'hazel spruce' species"(4).

Many a violin maker whose instruments today sound as well as his name must owe a great deal to this Italian gentleman. We do not learn any more about him in the article quoted above.

In the 18th century

Let us now explore whether this clever choice is a very old method. Timber-slides are known to have been used in many alpine valleys earlier than the 19th century. We are fortunate to get exact information from Hans Rudolf Schinz, parson in Uitikon, who published from 1783 onwards his "Beyträge zur näheren Kenntniss des Schweizerlandes" [Contributions to a better knowledge of Switzerland] (2).

He writes as an eyewitness and obviously is quite impressed himself : "In the middle and lower valley the abundance of timber found is put to better use, as fire-wood and for building purposes. A lot of it is being exported, and the means of transport employed in some of the districts, especially in the Mahntal and Luggaris, are quite remarkable. Where there is no water or where the valley is very narrow, such that timber thrown into the streamlet would hinder its own way, the wood would be left to decay had methods not been invented to bring the timber down without the aid of water and if paths had not been brought into the wilderness, where nature did not provide any.

This the Italian traders achieve by some kind of bridge or slide ; in a most audacious way. They bring down not just very small timber, fit for the saw, they bring it without the help of water and without great efforts from the farthest and wildest regions to the next river - in winter only, though"(2).

We already know the procedure. It will be interesting to learn why these slides would work in winter only. The reason is their way of construction, a fine example of advanced carpentry. "These slides are made from wood only, without any iron or nails and are stable only because of the artful way of attaching one beam to the next one and because of their interaction by pressure and connexion"(2). These frames could fulfill the high demands only in freezing weather. "Additional stability was attained in winter by ice and snow and the effect of freezing, that served to glue the parts together"(2). Nails and glue were thus replaced by the binding force of frozen water.

"The Italians call this kind of slide 'sovenda'. Its construction is a very specialized task which plain carpenters or wood chackers could not achieve. Only the inhabitants of the little valley of Pontirone (at the entrance of the Bolenzer valley) know about this craft and they get schooled in it from their early days. The men there know of no other craft ; each year they leave women and children and, having made contracts with the traders, live for weeks and months at a time in the wilderness, surviving on the most simple food, in order to do their hard work..."(2). This kind of effort would not be possible without the help of traders who were well provided with capital : "There exist in the Italian part of Switzerland several societies mostly from Brisago. They provide the timber needed by the large city of Milano that produces everything but wood in abundance in its rich fertile plane. These traders combine their resources, find out where far-off forests might be available for cutting and explore them with the most experienced men of Pontirone.

They will, based on their experience, predict exactly how much wood there is and whether it will be able, considering all sidetracks and detours by slopes and hills, to make its way down to the next river"(2).

The decision made, hard work started. "They will work according to their own plan and cut the forest in the direction that seems most favorable to them, with the cut trees falling in a way that makes it possible for them to get to the slide. The trunks will be cut in blocks of 8 to 15 feet. The branches remain there. Wood that cannot be cut into blocks is used for the building of the slide, which is started right at the forest. In order to save work and material the timber will slide on the ground soil whenever the slope is sufficiently steep. For that purpose it will be made as even as necessary. A small wall or dam of stones, soil or pebbles will be erected, the hollow will be lined and along its length the dam will be covered with beams which are cut to measure or fastened with poles. If the more horizontal surface gets lost in a cleft the slide will be built where there are the fewest curvatures, corners and angles... The slide must always be at least three feet wide and two feet deep, and the strongest logs must be able to pass unhindered. Valleys, brooks, clefts and crevices thus can be bridged"(2).

It may not always have been that simple, for the force of the timber thundering down was greatest in the bends. "Experience is needed most for the building of the sharp corners and angles in such a way, that the sliding timber blocks do not tear the dam apart. They should not get stuck or hinder the following blocks, forcing them out of the slide and into the next abyss. For that reason the blocks must have a given length. If they are too long, they would get stuck, if they are too short, their weight would not suffice to let them slide"(2). All of that needed the proper measure of the technique to be successful ; economy too required the proper proportions. "These slides were constructed during the summer and leased according to their length. The unit of measure is called Pontana and measures 26 feet. One Pontana costs 7 1/2 Lire and that includes the costs for cutting the wood and building it"(2). These high costs seem to be justified, since we may conclude from the parson's remark that wood in Milano must have been pretty expensive at the time.

On a cold winter night ...

Let us once more accompany Hans Rudolf Schinz into the mountains. The Sovenda has been finished in the autumn. It can be used only when it freezes. "After the timber has been cut the blocks are heaped up near the Sovenda in such a way that in the winter two men with wooden levers can without much effort lift a log a minute onto the slide. And as soon as the cold nights of January and February arrive, the traders along with 60 to 100 burratori start their work of filling the Sovenda and all gaps in the wooden structure and the lining with snow. Then they lead a brook over it or pour water out of pails, especially where the joints are, in order to give stability to the frame and the beams which thereby freeze together. The firmer the path is frozen the faster the logs will shoot down. A lot of attention is given to filling all corners with snow, such that it resembles a smooth canal"(2). Now we know about the technical part.

Let us enjoy the fascination of the special atmosphere of these fantastic nights in the cold mountains. "When everything is thus prepared and ready great fires will be lighted at every angle and corner and in distances of about 200 yards ; they light the slide. At each fire two or three men keep watch and when the sliding down of the logs begins each group of men passes the word on to the next one. Message can thus be communicated in a matter of minutes back and to from points hours apart"(2). This echoing sound of the night is in fact polyphonic music, since the calls of the Burratori join the sound of the "singing" timber. And this goes on for hours.

