Good intonation and balance are two basic elements that are essential to any good performance. When a band lacks either good intonation or balance, it is quickly and painfully apparent. Both conductors and ensemble members are responsible for good intonation and blend, but the process needed to reach these objectives is not always easily found. While intonation and balance are always a challenge, there are useful techniques that directors and band members can implement as they attempt to achieve their goals with these important elements.

Initial Tuning

Tuning is the essential first step of every rehearsal. Tradition dictates that orchestras tune to an A, because it serves the string section well. However, although the A works equally well for some wind instruments, it has only limited benefit for other winds. For this reason, many bands elect to tune to B♭ or F as the principal note. Again, however, these notes serves some instruments better than others. To accommodate all of the various instruments of the ensemble most effectively, it may be best to use several tuning notes, instead of one, so that each instrument is given a tuning note that is best suited to it. Consider using specific tuning notes for particular sections of the band, as suggested below:

Concert F – horns, clarinets, bassoons
Concert A – strings, flutes, oboes, saxophones (all sizes)[1]
Concert B♭ – trumpets, trombones, euphoniums, BB♭ tubas used in band playing
Concert C – C trumpets, CC tubas used in orchestral playing

The reason behind most of these suggestions should be readily apparent. The choices in many cases are based on the overall length of the instrument with few or no valves or keys depressed.

Mastering Intona

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Most school bands will find that tuning to F, A, and B♭ (C is seldom needed), as suggested above, helps to improve the intonation of the ensemble as a whole. This process usually works much better than just tuning everyone to either Concert F or B♭. Using these additional tuning notes does not take much longer, and the results are worth it.

One extra cautionary point about the tuning process is that students should be aware of the tendency to want to hear their pitch on the sharp side. Players may seek to find a comfort zone in which they are able to hear themselves, and more often than not, this tendency leads to a player's pitch being high. To counter this tendency, especially with wind players, it is often a good idea to have everyone pull out so that all players begin the tuning process flat. It is usually easier for players to come up to the desired pitch, rather than come down to pitch. The director's goal should be to bring everyone's pitch to A440 and to try to keep it there so that this increasingly becomes the norm.

Another general rule to note is that when players are having trouble hearing themselves, they usually are closer to being in tune and blending with the rest of the section. Similarly, when two different instruments are playing perfectly in tune, they usually will blend their timbres, creating a new sound

quality. Thus, when a flute and clarinet player are playing perfectly in tune with each other on a unison pitch, they will create a tone quality that is a hybrid of these instruments (a flutinet, if you will).

After the initial tuning is done, there should be an ongoing process of evaluating intonation, and this should continue throughout the rehearsal or performance. During this process pitch adjustments will be made through adjustments in embouchure or adjustments of the hands or finger, rather than from any changes to the length of an instrument. In making these adjustments the teacher and students will need to draw upon good listening skills.

Maintaining the initial pitch standard should also be an ongoing goal, especially when the performance is held on a well-lit stage that continually gets hotter as the concert progresses. Longer pieces may also cause the overall intonation to become progressively worse if individual players

tion and Balance

By Stephen L. Rhodes

give in to the tendency to want to hear themselves, which usually makes the pitch go sharp. When this happens with a number of players, the overall pitch will continually climb as each player unconsciously gets caught up in a game of one-upmanship.

Modes of Tuning

Satisfactory intonation has been the subject of much study. Experimentation over hundreds of years has led to the development of a variety of tuning systems. Despite all of this study and experimentation, there is no tuning system that fits every situation, melodically or harmonically. Therefore, the goal with all tuning methods is to find a process that involves the least invasive compromises.

To appreciate the struggle to create functional ensemble intonation, it takes a basic understanding of Pythagorean, Just, and Equal temperaments, along with an understanding of how these three interact with each other.

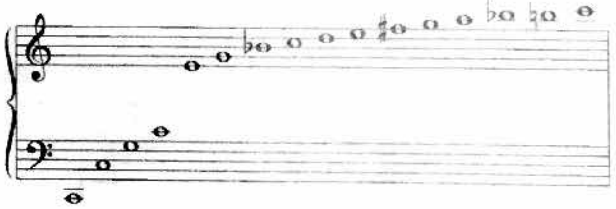
Pythagorean Intonation: Tuning with Melodic Sense

Western tonality is based on scales of eight notes within an octave designed from varying patterns of whole and half steps. The placement of the half steps is the most critical aspect of each mode. For instance, a major scale (Ionian mode) can be divided into two identical groups of four notes. The first group of a C scale is C D E F, and the second is G A B C. Each group represents a perfect fourth, and each contains a leading tone, with half steps leading from E to F and B to C and with the intervals in each group being whole step, whole step, half step.

Pythagorean tuning raises the third and seventh scale degrees identically, placing them higher than Just and Equal temperament would. This raising of the third and seventh scale degrees creates what is known as tendency intervals, which allow for an enhanced melodic feel.

