

Some Insights, Comments and Exercises on Tuning and Intonation

Dr. Benjamin Boone, California State University, Fresno.

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Following are a few thoughts, insights and exercises I hope will help you and your ensemble better understand -- and therefore more effectively execute -- tuning and intonation. I will first examine the pitfalls of tuners and equal temperament, then offer some strategies for teaching effective tuning and intonation.

The Trouble with Tuners

Digital tuners are wonderful tools. But like any tool, tuners can be used to either build or demolish. All too often tuners are used incorrectly and actually teach students to mishear.

Digital tuners are tuned in equal temperament, a method of tuning which divides the octave into 12 equal semi-tones. Designed for instruments that cannot inflect tuning, this system was used for some fretted instruments as early as the 1500's. After utilizing myriad systems of tuning such as Pythagorean tuning, just intonation, meantone temperament and well temperament, equal temperament became the norm by the early 20th Century. In prior systems, certain keys (and intervals) were fairly "in-tune" while others were not. But in equal temperament, each of the twelve "keys" is equally out-of-tune. For example, in equal temperament, a perfect fifth is approximately 2 cents flat (compared with pure tuning), a perfect fourth 2 cents sharp, major thirds are 14 cents sharp, minor sixths 14 cents flat, minor thirds are 16 cents flat and major sixths 16 cents sharp. These adjustments were made to rectify discrepancies in various pure tunings. For example, if one played 3 pure major thirds in a row, it seems as if they should end on a note an octave above the first note (Bb-D-F# - A#). Instead, that pitch is 41.1 cents shy of the octave. So in equal temperament, each major third is expanded. Four stacked pure minor thirds overshoot the octave by 62.6 cents, so in equal temperament, minor thirds are contracted. (see "Temperaments" and "Intonation" at <www.grovemusic.com> for more examples)

Equal temperament thus emphasizes sameness between keys and intervals, and as such, much potential for color, shading and resonance is lost. Gone are split accidentals (such as D# and Eb) and other such nuances that inform high-level performances.

The following anecdote illustrates the harm of relying on tuners and equal-temperament sensibilities: I was a fellow at the Aspen Music Festival shortly after the advent of digital tuners. While there, I diligently worked with the tuner, learning to inflect each tone on the saxophone so that I was "in tune" according to the tuner. I then began placing the tuner on my stand during rehearsals (after calibrating it to the tuning note) and checking myself

whenever I had a long note. The tuner said I was always dead on pitch – but I never sounded worse! My mistake was four-fold. Firstly, I was primarily relying on my eyes rather my ears to tell me if I was in tune; secondly I was programming myself to hear incorrect intonation as correct (octaves were flat, etc.); thirdly I was assuming there was one absolute correct tuning for each note regardless of whether my pitch was the third, fifth seventh, ninth or alteration of the chord (see flexible tuning below); and fourthly I was operating in an inherently less resonant tuning system. Alas, one of many youthful mistakes – but one from which we all can learn a valuable lesson: If a piano, MIDI device or tuner is used to check tuning (as is all too often the case), students will suffer poor results – they will believe they are in tune when they are not, and they will learn to mishear.

So how *can* you teach your ensemble to hear “in tune?”

Basic Skill Set

Playing in tune necessitates that students possess three separate skills. First and foremost, they must be able to *hear* (not see on a tuner!) what is in tune and what isn't; secondly, they need to be able to ascertain whether they are sharp or flat; and thirdly they need to have the technical facility to be able to make the proper tuning adjustment on their instrument. Breaking up the tuning process in this manner, and teaching these skills separately will help improve tuning more expediently.

Hearing what is in tune

A good way to begin is to have students match unison pitches. Play a pitch on a piano or tuner, and then have the students sing the pitch. Next, match with their instrument. In both cases, have them raise, then lower the pitch slightly to find the area of greatest consonance. After all, the ability to discriminate between relative levels of dissonance and consonance is at the core of playing in tune. Once in tune, have them raise and lower the pitch again (using embouchure or equivalent), focusing on the sound of “sharp” and “flat.” You may utilize a tuner, but do not allow them to blindly adjust without hearing the incorrect tuning, and avoid the temptation of simply telling them to push in or out.

