Beyond Temperament: Non-Keyboard Intonation in the 17th and 18th Centuries

Bruce Haynes


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Beyond temperament: non-keyboard intonation in the 17th and 18th centuries

My system is not based on any keyboard temperament; rather, it displays the sounds found on unrestricted instruments like the cello, violin etc., that can play purely in tune . . .

(Georg Philipp Telemann, 'Neues musicalisches System', 1743)

'Temperaments' are closed systems designed to help make the intonation of instruments with immovable pitch (like the organ and harpsichord) convincing. But singers and players of stringed and wind instruments have no such limitations—'temperament' is too rigid a concept to apply to them.

Since keyboard temperaments have been studied and discussed for some time, it seems odd that the intonation of singers and orchestral instruments has had very little attention. It is a subject that is much harder to treat quantitatively, as it depends so much on context. Playing 'in tune' is a relative and very personal affair, and no set of rules or abstractions from practice can possibly encompass its complexities, or substitute for an alert ear and a willing spirit. But certain basic assumptions of a singer or violinist in the 17th and 18th centuries concerning intonation were quite different from ours, and an understanding of them is not only useful in every day ensemble work, but adds an unexplored expressive element to Baroque and Classical performance. Ultimately, using the available historical information, early musicians must work out this question for themselves.

The appendix to this article therefore presents extensive extracts from original sources on non-keyboard tuning.

Historic expedients to the tuning problem

It is a troublesome physical fact that it is not possible, either in theory or practice, to combine both pure 5ths and pure major 3rds in the same tuning system. A series of four pure 5ths placed above each other (for instance, C-G, G-D, D-A, A-E) will produce a major 3rd (C-E) considerably wider than pure. This is called Pythagorean tuning, a tuning commonly used in the Middle Ages; the 5ths are pure, which means the 3rds are large—larger even than in equal temperament. A different system, mean-tone temperament, became common by the middle of the 15th century in response to the need for better 3rds. Mean-tone favours 3rds: in order to get them low enough, the 5ths must suffer by being tuned small.

Because of its one great advantage, practicality, equal temperament had some adherents even in the 18th century and before, but the attitude of one writer of the time was probably typical: it produced, he wrote, a 'harmony extremely coarse and disagreeable'. Sauveur in 1707 said equal temperament 'is used [only] among the least able instrumentalists, because it is simple and easy'.

By contrast, the most common tuning of the time was described by a number of writers, including Telemann and Quantz, and was engagingly summarized by the singer and musical theorist Pier Francesco Tosi, who wrote in 1723:

Everyone knows that there is a Semitone Major and Minor, because the Difference cannot be known [i.e. played] by an Organ or Harpsichord, if the Keys of the Instrument are not split. A Tone, that gradually passes to another, is divided into nine almost imperceptible Intervals, which are called Comma's, five of which constitute the Semitone Major, and four the Minor. . . . If one were continually to sing only to those above-mentioned Instruments [the organ and harpsichord], this Knowledge might be unnecessary; but since the time that Composers introduced the Custom of crowding the Opera's with a vast Number of Songs accompanied with Bow Instruments, it becomes so necessary, that if a Soprano was to sing D-sharp, like E-flat, a nice Ear will find he is out of Tune, because this last rises. Whoever is not satisfied in this, let him read those Authors who treat of it, and let him consult the best Performers on the Violin.

Among Quantz's many comments on tuning, he explained that

What led me to add another key not previously used on the flute was the difference between major and minor semitones. . . . The major semitone has five commas, the minor only four. For this reason, Eb must be a comma higher than D♯.

From our perspective in the late 20th century, we are introduced here to two rather startling concepts:

1. the existence of major and minor semitones (a D♯ different from an Eb, for instance);
2. the possibility, therefore, that on some notes the harpsi-
The musical amateurs (1755). Oil painting by Julius Quinkhard (Amsterdam, Rijksmuseum)
chord or organ might be tuned differently than the other members of an instrumental ensemble.

