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One might say that in different historical periods musical composition was sometimes deeply affected by the kind of tuning system operative at the time, as certain sonorous effects and certain melodic impulses were conditioned by virtue of the nuances of a particular style of tuning.

In this brief essay a few musical excerpts will be shown, each reflecting in its own way the nature of a given historical style of tuning. The kinds of tuning to be explored here are:

Pythagorean (with pure 5ths and rather impure diatonic 3rds): the Middle Ages

Quasi-Pythagorean (with pure 3rds between the naturals and sharps): late 14th and early 15th centuries

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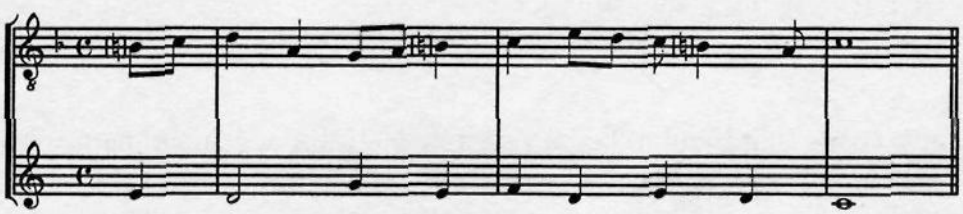
* The information presented in this article will be integrated into *Performance Practice Encyclopedia* with a more comprehensive technical discussion.

Meantone (with pure or moderately tempered 3rds throughout the scale): late 15th, 16th and early-to-mid 17th centuries
Irregular (with distinctly varied nuances of tuning among the 3rds): late 17th, 18th, and early 19th centuries
12-note equal-division (with rather impure, uniform 3rds): 19th and 20th centuries (and some 16th-century music)

Pythagorean Intonation

In Pythagorean intonation—which seems to have prevailed throughout most of the Middle Ages—the 5ths were pure, but the 3rds and 6ths impure by rather more than in modern equal temperament: 11 schismas versus 7 for the major 3rd, or versus 8 for the minor 3rd and major 6th. Thus, in the tenor and alto range the 3rds and 6ths would beat more nervously (than in equal temperament: 11). The Pythagorean major 3rd is larger, and its diatonic semitones smaller, than their equivalents in equal temperament. The following excerpt by Landini, therefore, when heard (as it likely was originally) in Pythagorean intonation, contains a cadential *b* in the upper melodic line which makes a higher, and hence more expressive, leading tone to *c'*. It also beats so jarringly with *d* that contemporaries might well have heard it as dissonant, wanting it to resolve to *a* before finally leading up to *c'*.

Ex. 1. Francesco Landini, "Chi più le vuol sapere" (conclusion)

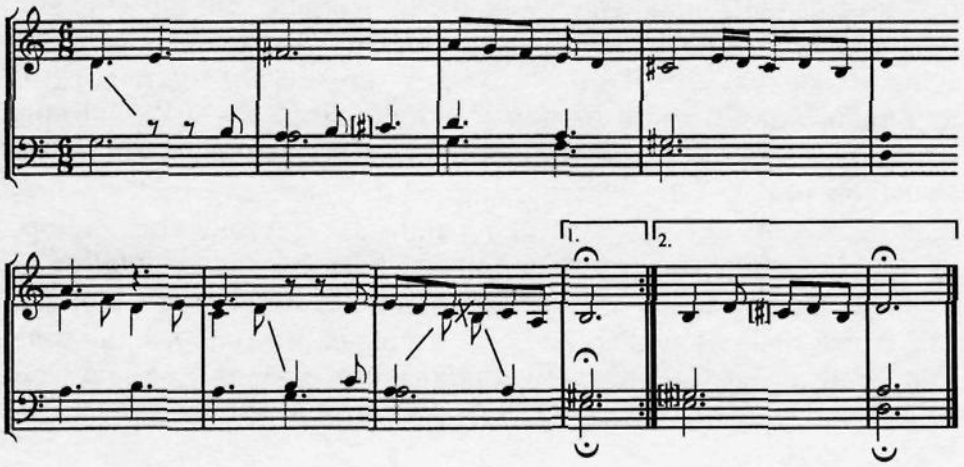


Quasi-Pythagorean Temperament

In a quasi-Pythagorean temperament—which entered into some late medieval polyphony involving sharps—the 3rds and 6ths between two natural notes (e.g., *G-E*) and those between a natural and a flat (e.g., *G-E♭*) are of the same "impure" quality as in Pythagorean

intonation, while those between a natural and a sharp (e.g., *B-G#*) are distinctly more euphonious, being virtually pure or altogether so. Thus the sonorities in the second and fourth bars of Example 2 would be quite different in their sound quality from those immediately preceding them in the first and third bars respectively.

Ex. 2. Landini, "O fanciulla giulla" (beginning, end of final section)



It is likely that Landini had a very fine ear (perhaps due in part to his blindness), and he is known to have tuned an organ with a chromatic keyboard at Sta. Annunziata in Florence, for which he must have had *some* quantitatively precise idea of the intonation of the chromatic notes.