Next, use a few helpful exercises adapted from Gerald Eskelin's *Lies My Music Told Me*: Have half the class sing a pedal tone while the other students slowly glide up from that pitch, listening for the relative consonance and dissonance that is created between the two pitches. Guide them as they glide up past the fifth and then to the octave. You will have to guide your students to area most resonant, as most have learned to mishear acoustically pure intervals. When you find it, the overtones will re-enforce each other and resonance will drastically increase. Once students hear, and feel this pure tuning, they will be able to re-produce it on their instruments.

Flexible Tuning

One of the flaws of the digital tuner is that it gives students the false impression that each pitch has an absolute correct tuning regardless of its harmonic context. Nothing could be further from the truth. If an “A” were part of a root-position A major or minor triad, then it must be tuned to match the first overtone of the lowest A. If, however, that same “A” were the fifth of a D root-position major or minor triad, then it must be altered to align with the second or seventh overtone of the lowest D. If it were the third, say of an F# minor or F major triad, then it must align with yet other overtones. In short, a student must learn to alter (inflect) their tuning so that their note aligns with the surrounding overtones.

To ingrain this much-needed concept of flexible tuning, play a low Bb on the piano and have the students play a Bb concert. Have them hold the pitch while you move to a low Eb on the piano. They will have to alter the tuning of the Bb in order to be in tune with the Eb, because now Bb must align with the overtone an octave and a fifth above Eb (Bb) rather than the overtone and octave above Bb (Bb). The harmonic context has changed, and so must the tuning. Next try a Gb in the bass, then a G. Soon your students will understand this concept, listen more intently to the relationship of their pitch to the surrounding harmonic context, and surprise you with their resonance.

Tuning the band at the beginning of rehearsal

As a student, I used to tune at the beginning of the rehearsal by pushing in or out on my saxophone mouthpiece, paying little attention to whether other factors might be causing my tuning problem. I now know that by doing so a bit too aggressively, I actually created more tuning problems than I solved. Let me give a general example: Imagine a tubular instrument that is in tune with itself when it is 20” in length. Aristotle teaches us that if we effectively shorten the tube in half (by lifting fingers, pressing a valve, adjusting a slide) – to 10 inches – the frequency will be twice as fast and thus the pitch will be twice as high (an octave). Let us now imagine the player of this tube hears they are flat with the tuning note, and instead of adjusting embouchure, warming up their horn or changing reeds they push in their head-joint or tuning slide one inch. The tube is now 19 inches long and they sound in tune. The tone-hole/valve combination/slide position that previously rendered an in-tune octave now renders an out of tune note. Why? To render an octave above the lowest pitch, the effective length of the tube would now need to be 9.5 inches (half of the 19 inch tube) rather than 10 inches (where it originally was)! The tube is now out-of tune with itself, which will result in myriad tuning problems.

For this reason, encourage students to find the position that renders their instrument in tune with itself (note: the smaller the instrument, the more a slight change will alter the tuning, and the better the quality of the instrument, the more likely it will be in tune with itself). When tuning, encourage them to alter their embouchure, the position of their hand in bell, reed, jaw pressure etc. to yield in-tune playing. A common error among reed players is put too much pressure on a reed, which inhibits vibration and raises the pitch.

To compensate for the sharpness, they pull out – often too far – and render their instruments out of tune with itself. In this instance, proper embouchure would have solved the problem. Brand, hardness and relative age of reed will also effect tuning.

Ending thought: You already know how to do all of this

Students might resist your insistence that they learn to hear the slight differences in frequency necessary for proper inflection, thinking it beyond their capability. It might be helpful, then, to demonstrate to them that they can already process pitch to an amazing degree of accuracy and with ease. Sing the vowels “A-E-I-O-U,” one slowly after the other on the same pitch. The only difference between these sounds is the amplitude of certain overtones – so since they easily identify these differences every day, it is clear they can hear discrete changes in the overtone series! Similarly, we can differentiate whether our child is getting a cold, whether our car is needing a tune-up (note the syntax used!), whether it is Jim or Bob on the phone and thousands of other sounds due to our ability to hear slight differences in timbre (i.e. overtone combinations). My dissertation research even suggests that people speak with discernable pitches in “keys” and that speech partners commonly match pitch and speak “in-tune” with each other to an amazing degree of accuracy. In short, our students *already* have the innate ability to discriminate pitch to an astonishing degree – it just needs to be brought into their awareness through guided listening.

Benjamin Boone is an Assistant Professor of Music at California State University, Fresno. His music has received numerous awards and honors and his research has been discussed in Groves Dictionary.