Just Intonation: Well-Tuned Intervals

Just intonation is the natural harmonic pattern based on sounds occurring from an open tube or a stretched string. For example, when a string is stopped at the mid-point of its length and then plucked, the resultant sound is double the vibrations per second or one octave higher. Just intonation requires an analysis of how intervals should be tuned, based on the interval relationships evident in the overtone series.



Just intonation is most helpful when analyzing intonation problems that occur with simple chord intervals, such as fifths and thirds. With perfect fifths, Just intonation would call for fifths that are naturally higher than in Equal temperament (which occurs when the pitches in a scale are divided as a series of evenly spaced half steps). Just intonation produces major thirds that are naturally lower and minor thirds that are slightly higher than those in Equal temperament.

After studying the intervals and tendencies in Just intonation, students will learn how best to tune these intervals. This understanding will help students to eliminate the sound of beats that occur when two or more notes in an interval are being played out of tune.

Equal Temperament: A Compromise

Equal temperament is a tuning system that is based on an octave divided by a series of half steps in which all of the half steps are equidistant from each other. Keyboard instruments, including piano and percussion keyboards, are all based on Equal temperament. Instruments with Equal temperament tuning do not use the natural sharpness of leading tones that occur when music is thought of melodically (as in Pythagorean tuning). Equal temperament also does not use the natural flatness of the third of a major triad, which occurs when pitches are thought of harmonically (as in Just intonation). Thus, except for octaves, Equal temperament is ultimately is a compromise, as it is different from both the Pythagorean and Just temperaments.

When comparing the various scale degrees in the frequency ratios listed below, pay close attention to the fifth scale degree (G), the third (E), and the seventh (B). Melodically, the third and fifth are noticeably higher in Pythagorean tuning when compared to Equal temperament, which reflects what the pitch tendencies of a melodic line should be. Also, the major third in Just temperament is noticeably lower than in Pythagorean and Equal temperament, which reflects how low the pitch should be in a triad that is correctly tuned. Notice also that the interval of a perfect fifth (C-G) and perfect fourth (C-G) are the same ratio in Pythagorean and Just temperaments.

The result is a blend between listening for what seems best both melodically and harmonically. All of this can seem overwhelming when trying to listen to everything with two different ears. The task of the conductor is to listen critically to all that transpires and to use the information above if any problem arises. Concerning the different temperaments and band intonation, Mark Hindsley once observed:

> "It is my conclusion that we should try to have our bands play in a the combination of the just and Pythagorean temperaments. Theoretically and for practicality, wind instruments would be tuned to equal temperament in manufacture and adjustment: in their playing we should go as far as possible toward the tone pitches of the other temperaments. We should prefer the Pythagorean scale for melodic lines, but at the very worst may have to accept the equal scale, We should prefer the consonant, simple-ratio relationships of the just scale harmonically, but at the very worst we may have to accept the harmonic relationships again of the equal scale."[2]