A system that differentiates between half-steps, according to their harmonic function, suggests refinements unknown to our ears, which have grown accustomed to a mere 12 notes to the octave. But as far as Quantz was concerned in 1752,

Appreciation of [this difference between flats and sharps] is needed by anyone who wants to develop a refined, exact and accurate ear in music.

Modern players usually raise sharps and lower flats to enhance their melodic function as leading, or 'tendency' notes. This practice has its roots at the beginning of the Romantic period with the rise of equal temperament, and is the reverse of the normal practice of 17th- and 18th-century musicians, for whom leading notes were low. Our contemporary preoccupation with melody is apparently recent; a stronger harmonic orientation and more 'vertical' awareness naturally tends to favour the pure major 3rd (which is much smaller than the beating, unresonant equal-tempered one).

The pure 3rd is an interval that is both natural and very satisfying to play, and, indeed, most modern musicians seem to gravitate towards it, especially string players tuning to their open strings. But pure 5ths are even easier and yet more tempting to tune on a stringed instrument. Since the end of the 18th century, therefore, 5ths have usually won out over 3rds in string intonation (compare the Pythagorean system, with its perfect 5ths and high 3rds). Rameau (1737), Quantz (1752, chap.17/4) and Sorge (1744, p.53) indicated that some violinists in their day were also inclined to pure 5ths (see appendix for these texts), but they considered this a mistake and associated it with poorer players. They reasoned that a violin tuned to perfect 5ths would be out of tune with the harpsichord or organ, but the deeper implication was that it would also be unsuited to the general intonation system of the period. As John Hind Chesnut wrote (p.271):

Modern intonation practice . . . is not appropriate if our goal is to play Mozart's music as he himself wanted it played. The quasi-Pythagorean 'expressive' or 'functional' intonation of 19th- and 20th-century non-keyboard instruments is particularly foreign to the tradition in which Mozart stood.

**Tempering and 'intoning justly'**

We are not dealing here with a closed tuning system based on a circle of 5ths like a keyboard temperament. Sources discussing non-keyboard intonation usually only expressed the general principle that flats were a comma higher than sharps. This says nothing about the naturals; it implies a general system but does not indicate any specific temperament.

Quantz wrote:

. . . the other instruments play [the notes] in their correct ratios, whereas on the harpsichord they are merely tempered.

'Merely tempered' is the key phrase here. If we use both D♯ and Eb, G♯ and Ab, etc., we will need more than 12 notes in an octave. These different enharmonics are available for the singer or violinist, who is able to adjust intonation while performing, but keyboard players (unless they have instruments with split keys) are forced to resort to complicated systems of temperament.

'Temperament' in this sense means 'compromise', an expedient that attempts to make the best of the fact that only one note can be played when two are needed. It is an artifice that gives the illusion that a keyboard instrument is as well in tune as the other instruments when played by musicians with the 'refined, exact and accurate ear' of Quantz's time.

For non-keyboard instruments, in fact, 'temperament' is not even possible. Without a fixed tuning, intonation is influenced by technical situations, subjective perceptions, even differences in dynamics. Players of such instruments are incapable (even if they wanted it) of the level of consistency in intonation implied by a temperament.

But although they are not bound by any closed system, it would still be useful to see how original descriptions of their tuning might be roughly fitted into a keyboard system, since they normally perform with harpsichords or organs. A keyboard temperament can also operate as a frame of reference or model, from which singers and players of instruments with flexible intonation can occasionally depart in the context of the moment. Ideally, a 'synergetic' relationship will exist, in which the keyboard is first tempered as closely as possible to the physical and musical needs of the other instruments, who in their turn refer back to it for guidance.

By definition, we can deduce that a tuning that distinguishes between enharmonic pairs, with sharps being a comma lower than flats, does not resemble either equal temperament or the Pythagorean system (in which sharps are higher than flats). If it is a system at all, it must be closer to either just intonation or some form of mean-tone.

