

The Bach Temperament?

J. S. Bach has always been considered a seminal figure in the history of temperaments. His *Well Tempered Clavier*, the first volume of which was published in 1722, includes preludes and fugues in each of 24 keys: all 12 major and minor keys available in the standard European division of the octave. Very methodically, he began with a prelude and fugue in c major, then a pair in c minor, then c# major, c# minor, d major, d minor, proceeding by half steps from c to b. In essence, this was a declaration that each of the 12 notes in the octave could be used as the “tonic,” or key center. Furthermore, each note could appear in multiple functions, “enharmonically.” C sharp could also be D flat – or B double sharp. C natural could also be B sharp or D double flat. This would allow the composer the freedom to move through any number of key centers, even “remote” ones, within a single piece, a hallmark of Bach’s style.

In the Mean Tone tunings common in the period leading up to Bach’s time, an “accidental” could only be used in one way: as a sharp or as a flat. There was a definite and fairly large difference in pitch between the two. When a piece required G sharp instead of A flat, that note would have to be re-tuned. Also, one of the fifths, usually A flat to C sharp, would be a horribly out of tune “wolf” interval. This style of tuning did not allow for the harmonic freedom sought by Bach and many of his contemporaries.

For the better understanding of piano technicians unfamiliar with historical temperaments, it may be useful to focus on a series of contiguous major thirds (M3s), as for example CE, EG#, G#C. In equal temperament, all these M3s are quite wide, and have fairly rapid beats. Mean Tone tunings are characterized by pure, beatless M3s (or possibly by M3s that beat, but far more slowly than in equal temperament). Suppose two of the M3s in our contiguous series, CE and EG#. are tuned beatless. G#C will then beat at a rate that is more or less the sum of the accumulated beats of all three M3s in equal temperament, very fast indeed. G# can be tuned to form a beatless M3 with C by raising its pitch considerably (and we would now call it Aflat), but as a result EG# would beat very rapidly. In Mean Tone tunings, two of the three M3s in each system of contiguous M3s are beatless, the third being very wide and “out of tune” as a M3.

In the late 19th and early 20th centuries, most music scholars asserted that Bach intended his music to be played in equal temperament. Indeed, some claimed (erroneously) that he invented equal temperament. More careful study of theoretical and descriptive writings of Bach’s time revealed that, in fact, a number of musicians and music theorists were advocating a variety of unequal temperaments which allowed for all keys to be used enharmonically, and which eliminated any “wolf” interval. These unequal temperaments have become known popularly as Well Temperaments, after the title of Bach’s set of compositions.

But what temperament did Bach himself use? Much debate has surrounded this question, and many have gone to great lengths to “prove” that one or another temperament must have been the correct one. (A strong case has been made for the temperament known as Werckmeister 3, for example, at least with respect to organ tuning). Recently, harpsichordist and tuning scholar Bradley Lehman published a series of two articles in the journal *Early Music* (Oxford University Press, volume 33, nos 1 and 2, February and May, 2005) in which he claims to have deciphered a diagram Bach left in a very obvious place: on the engraved title page of *The Well Tempered Clavier*.



Figure 1

The diagram, reproduced above as figure 1, consists of a number of loops above the title, *Das Wohltemperirte Clavier*. On first glance it appears to be merely a decorative squiggle, but careful attention reveals that it is a very odd decoration. It contains a variety of different loops, some simple, some with a single “knot,” and some with a double “knot.” These are in a pattern which lacks the symmetry expected in a decoration. Further, there is a letter C, near the C of *Clavier* and attached to one of the loops.

According to Lehman’s interpretation, each loop represents a fifth in the tuning sequence, with the simple loops being “pure” (beatless), the single knotted loops being tempered, and the double knotted loops being doubly tempered. The letter C indicates the location of middle C as the standard starting point. Tuning through a circle of fifths starting at C was standard practice for “laying the bearings” (tuning the temperament) from the 16th through the mid 20th centuries. In Lehman’s view, the notes of the temperament are laid out in relation to the “squiggle” in accordance with the following diagram (figure 2), which he inverts for ease of viewing.



Figure 2

Lehman interprets the double knots as $1/6$ comma 5ths, a width commonly used in the 17th and 18th centuries as a transition from the earlier $1/4$ comma mean tone. For a modern piano tuner, this translates as being twice as narrow (5ths) or wide (4ths) as in equal temperament: 5ths beating a little over 1 bps, 4ths beating around 2 bps. The single knotted loops are seen by Lehman as $1/12$ comma, the same as equal temperament, and the simple knots, as noted earlier, as pure or beatless.

To tune this temperament, one begins by tuning most of the naturals. Bach would have started at C, but it is also possible to start at A. Simply tune through the series of fifths from F to E (FC, CG, GD, DA, AE), using the $1/6$ comma criterion noted above. The test intervals will be the M3s FA and CE, which should beat at approximately half the rate of equal temperament (about 3.5 bps and 4.5 bps).

Beginning with A3, first tune F3 so that F3A3 beats around 3.5 bps. Then tune D4 so that A3D4 beats about 2 bps; tune G3 so that G3D4 beats a bit faster than 1 bps; tune C4 so that G3C4 beats about 2 bps; check F3C4, which should beat a bit faster than 1 bps. If this didn’t come out correctly, make adjustments, going through each of the steps

again to even up the beat rates of the P4s and P5s. Finally tune E4 so that A3E4 beats a bit faster than 1 bps, and so that C4E4 beats about 4.5 bps.

Alternately, beginning with, C4, tune F3 so that F3C4 beats a bit faster than 1 bps; tune G3 so that G3C4 beats about 2 bps; Tune D4 so that G3D4 beats a bit faster than 1 bps; tune A3 so that A3D4 beats about 2 bps; check F3A3, which should beat around 3.5 bps. If this didn't come out correctly, make adjustments, going through each of the steps again. Finally tune E4 so that A3E4 beats a bit faster than 1 bps, and C4E4 beats about 4.5 bps.

From this point on, both tuning sequences are the same. Tune three pure 5ths/4ths: E4B3, B3F#3, and F#3C#4. This will make the M3s G3B3, D3F#3 and AC# beat at gradually increasing beat rates (D3F#3 can be checked by first tuning D3 to D4). Finally, tune the remaining 5ths/4ths as in equal temperament: C#4G#3, G#3D#4, and D#4A#3. A#3 should end up forming a pure or slightly narrow P4 to F3.

For the convenience of those using ETDs, the cents offsets are: A 0.0; A# +3.9; B 0.0; C +5.9; C# +3.9; D +2.0; D# +3.9; E -2.0; F +7.8; F# +2.0; G +3.9; G# +3.9. For a more detailed description, see Lehman's articles, which can be downloaded at no charge as a pdf file via a link at www.larips.com.

An interesting feature of this temperament is the fact that EG# is the fastest beating M3, in contrast to many well temperaments like the popular Valotti and Young where DflatF and F#A# tend to be the fastest. This is a milder sounding Well Temperament than many, with a different skewing of key colors. It works well on the piano as well as the harpsichord, to my ear.

While Lehman's articles have generated some controversy in the combative world of temperament scholarship (several letters appeared in the August, 2005 edition of *Early Music*), it seems clear that his interpretation, possibly with some modification, will have some influence for years to come. His version of the "Bach Temperament" has already found an enthusiastic following among lovers of Baroque music, and among a number of professional piano tuners.