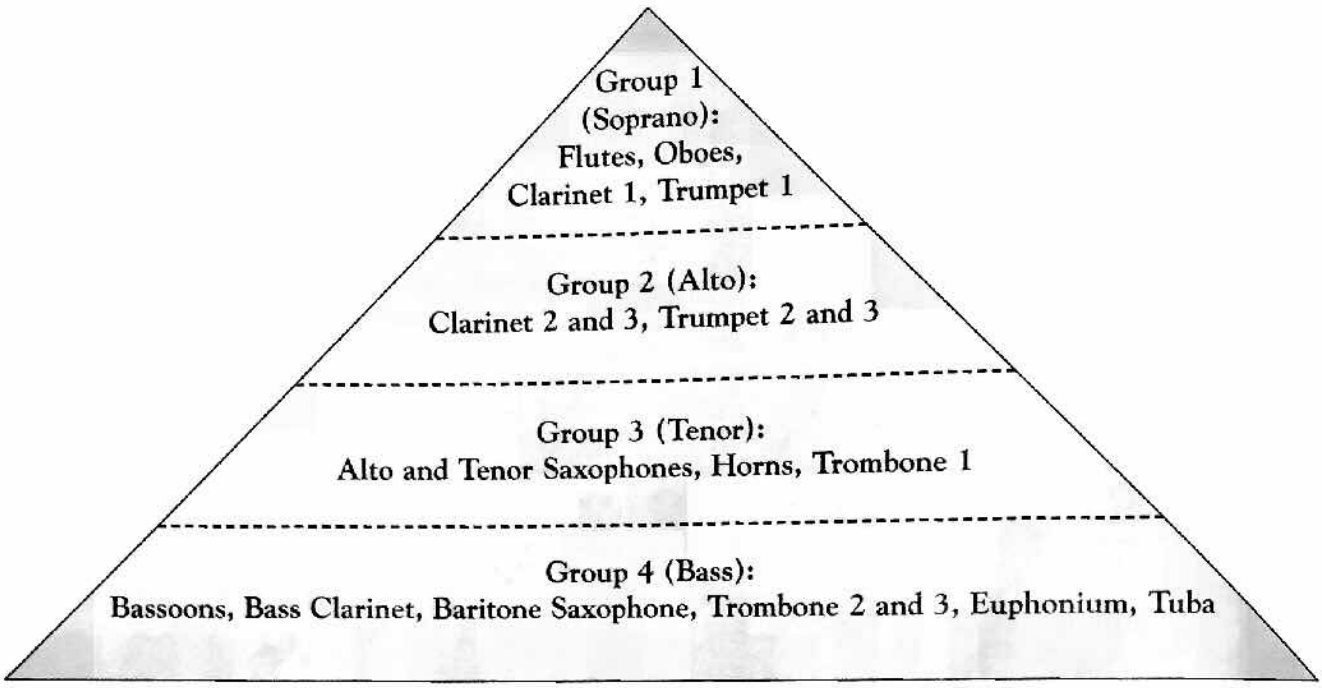
Frequency Ratios

Note	Pythagorean	Just	Equal Tempered
C	2.0000	2.0000	2.0000
B	1.8984	1.8750	1.8877
B♭	1.7778	1.8000	1.7818
A	1.6875	1.6667	1.6818
A♭	1.5802	1.6000	1.5874
G	1.5000	1.5000	1.4983
F♯	1.4238	1.4063	1.4142
F	1.3333	1.3333	1.3348
E	1.2656	1.2500	1.2599
E♭	1.1852	1.2000	1.1892
D	1.1250	1.1250	1.1225
C♯	1.0679	1.0417	1.0595
C	1.0000	1.0000	1.0000

Which Method Is Best?

Research has analyzed which of these three modes of tuning performers most commonly use. In a study of how string players perform, the research showed that no particular method of tuning is adhered to at all times. However, it did show that when melodic patterns arise in tonal music, then the intervals tended to lean more toward Pythagorean tuning. Performers placed more importance on creating melodic leading tones, rather than on harmonic blend.[3]

The two other approaches, however, proved to be important at other times. When tuning simple chords,



Just intonation is valuable. Equal temperament is acceptable when working on melodic lines and is preferable when tuning chromatic harmonies. In sum, however, no one temperament is completely acceptable in all cases, and all three approaches have their virtues at particular times and situations.

There also are times when inevitable compromises must be made. When playing with mallet percussion and piano, which are Equal temperament instruments that cannot make adjustments, the best choice may be Equal temperament. On the other hand, if the wind instruments are sustaining their notes, while the sound of mallet instruments or piano is decayed, then the sound of the winds may be the dominant sound to address when tuning.

Another occasion for compromise occurs when pitches are playing a dual role. For example, a pitch may be both the third of a chord and also the leading tone of the melody. It would be impossible to lower the pitch of the third to tune the chord, and yet also simultaneously raise the pitch of the note as a melodic leading tone. In these places, the ear has to be the guide. It may help to consider the length of the chord. If the chord is held for a long time, the tendency may be to place value on the chord intonation over the melodic tendency of the notes. Conversely, if the chord is short, the melodic tendency may be more important. Ultimately, you have to listen and decide which factor carries more weight at that moment in the music. It is also important to remember that a sustained note held through several chord changes may require an adjustment in pitch to fulfill the nature of the note within each chord.

Intonation and Balanced Dynamics

Achieving balance with dynamics can have a dramatic effect on the overall quality of the ensemble's sound. This includes good balance between high and low pitched instruments, balance within chords, balance between octaves, as well as balance between musical components such as melody and countermelody. There are several concepts that may help in the ongoing challenge to play two or more pitches together with the proper balance and alignment.

Balance of Low and High Sounds

First, correct balance between low and high sounds is critical, not only for a good ensemble sound but also as an aid to better intonation. When played softly, high overtones are less audible. The upper instrument played at *pp* and the lower at *mf* will produce a more satisfactory result, both in intonation and in dynamics. Because there are fewer overtones audible in lower frequencies, it is generally perceived to be easier to tune to a low pitch rather than a high one.

Francis McBeth advocates this approach in his book *Effective Performance of Band Music*. McBeth takes the position that the band has better balance and better perceived intonation if the lower instruments play successively louder than the high instruments. For example, the tuba should play louder than the piccolo and the third clarinet should play louder than the first. The balanced pyramid effect that McBeth proposes is shown in the diagram above.

When the ensemble plays in this manner, the lower overtones are not as easily dominated by the upper overtones, and a darker sound results. Whether the ensemble actually plays better in tune this way (as I think it does), or whether the ear just perceives that it is in tune (as some believe), the better results are obvious.[4]

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