Tuning Aurally

Tuning Pathology: from Malady to Melody

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Virgil smith talks about the “full sound.” It might be a trend moving from the old science that says you can learn something by breaking things down into increasingly smaller segments, to a more holistic approach. Pythagoras proposed that instead of changing the fifths to the octave, we should change the octaves to the fifths. What goes on to prevent us from attaining the holy grail of the perfect tuning? Should we change the name of “piano” to “compromise?” Some maladies result from the nature of the piano. Other maladies result from the ability of the technician. Maybe it’s really our job to deal with the situation and move on.

What are our goals? What do we want to accomplish in the two hours we have? Improve the piano. Do no harm. Focus on unisons. Make sure the customer is happy and satisfied. Leave with a feeling of personal self-satisfaction of creating harmony and improving the world in a small part. Be consistent. Educate and inform the customers. Get paid.

What’s going to prevent us from reaching our goals: condition of the piano, time, tuning stability? The potential of the instrument might not match the skill level of the pianist. Tune to 440. The scaling of the piano and false beats might hinder a pure tuning. The hammer condition can influence the quality of the tone. The skill level of the tuner is a factor as well.

Stability

What can prevent a stable tuning? Some causes can be the amount of friction or lack thereof over the bearing point, tight or loose pins, splits in the pin block or bridge. The position of the friction points on the strings has a lot to do with the stability of the piano. There is friction at the tuning pin, over the felt, under the de capo bar, across the bridge pins, and around the hitch pin. The most recent Journal has a detailed article on this topic.

Our brain is our computer and our arm moves the tuning lever to determine that static friction equals dynamic friction and everything comes out equal. This nebulous formula is different with every piano. With increasing experience we learn and carry more formulae and techniques in our knowledge base. Our goal is to change the pitch of the speaking length of the wire, while at the same time we are changing the tension of the entire wire, which moves unequally due to friction.

Tuning pin torque is only a part of how tuning pins behave. A pin may have a lot of torque but might feel mushy and not change. How does the tuning pin behave in that hole? How many different types of pin blocks are there? We have to figure out how much to turn the pin before the pitch will change. There are basically four factors to consider:

- low torque, high friction
- high torque, low friction
- low torque, low friction
- high torque, high friction

We have only two ways of affecting this: the tuning hammer and the tuning pin. We are equalizing the dynamics of friction between the different sections of piano wire. Sometimes rubbing the string with a brass rod, wooden dowel, or string rollers on the speaking length can make the tension change enough to drop the pitch. Don’t tune by pounding hammers; tune normally, then pound to check its stability.

Some factors that make strings drop after pulling the note way up tend to be due to the relationship of the string length between the tuning pin and the capo bar. If there is felt under the string right after the pin, there is increased friction. Our arm serves as a calibrated torque wrench.

False Beats.

Most fixes for false beats involve major changes, like new bridge pins, agraffes, changing string lines, etc. The false beat is there for a reason. If we can change something like the string against the bridge pins, how long will it stay? The string is taking a natural path of least resistance, so if we change a false beat it may just come back again. False beats are like a multiple choice test where there's more than one answer. We can't focus on individual partials: just make the note sound as good as you can. Sometimes rubbing the string on the bridge can make a difference, but not always.

Roger believes that 90% of false beats are loose bridge pins. Steve says that if the false beats are in the top octave, rarely go after them. Fist he will rub a stick on the bridge. If that doesn't work, he uses an impact tool to set the bridge pin. His third option is to use Roger's twisting tool.

440

The tuning fork is good for setting a 440. Here are some tests for "A."

- "A" also gives the third partial of "D."
- Play F-A and then D above there as a test.
- "A" gives the 7th partial of B1.
- Also check "A-0" to "A."
- Then check C#1 with the fork to "A."

Scale

With tunings, scale will involve inharmonicities. Read Dan Levitans' reprinted article in the August Journal, where he makes a distinction between two different types of inharmonicity. One is the inharmonicity of a single string due to its stiffness. The other is between two strings, where the higher the inharmonicity is (the greater the inharmonicity coefficient), the narrower the sound; this causes the intervals to sound narrower, so we stretch the strings more to match the partials. For the lower note of the interval we always listen to the higher partial, which is increasingly sharp because the inharmonicity is exponential, not linear or proportional.

A Baldwin Hamilton at C40 had an inharmonicy coefficient of .28, derived from an equation by measuring with a yardstick and a micrometer (length and diameter of wire.) On a Wurlitzer it measured at .41, showing that each piano can be quite different. Consequently we need to throw out the textbook of precise beat rates, and use each piano as the *terra firma* for its particular scale and tuning.

Checks

Once you have set your temperament, check with contiguous thirds, contiguous fourths and contiguous fifths. There is a point in each piano where an interval covers both a wound string and a plain wire.

One indicator check is the relationship between a 3:2-fifth and a 6:4. A good check to see if a fifth is in tune would be to play a 6^{th,} and then the octave. The difference between the two tells how much difference in inharmonicity there is between the two notes. It might happen, but not very often, that the 3:2 might be equal with the 6:4, but usually the 3:2 is slower. It might also be that the lower 3:2 test shows no change in beat rate; if that's the case, you're dealing with a lot of stretch and inharmonicity: they might sound good, but they won't sound right. It's also possible, rarely, that the 3:2 is telling you that the fifth is widened, which is scary; in this case, the 6:4 relationship would be wild and the fifth will have to be widened to get rid of it, even though this will make the 3:2 even wider. All problems have to be dealt with. When you are done and the downward progression sounds smooth, there must be compromise.

There are a number of useful checks to listen to.

- 3:2 and 6:4
- In the treble, the tests are 3rd-10th-6th: slow, faster, fastest. Sometimes this could be slow, fast, same, where a fifth can be pretty pure, or it could be slow, slow, fast.
- The octave should be at least equal, not narrow. In the octave, the 4:2 is half a beat, and the 6:3 can be more; there could be a 6-beat difference in the partials.
- The seventeenth should be faster than the tenth.
- In the high treble, do double octaves, with the third, seventeenth and sixths.
- Another check is the minor third and seventeenth.
- Tune a double octave fifth; it should not be wide, but it can be equaled out.

Unisons

In the unison note, there is no inharmonicity. So why do we struggle so much with unisons? It requires precision. We have partials to tell us. Phil Glenn taught a class in teaching unisons, but almost always his class would turn into a trouble-shooting class figuring out why the strings were off from the partials. Why? Hammer-to string fit, tension, and false beats could all be possible causes.