

The History of Musical Temperament and Pitch Before 1750

To most musicians, the idea that the sound of notes has changed is a foreign concept. Over the past 2000 years temperament has changed, from region to region, from musician to musician, from year to year. The history of tuning is important because in order to understand the music of the time, you need to understand that the music didn't sound the same today as it sounded then.

Ancient Greece

The discovery that the most important musical intervals are related to the ratios of whole numbers was probably first discovered by musicians of Egypt or Mesopotamia in the second or third millennium B.C. In both these early cultures, it was thought that mathematics, religion, and music were all related to each other. The Greek philosopher Pythagoras is thought to be the one who introduced whole number ratio tunings for the octave, the perfect fourth, and the perfect fifth into music theory in the sixth century B.C. After Pythagoras, quite a few Greek philosophers spent much of their time studying music. The Harmonists, as they came to be called, created hundreds, if not thousands of different tunings, all expressed in terms of ratios. Most of their writings were lost, however, they were summarized in the second century by Claudius Ptolemy. Two things are uncertain, however: Pythagoras may or may not have actually been a real human, and Ptolemy may have been the creator of many of the tunings that he credited to the Harmonists. Ptolemy did create some new tunings, and also contributed to the fields of astronomy and geography. The ditonic and the syntonic have both had the most influence. Ditonic is similar to our major scale. It uses 8 notes, and has something similar to half steps, and something similar to whole steps.

After the fall of the Roman Empire, much of the Greek music theory was lost. Some was written down by the Roman philosopher Boethius, who lived right before the fall of the Roman Empire, and some was also further expanded and developed in the Middle East. However, the Middle Eastern theory seems to have not have had an influence on the music theory in the West.

The Early Middle Ages

In the Early Middle Ages, Western music was based mostly on Pythagorean intonation. Pythagorean tuning (and hence polyphony) is all based on the ratios one, two, three and four, meaning that the following intervals were acceptable as a consonance.

1/1	unison
2/1	octave
3/2	perfect 5th
4/3	perfect 4th

All other intervals are dissonant, including thirds and sixths.

Late Middle Ages/ Early Renaissance

In the later middle ages and early Renaissance, thirds and sixths became to be regarded as consonant, and part of polyphonic music. Written music theory didn't change until later- it was considerably behind the music practice. Much of the reason for this was because theorists couldn't abandon the idea the idea that 3rds and 6ths couldn't be expressed a ratio as easily as the earlier consonances

Eventually, these ratios were came up with, by the English monk Walter Odington (c. 1300).

5/2	minor 6th
5/3	major 6th
5/4	major 3 rd
6/5	minor 3rd

These ratios were not widely accepted by other theorists, until the rediscovery of earlier Greek writings about music theory, where it was discovered that these ratios had already been discovered, several hundred years earlier.

The Renaissance

Gioseffo Zarlino, (1517-1590) an Italian Renaissance music theorist, wrote that consonance was the product of ratios of the integers one through six. The major and minor triads were discovered because of this, and this was the beginning of the common practice period and the development of chordal and harmonic music during that time.

While the theorists in the time of the Renaissance felt that Just Intonation (intonation based on ratios) was the basis of melody and harmony, the musicians didn't always agree. There were other things that the musicians of the time had to take into account. First, there was a growth in the music written for fretted instruments, and keyboard instruments. Before this time, the music had been mostly vocal music, and the voice was able to vary between intonations without a thought. However, in the Renaissance, instruments such as the lute, guitar, or the viol, could not switch as easily between intonations, and organs and harpsichords could not switch tuning at all. An instrument which is has fixed pitch cannot play just intonation for more than a few related keys without the addition of many more keys, meaning that there would be far more than 12 notes in an octave. During the 16th and 17th centuries, several instruments were created that had more than 12 notes in the octave, but they were soon discontinued. This was probably due to the complexity of the instrument.

arbitrary starting note	just intonation	equal temperament
c	0	0
c#	114	100
d	204	200
d#	294	300

e	408	400
f	498	500
f#	612	600
g	702	700
g#	816	800
a	906	900
a#	996	1000
b	1110	1100
c	1200	1200

