Problems of Pitching

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Every piece of wood and metal and every hollow body has an integral pitch of its own.

With wooden or metal bars, an obvious example is the xylophone family; with hollow bodies the equally obvious example is the Helmholtz resonator and its blown musical offshoot, the ocarina.

For xylophone bars the pitch is obviously desirable. The pitch can be regulated by a longer or shorter length of bar and can also modified by shaving under the middle or at the ends. But there are other wooden bars where pitch can be a problem to us. Drum sticks are one example. When we play on a drum with a pair of sticks we expect to hear the sound of the drum. If it's a pair of timpani we want to hear their pitches; we don't want to hear any pitch from the beaters. If it's a side drum we don't expect to hear a pitch from the drum, although any drummer can tell you that there is indeed a pitch, somewhat disguised by the snares, and if that pitch disturbs the sound of the music, the player will adjust the tension of the drum heads accordingly. Tenor drums and bass drums all have adjustors to sort out any pitch problems.

But side drum sticks are indeed a problem. Tap the stick on an inert substance such as a practice pad, or tap one stick against the other, and a pitch is clearly heard. Tap the other stick on the pad and only too often a different pitch will be heard. Then when playing on the drum, not only will the sound of the drum be heard but also the strokes from each hand will sound different, one higher than the other. The difference is often slight enough to be ignored, but it can be gross enough to upset the hearer, and certainly upset the player who wants each stroke to be identical with the last. As a result, the more conscientious player will often try to pair up sticks to get their pitches as close as possible to each other.

This is much less a problem with timpani beaters because it is not the bare stick that strikes the drum but the felt or other material on the end, and anyway the felt head will to a great extent have clamped and nullified the pitch of the stick. The same applies to xylophone family mallets; there also it is some other material that strikes the bar and anyway the shafts are seldom wood and are usually light cane or plastic, neither of which appears to have an inherent pitch of its own.

Returning to the side drum, the snares themselves do not normally have any inherent pitch and even when they do, old-fashioned gut snares for example, or the modern open-coil wire snares, they are grouped in sufficient numbers that no one pitch would ever be discernible.

Tabor players in early music ensembles do have a major problem here. The snare is often single and is normally of gut. We all know that a single string under tension will produce a defined pitch – how else do we tune our fiddles and guitars? And the struck head of the tabor itself will, like the side drum, have a discernible pitch which may or not clash with that of the pipe. So the tension of both snare and head will often need adjustment. This was a problem that I almost invariably faced when I was playing with Musica Reservata, needing to tune both snare and drum tension to match what was being played.

I referred at the beginning of this article to a hollow body. A drum is indeed a hollow body, assuming that as with the side drum and tabor there is a head at each end of the body – we will come back to single-headed drums. So when we strike the side drum or tabor, do we hear the pitch of struck head or that of the air-body inside the drum? Or are the two aligned? I am not an acoustician and do not know the answer to these questions, but in my experience with both, adjusting the tension of the struck head seems enough to cure any problem, but that adjustment is essential.

With timpani, the tension of the head is coupled with the resonance of the air-body inside the kettle. Here it would seem that the tension of the head can over-ride the pitch of the air-body and that the effect of the air-body is more a matter of tone quality than pitch. Certainly the tone quality of a pair of timpani, and the resonance of the sound, depends greatly on the air-body of the kettle. Timpanists of the British generation before mine swore by the tone quality of the

Hawkes-Cummings deep cylindrical shell, just the Germans did of the Dresden deep conical shell. Today we hear similar comments about modern pedal timpani, not only condemnation of early American and British models with their internal mechanisms that broke up the free movement of air within the shells, but also with external mechanism models that clamped the shells and prevented the shells themselves from vibrating sympathetically. Bear in mind (though I did not mention this in the beginning) that the shells themselves will have a pitch – they are bowls, as is a bell, and most of us have at least one bowl in the kitchen that rings like a bell when it is struck. Much of that ring is vitiated by being clamped by the head itself, for bells and bowls vibrate most strongly at the rim, but nevertheless the shell is best left as free as possible to vibrate sympathetically.

I mentioned single-headed drums above. With bongos and other deeper-shelled bodies like congas and tomtoms, there is normally a system of mechanical tuning, and so things are easily adjusted. Frame drums such as our tambourine are a real problem. Our tambourines usually have the head pinned to the shell around the circumference. Most other frame drums around the world either have the head lapped round the shell or glued to the face of the shell. Here the climate is the problem. If it is hot and dry, the pitch of the drum may be too high for effective use, and if it is damp, then the response of the head may just be a dull thud. A damp cloth can bring the pitch down, even if means having a bucket of water close by. With high humidity, in a village environment, the player can wander over to a nearby fire and hold the drum near it, but you can't do that on a concert platform. Often the only recourse is to rub the head hard with the hand and hope that the friction, and resultant heat, will bring the head up enough to respond to strokes, and often more problematic, to thumb rolls. However, rubbing the head hard can also draw response from the jingles, to the fury of the conductor and ribald response from one's colleagues. There's no easy solution to that one except the use of plastic heads.

With the dance drums of Papua New Guinea, the whole system differs. Any undesirable pitch of the drumhead is controlled by pellets of tuning wax, and the desired pitch is that of the air column within the drum. These drums are in fact stamping tubes, the pitch of the tube generated by striking the head with the hand.

Let us turn now to the hollow bodies common to so many of our musical instruments, especially of course our stringed instruments.

Here there is a whole series of factors, each with its own pitch.

Each plate of the body, the belly and back, has a pitch. Before making the instrument up, the maker will tap each plate repeatedly and adjust the response with the tools to achieve the desired tonal quality and pitch. Even with monoxyle bodies the back may have some inherent pitch, though if the belly is of skin, even if it is sufficiently taut to have a pitch, there is little that can be done to it other than with pellets of tuning wax (as is done on the New Guinea drums above). Once the body is made up, to some extent the ribs will clamp the body, but nevertheless there can still be some inherent pitch. When the instrument is being played, any vibration of the back will often be clamped by contact with the player's body, and while a modern chin-rest will free the belly to vibrate, direct contact with the chin can inhibit any vibration of the belly.

The real problem lies in the pitch of the contained air-body. Here again we have a form of Helmholtz resonator. The pitch is that of the volume of the container, modified as it may be by the shape of the body, and that pitch can be tuned by the area of the open hole. We get different pitches from an ocarina not by the position of the fingerholes but by the total area of open hole, depending on the diameter of the holes and the number of them that are open.

The same thing applies to our string instruments, except that the area of open hole is fixed by the maker. This is why the response of a baroque guitar, with a pierced rose covering the soundhole, is very different from that of the modern guitar with its open hole. One problem with some modern lute makers is that they may have forgotten this and choose a nice pattern rather than considering how the holes in their pattern may affect the sound of the lute And this, too, is why violin makers are careful in the design of their f-holes.

The player and audience may not register any concept of pitch from the instrument's body because the dominance of the pitch of the strings is so much greater, but they will be aware of the resulting tone quality of the instrument as a whole, of which inherent pitch is an element. This why no two instruments, even by the same maker, will ever sound exactly the same – the wooden plates differ, the contained air-body will slightly differ, however much the maker may have striven to adjust the one to suit the other. And this why players will always say, when choosing an instrument, 'This one, not that one', for each player will have their own preferences.

Finally, and this I will ignore here because I have already dealt with it in the article on Human Instruments, also on this site, one needs also to consider the air-bodies within the player. Why else do two players sound different when they play the same instrument?