TRAVERSO

HISTORICAL FLUTE NEWSLETTER

Playing In Tune on a Baroque Flute

by Catherine Folkers

LEARNING the principles of correct tuning involves a paradigm shift from our 20^{th}-century belief that playing the flute in tune means matching the notes as they sound on a piano or harpsichord. Keyboard tuning—even in a historical temperament—is really about choosing how to be out of tune. This article will show why that is so, and how we as flute-players have the option of playing better in tune than any temperament's compromises allow. Reprogramming our ears to accept an unfamiliar concept of tuning may seem daunting, but is actually simple and easily learned. And it's worth the trouble: a working knowledge and understanding of tuning can enliven and enrich our performances as well as increase our fulfillment as players.

PURE INTERVALS

The best way to begin to learn about tuning is with your ears, putting aside for the moment the mathematics and theories of temperaments. The concept is simple: notes themselves are not in tune or out of tune—intervals are. The fundamental building block of all tuning systems is called a "pure" interval, and any interval that is not pure is not in tune. It's that simple.

Hearing and recognizing a pure interval is much easier than explaining it. If you are not already familiar with the sound, start by getting accustomed to it. You will need a way to generate two pitches at the same time, with at least one of the pitches adjustable. Tuning intervals on a harpsichord is a good way to learn, but requires continually re-striking the keys as the notes die away. A better option is using two sound-generating devices such as adjustable electronic tuning machines. Or use one machine to play a drone while you play the other note of the interval on the flute.

Begin by tuning a major 3^{rd}, for example, from C to E. Establish a pitch for the C. Then play an E at the same time as the C, making it as flat as possible as a 3^{rd} to the C. Slowly begin to raise the pitch of the E again. As it rises you will begin to hear pulsations called 'beats'. A beat is an acoustical phenomenon resulting from two sound waves of different frequencies crossing paths. We hear it as a small regularly-spaced intensification of the sound. Slow beats, such as two or four to the second, are not unpleasant to the ear; faster beats become progressively more so.

As the interval approaches pure, the beats will become slower and slower until they stop altogether. At the moment that happens, the interval is perfectly in tune, or "pure". If you raise the E too far, the beats will begin to sound again, becoming faster as the interval becomes wider. You can make it pure again either by raising the bottom note, or by lowering the top one.

Once you have trained your ear to recognize a pure major 3^{rd}, practice tuning minor 3^{rds}, 4^{ths}, 5^{ths}, octaves, and unisons, all of which are easy to hear. Generally speaking, the smaller the consonant interval, the easier it is to hear beats. A 3^{rd} is easier to tune than a 6^{th} or a 12^{th}, for example.

When two tones sound simultaneously, you may also hear an added tone of a different pitch, often an octave below, called a resultant tone. Its frequency is the difference or the sum of the frequencies of the two primary notes. When the primary interval is pure, the difference or summation tone will also be in tune. In fact a slight inaccuracy in the tuning of the primary interval produces a more pronounced inaccuracy in the resultant tone, so as well as listening for beats, we can tune an interval by listening to and tuning this extra unplayed note. This is especially audible when two flutes play together.

Keyboard instruments are not a good guide for tuning melody instruments: they are inherently and purposefully out of tune

When you have the sound of a pure interval in your ear, and if you have enough equipment to generate three tones, you can move on to tuning triads. Start with a pure 5^{th}, add the 3^{rd} and notice again the effect when the 3^{rd} becomes pure. The entire chord becomes louder and richer.

KEYBOARD TUNING

Unfortunately, it is not possible to tune a keyboard instrument with every interval pure. To understand why, it's necessary to delve into the theory of tuning.

If you begin with a fixed pitch for C and then proceed to tune a 'circle of 5^{ths}' (tune G a pure 5^{th} above the starting C; from the G tune the 5^{th}, D, pure; from the D tune the A pure, etc. until you reach B#) you will discover that the B# you've arrived at is nearly one quarter of a semitone higher than the original C, whereas C and B# are the same note on a keyboard.

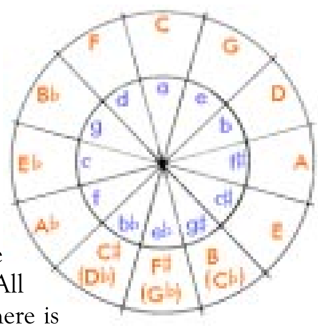
This difference between twelve pure 5^{ths} and seven octaves, (that is, the difference between B# and C as described above) amounts to about $^{1}/_{9}$ of a whole tone, and is called a Pythagorean Comma. Likewise there is a discrepancy between two octaves plus a pure major 3^{rd} and the sum of four perfect 5^{ths}, called a Syntonic Comma. The Pythagorean and Syntonic commas are nearly equal, differing only by $^{2}/_{100}$ of a semitone.

Keyboard tunings solve this problem by de-tuning, or "tempering" some of the pure intervals, distributing fractions of the comma over a number of 5$^{\text{ths}}$. In other words, they render some of these intervals slightly out of tune in order to remove the one wildly out-of-tune 5$^{\text{th}}$ in the circle. That is why keyboard instruments are not a good guide for tuning melody instruments: they are inherently and purposefully out of tune.