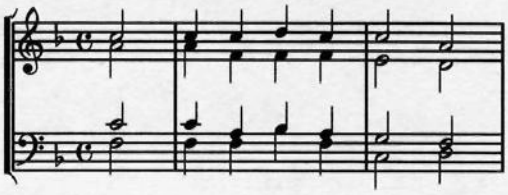
Meantone Temperament

Within each shade of meantone temperament—the kind of keyboard tuning most prevalent during the late 15th, 16th and early 17th centuries—there are no nuances among the available triads. But of course differences exist among the various shades of meantone. For instance, in 1/4-comma meantone the major 3rds are pure while the

5ths are impure by nearly three times as much as in equal temperament, whereas in 1/5-comma the 5ths are tempered slightly more than twice as much (as in equal temperament), the major 3rds about a third as much and the minor 3rds a little more than half as much. In 1/6-comma mean-tone—which was widely used in the 18th century, at least among the diatonic notes—the 5ths are tempered twice as much as in equal temperament, and the major 3rds by 3/7 as much.

Since the 5ths in a meantone temperament are less pure than in equal, they are more likely to beat noticeably. One 17th-century theorist[1] observed that this moderate beating made the interval sound more charming, and Example 3 illustrates how composers seem often to have relied upon it to add a vibrato-like grace to the 5th in a triad—in this case on the accompanying organ, if not actually among the singers.

Ex. 3. Michael Praetorius, "Lo, How a Rose E'er Blooming" (beginning)



Late-baroque composers evidently expected an analogous quality in the diatonic major 3rds as well. The top notes in Example 4 sound dull in 1/4-comma meantone temperament, but properly charming in 1/6- comma meantone—and then, to anyone who has listened to these comparisons, uncomfortably nervous in equal temperament.

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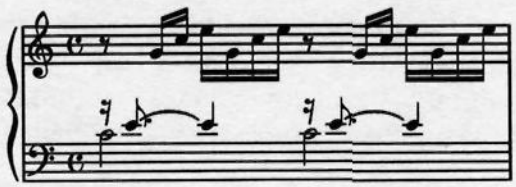
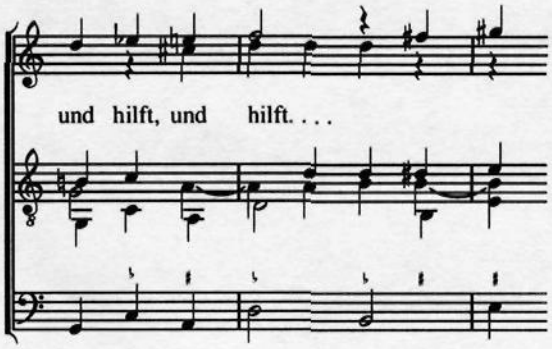
[1] Wolfgang Caspar Printz, *Phrynis Mitilenaeus* (Dresden and Leipzig, 1696), 87-90.

Ex. 4. J. S. Bach, "Prelude in C-major," WTC I (beginning)



A feature shared by all shades of meantone temperament is that three major 3rds do not make an octave, nor do four minor 3rds (though they would if three major ones did). This is an important conceptual as well as acoustical hallmark of meantone temperaments, because it excludes all those (enharmonic) modulations which depend upon equating a sharp and a flat, and which are so indispensable to 19th-century chromaticism. Thus in Example 5 one experiences no sense of identity between the violin's $E^{\flat}$ and the singer's *D#*.

Ex. 5. Heinrich Schütz, "Die so ihr den Herren fürchtet" (excerpt)



Irregular Temperaments

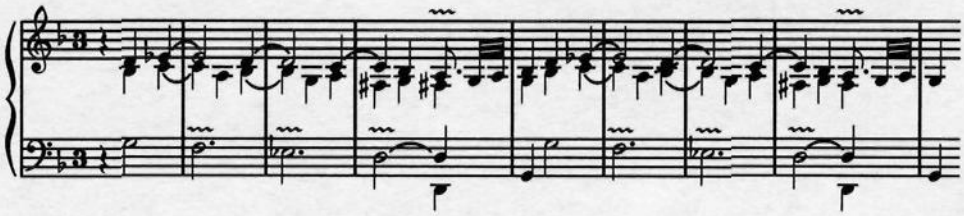
During the mid-to-late baroque, nuances of intonation among the 3rds became the norm. Musicians of the time often discussed the musical virtues of these irregularities, as creating distinctions between one key and another and thereby creating variety in the musical continuity.

One may distinguish between a French style which emerged in the late-17th century (and which 18th-century musicians sometimes called the *tempérament ordinaire*) and a subtler, German style which appeared during the first half of the 18th century and which is historically and musically best for most of Bach's music.

The relative effects on the various keys can be illustrated by the fact that C-minor, rendered comparatively dark by the German style, was even darker in the French style because of its lower flats and lower leading tone (*B*).