"The only job of the men at their posts is to guard and aid the sliding of the logs by hitting them with an axe and keeping the slide clean of any obstacle ; if however anything hinders the course the first guard has to be notified so that the start of the sliding down can be stopped. This work will get started by nightfall : it continues till early morning ; in twelve hours thus 3000 to 6000 logs will be transported over two hours distance. The men are in a great hurry, for it is very important that all the felled timber - about 12 000 to 20 000 logs - can be gotten out of the forest in one stretch, since the sovenda may get damaged as soon as thaw weather sets in.

The speed of the biggest logs, the noise, the sliding, the halting, the shouting and whistling of the workers in the wild mountains, the lightening, the awe caused by deep night and cold winter, rocks that are covered with snow, that often thunders down in small avalanches, adding a noise of its own. All this creates the fearful atmosphere of a special festive event. The awe it inspires can only be dispersed by lively conversation and the boldness of the enterprise itself"(2).

And all this time and in spite of the hecticness an Italian gentleman will sit quietly at a suitable place and strain his subtle and experienced ear in order to recognize in the stream of wood those logs which nature meant to be used by the builders of instruments. With a joyful gesture he will conduct the chosen logs from the solemnity of the cold alpine forest into the festive world of warm sounds.

In the 16th century

This report by Schinz might be valid for even earlier times. Such traditions did not arise in the 18th century. It seems probable that the Pontironi drew on experiences made in very old times.

We are not yet able to find out when the first slides were built. We do know however that the situation described here was not very different in the 16th century. "Luggaris" and "Borras", are names mentioned 200 years before Schinz in the same context, and Italian societies of traders provided with a lot of capital must have been influential then as later. We learn from the report of Josias Simlerus dated 1574 (5), that timber from the Ticino was regularly brought to Cremona and Venice. "It is common practice, that the long trees from Luggaris get cut into logs, which they call Borras, so that they can be transported through the narrow valley and the curved and wild mountain rivers to the great lake, where they float for the transport across the lake and further on through the Ticino to Milano and Padua. They transport not only the floats but also the wood from larches and other

trees with desired qualities, firewood especially for lime kilns and charcoal on the lake into the Ticino and further on the river Po till Cremona and up till Ferrara, Mantua and Venice to the ocean"(5).

Since Simlerus does not mention the Sovenda we do not know whether slides were in use then. Thus we may never know whether already in the 16th century an Italian gentleman found out about the singers in the noise of the night and had them put aside.

Critical remarks

Let it be. Finally we want to stress one point and compare the method of old times with our practice today. The historical procedure we got acquainted with in this article does question our way of judging the quality of wood. Then it was judged above all by the ear. The log's "singing" on the slide informed the observer, be he instrument maker or knowledgeable trader, very directly about the acoustical qualities of the wood. It could not have been tested any better. The timber was discovered vibrating ...! This is an example of holistic thinking - a typical attitude then and partly lost now.

Our ancestors knew that the behaviour of a material at large mirrors that in the small. From looking at the trunk no information was gained for the listener; only after cutting or while working with the timber did the trunk reveal the secrets of its anatomy to the master. But then the choice had already been made. One chose by ear !

What can we today achieve - or believe to achieve - when we judge mainly by sight ? Who could afford to listen to the singing of the timber ? We want our resonance wood to be fine, most regularly built, without any twists in the structure of the annual rings or the medullary rays, without the tiniest twiglet, and with an attractive, immaculate colour...!

In any case, good resonance wood has these characteristics now as then. But nature is rich in variety and has some tricks at its disposal that seem ironical to us humans. Does only "immaculate" - in our sense of the word - wood sound well ? Would not the use of non-immaculate wood in some old instruments, which are quite average with regard to the quality of the sound of historical instruments prove that it is not the visual aspect alone that guarantees high acoustic quality ?

This report about some of the aspects of past techniques suggests that we should reflect on our own behaviour. As members of a society that tries to appeal to the eye while it ruins the ear we may behave - with regard to the selection of wood - like a person wanting to buy "good apples" and deciding on the ones pretty to look at, though the other ones appealed more to the taste ? Do we want to replace one sense by the other ? We may learn from the "Italian gentleman" mentioned above that ear and eye may not always be exchangeable.

We may assume that those trees still growing in our forests - or what is left of them - do not differ essentially from those of past centuries. Very different though, as we have seen, is the present "art" of determining which timber will be best sounding. The old method has proved to be successful. Though we may find it somewhat bothersome it

is a fact that timber from former times does not betray the hard and cold slide on which it rumbled down. But it saved forever the glowing warmth of the fire accompanying its first steps into the realm of sound, even before a human ear recognized its golden worth.

Notes:

1."The Philosophical Works of Robert Boyle", by Peter Shaw, London, 1738, vol. 1, p.461. Boyle was living from 1627 to 1691.

2.Schinz, Hans Rudolf, "Beyträge zur nähern Kenntniss des Schweizerlandes", Zürich, 1784, Heft 2.

3.S. for ex., Ziegler, H. and Merz, W., "Der Haselwuchs", Holz als Roh- und Werkstoff, 19 (1961), p.1.

4."Die Haselfichte", in: Centralblatt für das gesamte Forstwesen, X. Jahrgang, März 1884, p.153.

5.Simlerus, Josias, "Vallesiae Descriptio", Libro II, De Tiguri, 1574, fol.257v.