MEANTONE

If we divide the comma into four parts, then temper—that is, narrow from their true proportions—any four adjacent 5$^{\text{ths}}$ by this fourth of a comma, the resulting system is called quarter-comma meantone. Divide the comma into six and alter any six adjacent 5$^{\text{ths}}$, and you have sixth-comma meantone.

Because it is necessary to set a fixed and inflexible pitch for every note in a keyboard scale, pure 3$^{\text{rds}}$ and pure 5$^{\text{ths}}$ are incompatible on keyboards. A meantone scale, however, since it is based on a slightly small 5$^{\text{th}}$, will ensure that (with octaves transposed to unisons) four 5$^{\text{ths}}$ are equal to a perfect 3$^{\text{rd}}$. Thus, at least in simple keys that stay within the range of the tempered 5$^{\text{ths}}$, the result is a triad structure that is very nearly pure to the ear, since the perfect 3$^{\text{rd}}$ is heard more clearly than the slightly small 5$^{\text{th}}$. Harmonies that wander much beyond this 'inner circle' however, become more uncomfortably out of tune.



EQUAL TEMPERAMENT

Pushing the logic of meantone to its conclusion, equal temperament makes possible the equal use of *all* keys by splitting the pitch difference between C and B# equally among all the notes of the 12-tone chromatic scale. All keys are equal. All the semitones are the same size. There is only one size of 3$^{\text{rds}}$, 4$^{\text{ths}}$ and 5$^{\text{ths}}$. However, there is a price to pay for consistency: in equal temperament there are *no pure intervals at all,* except for the octave and the unison. An equally-tempered 3$^{\text{rd}}$ beats uncomfortably to our ears at seven times a second. Major 3$^{\text{rds}}$ are tempered seven times as much as 5ths, minor 3$^{\text{rds}}$ six times as much. It is the most out-of-tune of all tuning systems!

UNEQUALLY-TEMPERED TUNINGS

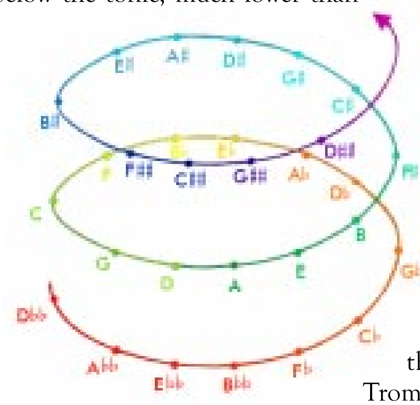
Since meantone and equal temperament are both flawed in different ways, other solutions to nature's conundrum have been proposed: unequal temperaments, in which some 5$^{\text{ths}}$ are tempered to render all keys serviceable, some more so than others. Werckmeister, Young, Marpurg, and so on, are temperaments (sometimes called well-tempered systems) named for their inventors, some leaning more toward equal, some toward mean.

ENHARMONICS & THE SPIRAL OF 5$^{\text{ths}}$

A circle of 5$^{\text{th}}$ is really a circle only in equal temperament. In systems in which all the 5$^{\text{th}}$ are pure the circle cannot be completed, since the twelve 5$^{\text{ths}}$ end with a B#, which is a comma higher than C. A more accurate way to represent this concept in non-equal temperaments is a *spiral* of 5$^{\text{th}}$ rather than a closed circle. (See illustrations).

In equal temperament, notes of identical pitch having different letter-names are called enharmonics, e.g. D# & E*b*, C# & D*b*, A# & B*b*. In pure tuning, however, the enharmonic notes are not equal—the B*b* which is a fifth above E*b* is a comma higher than the A# which is a 5$^{\text{th}}$ above D#. Consequently there are two different sizes of semitone.

Intervals such as 2$^{\text{nds}}$ and 7$^{\text{ths}}$ are difficult to tune harmonically, though with practice one can recognize small and large semitones. A leading tone, the seventh degree of the scale, is a large half-step below the tonic, much lower than we are accustomed to hearing. The baroque flute's F#, seemingly so flat to modern ears, often makes a pure 3$^{\text{rd}}$ in D major or a correct leading-tone in G major with hardly any adjustment!



Eighteenth-century fingering-charts and written instructions from the likes of Quantz and Tromlitz provide separate fingerings for enharmonic notes such as G# and A*b*, which along with our ability to change the pitches of notes with breath and embouchure, gives us a tremendous amount of flexibility in tuning. A well-tuned flute makes it possible to produce most enharmonic notes accurately if the correct fingerings are used.

HISTORICAL EVIDENCE

The good news is that, like singers, flute players can, within the limitations of their particular instrument and their flexibility of technique, produce both pure 3$^{\text{rds}}$ and pure 5$^{\text{ths}}$ against the notes on the keyboard. The flute can continue to play in pure intonation even when playing with a fixed pitch instrument whose tuning has been necessarily compromised. Clearly this concept will break down within complicated musical realities, but it stands up as well as any generalization.