Among Louis Couperin's harpsichord pieces, those in B minor and the unique pavane in F# minor (c. 1660) are accomodated so remarkably well by a late-baroque *tempérament ordinaire* that it seems likely that he may have invented such a tuning. And it has been further suggested that his other harpsichord music—most notably in G- and C-minor—was conceived for a scale with the 5ths $E^{\flat}$-$B^{\flat}$-*F* tempered larger than pure (as inadvertently implied in the tuning instructions in Mersenne's *Harmonie universelle* of 1636) but with *F#*, *C#*, and *G#* as in a regular meantone temperament. In Example 6, $B^{\flat}$ would thus be somewhat dark and $E^{\flat}$ quite expressively so, but *D-F#* would have the same relaxed and limpid quality as *F-A*.

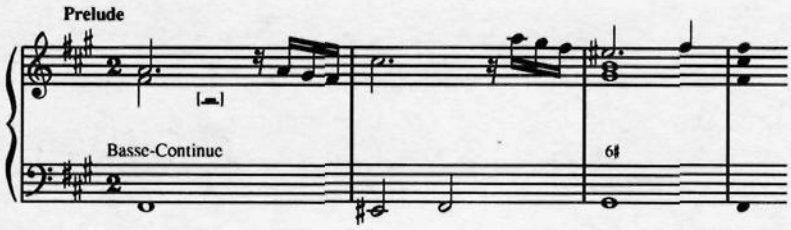
Ex. 6. Louis Couperin, "Passacaille in G Minor" (beginning)



Marin Marais, eminent master of the *basse de* viole, said in the preface to one of his volumes of music (1689) that if the thorough-bass part to his suite in F#-minor were found unduly difficult to realize in that key, the accompanist could realize it in G-minor and the soloist accordingly tune his instrument a semitone higher—but that this would cause the music to sound less "piercing" (*perçant*) than in the original key of F#-minor. Since the strings of the *basse*

de viole would actually be more taut (and therefore sound more brilliant) at the higher pitch, it seems that the piercing quality which Marais attributed to F#-minor was due to the extreme tempering of some of its intervals, for instance the major 6th *G#-E#* (see Example 7) in the unequal temperament of an accompanying harpsichord, and that Marais expected the *basse de viole* to match these nuances of keyboard tuning for the sake of a good ensemble sound.[2]

Ex. 7. Marin Marais, Suite in F#-minor (1689) (beginning)



Equal Temperament

In a scale where four 5ths make a consonant major 3rd, if three such 3rds are to make an octave (in which case twelve 5ths will also do so, since 3 x 4 = 12), they must average some 7% of a whole-tone larger than pure. This average is realized in equal temperament, which has been normal on the piano for more than 150 years and theoretically also on lutes and viols since the mid-16th century (though not always physically adhered to in playing).

Various treatises from the late 16th and 17th centuries say that equal temperament was normally used on fretted instruments. While extremely fine nuances of control in regard to intonation are uncharacteristic of these instruments (lute, viol, *vihuela da mano*, guitar), they normally include a pair of strings tuned a major 3rd apart (e.g.,

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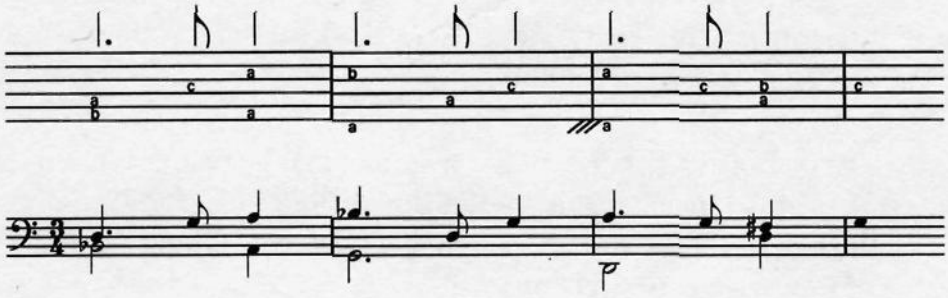
[2] For a discussion of several examples of the use of such nuances in music by J. S. Bach, please see my "A Quest for Bach's Ideal Style of Organ Temperament," forthcoming in the proceedings of the 1994 Musikinstrumentenbausymposium, *Stimmungen im 17./18. Jahrhundert*, conducted at the Institut für Aufführungspraxis in Michaelstein, and "Bachs Stimmung des Klaviers" (*Kongressbericht Stuttgart 1985*; English translation in *Musical Times* 126, De-cember 1985).

F-A), and the first fret is often used to mark off a diatonic semitone on one of these strings (e.g., *A-B*^{b}) but at the same time a chromatic one on the other (e.g., *F-F#*); and likewise for some of the other frets. This is illustrated in Example 8, which is from the most famous 17th-century French lute book.

Ex. 8. Denis Gaultier, La rhétorique des dieux (p. 165)



This way of using the frets excludes any tuning with a systematic distinction between diatonic and chromatic semitones, or with systematically different intervallic nuances in different keys.