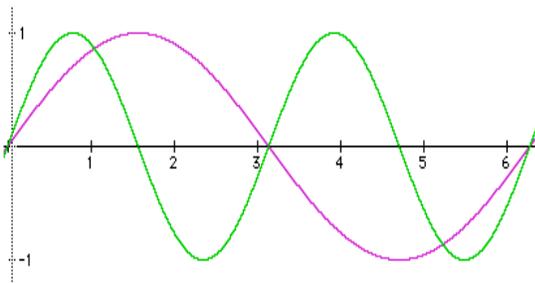
The Baroque Period

Throughout the Renaissance and Baroque Period, many different types of temperament were proposed, but, in keyboard instruments, meantone temperament became the norm. In lutes and viols, and other stringed fretted instruments, just intonation was probably the standard because it simplified the placing of the frets of the instrument. Meantone intonation is different than just intonation in the following ways: In just intonation, the 4ths and 5ths are perfect, and the 3rds and 6th are slightly off. In Meantone intonation, the 3rds and 6th are exactly in tune because it makes the triads in tune. This makes the 5ths slightly flatted (approximately 2 cents off) in certain keys. Meantone temperament makes 8 almost perfect scales, and 4 scales that are badly mis-tuned. Meantone temperament became the standard for a time, but music started to become more and more complex, and composers wanted to modulate to other keys, and introduce accidentals.

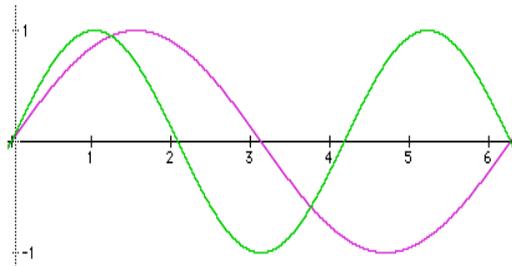
Because of this, in approximately 1750, equal temperament became the standard. Because this is a paper about music before 1750, I will only briefly discuss equal temperament. In equal temperament, all the notes are the same distance apart. This means that everything is out of tune. However, it is all equally out of tune, so you can play a major, minor, or other scale in any key, and it will sound as out of tune as if you had played it in any other key. This makes it easier to tune instruments. The French monk and Mathematician Marin Mersenne is

generally credited with the invention of equal temperament in 1639 in his *Harmonie Universelle*. Musicians did not change to equal temperament until significantly later. Keyboard instruments in Germany were probably the first to switch- there is evidence that some organs were tuned to equal temperament as early as the last quarter of the seventeenth century, although it did not become standard there until 75 years later. In France, meantone tuning was the standard until the 1750s, and in England, meantone was the standard until the 1850s. J.S. Bach wrote *The Well-Tempered Clavier* in the eighteenth century, and there is much debate on what was meant by well tempered. Some scholars believe that Bach was an advocate on equal temperament, and wrote *The Well-Tempered Clavier* to show what equal temperament was capable of. Other scholars believe that the term "well temperament" was used in the eighteenth century to describe temperament in which all keys were usable and in which the main consonances of the most central keys kept their just forms. This means that in well temperament, different keys had different characters depending on how far they were from the key that the instrument was tuned in. The idea that different keys had different moods was widely accepted during the baroque era.

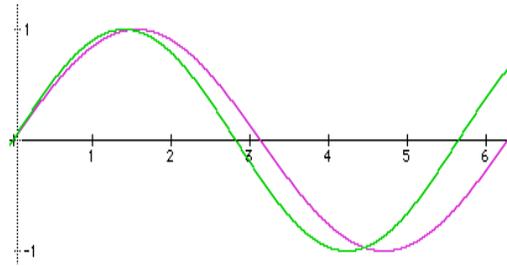
Why Just Intonation sounds "more in tune" to us:



This is an example of a sound wave of an **octave**. The lower the note is, the longer it takes for the wave to travel. The reason that an octave sounds consonant to our ears is because the waves have similar high points and low points



perfect 5th



minor 2nd

With Equal temperament, the sound waves do not line up as evenly, so we hear beating, or dissonance.

The Change of A

In the Middle Ages, and later, into the Renaissance, there was not always a set tuning note. Because of this, a lot of music was written in a different key than we now know. A, which today is thought of a 440, or a little sharper, varied between 370 and 567 throughout Europe. We know this now because of tuning forks. People who tuned instruments had their own tuning forks, and so now, we can trace what instruments they tuned, and hence where they were when. As you can see, there are several problems with this. Tuners can't really tune instruments that were not made with their pitches. Also, in composing music, especially vocal music, the ranges changed, according to the region. In certain sections of Europe, during the sixteenth and seventeenth there were more than one tuning per town. For example, in many towns, there was a choir pitch, and a church pitch. The church pitch was about a whole step higher. With the beginning of instrumental music, a chamber pitch appeared. Eventually, a compromise pitch was decided upon, at about 420.

Conclusion

As, you can see, over the Middle Ages, the Baroque, and the Renaissance, tuning and temperament changed a great deal. The study of these changes is fairly new. Harry Partch began studying them this century: other composers such as Lou

Harrison, have continued this study. Alexander J. Ellis has created hundreds of charts indicating the pitch that specific instruments were tuned at, and where and why. Because of this data, that is now easily available, new inventions that enable us to tell exactly what it is we are hearing, and more travel, we are now able to study these changes.

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