Written evidence from the 18$^{\text{th}}$ century about flute tuning is often notable for what it doesn't say as much as what it does. One of our jobs as 20$^{\text{th}}$ (nearly 21$^{\text{st}}$) century re-creators of baroque music is to try to decipher what the unspoken, accepted rules were for the best musicians of that time. Only within that context can we begin to interpret what was explained in writing. Did musicians, for example, differentiate between a D# and an E*b*? Were players aware of temperaments within an orchestra? Tromlitz and Quantz provide some answers, but short quotations would not suit our purposes: it really is necessary to read all of what they say in order to interpret the whole picture with any clarity.

PUTTING IT INTO PRACTICE

If your flute practice sessions for tuning have included setting an electronic tuner to each note and trying to match it, you will now, I hope, see what a fruitless endeavor that is. Instead, use the machine to generate a chosen note, and practice playing slow scales and arpeggios against that note, taking particular care that the 3$^{\text{rds}}$, 4$^{\text{ths}}$, and 5$^{\text{ths}}$ are pure. You can do this, moving the drone from note to note, whether or not the tuner is in equal temperament, and on every note of the scale. It's a great way to improve flexibility while you train your ears. Ironically, playing pure intervals against the notes of an equal-tempered scale can be as easy as playing them against the notes of a meantone scale, whereas matching each note of an equal-tempered chromatic scale may be much more difficult.

Playing the flute with tuning-consciousness requires attention to the harmonic structure of the music we play, especially when performing with a keyboard instrument. Choose a keyboard temperament which will provide the largest number of pure or nearly-pure chords for the music you will play. A meantone tuning will often prove the most satisfying, if it is possible to use it—that is, if your repertoire remains within a fairly small range of harmonic modulations. As pieces modulate, you may well find the harpsichord producing increasingly out-of-tune chords. But, like a dissonance resolving into consonance, the harmonic structure will move back to the home key from the outer reaches of harmonic relations, and you will once again find yourself back at the settled resonant stillness of an in-tune cadence, all the more welcome because of the noisy place you've just come from.

For more chromatic music, tuning plucked or struck keyboards in equal temperament was an option championed by many, even in the 18th century—organs have always been an exception because of their sustained, woodwind-like tones. On the harpsichord, the beating chords within equal temperament can be improved by omitting 3rds, especially in cadences, leaving them instead to the well-tuned flute.

As players we all recognize that there are times when theoretical rules and the practicalities of performance clash; this is certainly true in tuning. Yet a simple rule which works in all situations is this: play pure intervals whenever possible. I believe that the art of playing in tune depends on an ear trained to expect pure intervals and pure, resonant chords. With enough practice, we can also become proficient in the art of compromise; of making choices to necessarily play out of tune 'by ear' clearly and purposely.

Catherine Folkers, a partner in Folkers & Powell, has been playing, teaching, making, and researching historical flutes for over 20 years. Tuning is one of her favorite flute-related topics.

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The follwing seven items appeared in *Sine musica nulla vita: Festschrift Hermann Moeck zum 75. Geburtstag am 16. September 1997*, ed. Nikolaus Delius (Celle: Moeck, 1997)

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BOOK

Horst Augsbach, *Thematisch-systematisches Verzeichnis der Werke von Johann Joachim Quantz: Quantz-Werkverzeichnis (QV)* (Stuttgart: Carus Verlag, 1997)

INSTRUMENT

Jan De Winne Rottenburgh, boxwood/artificial ivory, a=415, serviced by von Huene, $925, includes shipping. Mike Willner, (212) 267-7722 x3087, mbw@prolofics.com

COURSE

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RECORDINGS

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Jacques-Martin Hotteterre "Le Romain", *First Book of Pieces for Transverse Flute*, Op. 2 (**Philippe Allain-Dupré**, **Jean-François Bougès**), Naxos 8.553707

Georg Philipp Telemann, *Sonate Metodiche* (**Hans-Dieter Michatz**), Move MD 3196

——— *Paris Quartets 1-12*, (**Barthold Kuijken**), Sony Classical Vivarte S3K 63115

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The Just Intonation Network **http://www.dnai.com:80/~jinetwk/**

KONRAD **Hünteler**, scheduled to feature at the Library of Congress **Flute Fest** in Washington DC on February 27, is unwell and has canceled engagements. No information was available from the LOC at press time on his rescheduling or replacement at the event.

THE WILLIAM E. Gribbon Memorial Award for Student Travel offers students support for travel and lodging to attend the 1998 annual meeting of the American Musical Instrument Society, Pomona College, Claremont, California, from May 21-24, 1998. College or university undergraduate or graduate students aged 35 or under may apply. Details:

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THE MILLENIUM **will not happen, as we all know, until** January 1, 2001. But will that dampen our celebrations in 2000? Of course not! Neither will the fact that ***TRAVERSO*'s tenth birthday** comes with Volume 11 No. 1 prevent us celebrating our 10th year of publication with this issue. Thanks to each and every subscriber for your support!

FLUTE MAKER **Rod Cameron** has unexpectedly lost the lease on his workshop in Mendocino, CA. Anyone with ideas for a new venue can get in touch at PO Box 438, Mendocino CA 95460. Phone (707) 937-0412, e-mail rcameron@mcn.org.