

12 Tone Musical Temperaments

By Dilan Wade

Since the inception of music, composers, instrument makers and musicians alike have struggled to find a tuning system that is both flexible and pleasing to the ear. A plethora of musical temperaments have been created and put into practice over many thousands of years but few have stood the test of time. The reason for this is mathematically complex and inevitably contains some level of compromise.

Arguably the oldest and purest tuning system is just intonation. By using very low whole number ratios, it aligns itself with the natural harmonic series produced by almost all acoustic sounds. The problem with just intonation is with its flexibility. Musicians playing a just intonated instrument with a fixed tuning are more or less confined to a single diatonic key. Moreover, even within this key, there are compromises of purity when playing polyphonically. When introducing a chromatic scale to just intonation, things get even more convoluted by requiring much higher integers to create interval ratios.

Temperaments such as Pythagorean, which is technically a type of just intonation, attempts to overcome these oddities by creating a sequence of pure fifths or fourths. This tuning system has its own issues by not being a mathematically closed system. It produces what is known as pythagorean comma which is a small remainder

of an interval between two enharmonic notes. This quirk also results in a “wolf fifth” which is a widened fifth that is very displeasing to the ear and generally unusable.

Meantone temperaments use irrational numbers to create intervals often resulting in more pure thirds but compromised fifths. In their day, these tunings were a bit more of an art than a science. Every professional tuner had their own variation. Meantone tunings were the standard in Europe for around 400 years and still sometimes used today but largely considered a “historical tuning”. These temperaments work very well in certain keys but can sound quite off in others.

Well temperament came into play in the late 1600's as a way for composers such as J.S. Bach to compose pieces in all 24 major and minor keys without any unusable chords. This tuning moves closer to equal temperament but still with varying degrees of purity depending of the key and chord being played. Many pianists today still use Thomas Young's Well Temperament as a way to exhibit varying degrees of warmth or brightness between keys.

The default standard tuning system in the western world for the past 200 years has been equal temperament. This system divides the octave into 12 precisely equal pieces. The result is a system without any pure intervals. The advantage is, one can play in any key and retain the same relative intervals. The interval of a fifth is very close to pure while the thirds are not close at all. Equal temperament works particularly well with many keyboard instruments as they are very time consuming and difficult to retune.

There is one recent solution to the problem of tuning that attempts to electronically mimic the dynamic intonation of a well trained choir or orchestra. Hermode tuning analyzes the chords that are being played in real time and adjust the tuning to come as close to just intervals as possible without audible retuning. It focuses in on major thirds, minor thirds and perfect fifths as these are the building blocks of most modern music. Hermode tuning is particularly useful as it maintains compatibility with equal temperament.

It appears that over thousands of years the general progression of musical temperaments has been to sacrifice more and more purity to achieve greater flexibility. This has given composers and musicians many more harmonic options and has expanded our musical horizons. However, this movement has been at the great expense of the clarity and openness of pure intervals. This being said, there is no right or wrong when it comes to tuning systems. All musical temperaments are still quite valid and must be taken into consideration when creating music.

Bibliography

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