Just intonation 'has always had a kind of fatal fascination for musicians because of the purity within the
basic scale of the tonic, subdominant, and dominant chords, and of certain melodic intervals that can be easily tuned to the open strings. Some early violin tutors indicate the use of a kind of just intonation, flexibly applied in a limited way (see appendix Rameau (1726) and Tartini (1754, pp.100–101)). But just intonation is a kind of ‘holy grail’ that is impossible to apply continuously, although ingenious attempts at it have been made. As Barbier put it,

The bulk of the violinists [in c.1730] were probably still accustomed to the just thirds and greatly flattened fifths of mean-tone temperament.

The line between just and mean-tone need not, of course, be strictly drawn on instruments whose tuning is not fixed. Some string players begin with open strings tuned to somewhat narrow 5ths and tune intervals purely to the open strings. Wind players, too, tend to adjust long notes purely. Of any consistent system, this tuning most resembles 1/4-comma mean-tone (‘mean-tone’ in its strictest sense), in which 3rds are pure (as in just intonation) and 5ths are smaller than pure by a quarter of the syntonic comma.

But the difference between enharmonic pairs in 1/4-comma mean-tone is much greater than that specified by early sources (41 cents as opposed to 22). The consistent use of 1/4-comma mean-tone is not, therefore, what they describe. Georg Muffat (1698) even warned violinists to resist the temptation to play leading notes too low (sic).

Tosi said that ‘a Tone . . . is divided into nine . . . Intervals, which are called Comma’s, five of which constitute the Semitone Major, and four the Minor.’ (The ‘comma’ referred to here is just under 22 cents wide). An example of a major semitone would be C–Db, a minor would be C–C#. Since the first is five commas and the second four, the difference between them is one comma.

An octave, as Francesco Geminani wrote in 1751, can be divided ‘into 12 Semitones, that is, 7 of the greater and 5 of the lesser’. Since the seven ‘greater’ or major semitones each contain five commas and the five ‘lesser’ have four, the octave will consist of a total of 55 commas, or parts. The 55-part octave, as the sources quoted in the appendix show, was a familiar concept in the 17th and 18th centuries. It corresponds to a temperament known now as 1/4-comma mean-tone.

Written sources

The term ‘mean-tone’ was not used in the 18th century; in fact, like many commonly accepted assumptions, musicians were so unconscious of alternatives to a system that included major and minor semitones that it had no name at all.

Among the more interesting descriptions of non-keyboard tuning are those by Telemann and Quantz. Sorge (1748, p.61) said that Telemann’s tuning system ‘cannot be applied to a keyboard instrument, but it may be rather convenient for the fiddle and certain wind instruments, and is the easiest for singers’. Chesnut has pointed out that Mozart also apparently distinguished the small and large half steps of a mean-tone temperament similar to 1/5-comma. Major and minor semitones were discussed as late as 1813.

In his 1707 Méthode (p.206), Sauveur classes instruments according to their ability to alter their intonation: the voice and violin are in a class in which accurate intonation depends entirely on the ear, while the key-boards are in one where no control is possible during playing. The woodwinds fall in an intermediate class, and are among instruments . . . on which the pitch is governed by projections, toneholes or touchpieces, but that can be nevertheless corrected by a sensitive ear.

A number of woodwind fingering charts from the end of the 17th to the end of the 18th century confirm the use of higher pitches for flats and lower for synonymous sharps, although the exact difference is not specified. Recorder charts are the most informative, since the instrument’s inflexible blowing technique requires alternative fingerings for correcting intonation. Among the many fingering charts that appeared for the recorder from 1630 to 1795, the earliest often choose only one of the two enharmonic pairs. By 1700 complete chromatic charts began to appear that distinguished most pairs, especially the d#/eb’. The most interesting charts were those by Johann Christian Schickhardt (c.1720), which distinguished g#'/db” and Thomas Stanesby Jr (c.1732), that distinguished every chromatic note.

To a lesser extent, traverso charts also offer useful information; Quantz’s additional key indicates that tuning corrections were more limited on the traverso than on the double-reed instruments (to which such keys were never added).

Although embouchure adjustments make the oboe’s intonation relatively flexible, most oboe charts indicate alternate fingerings for some sharps and flats, from the earliest existing chart (Bismantova, 1688) to at least 1816 (Whitley). The synonymous pairs that are given the most alternate fingerings are the ‘left-hand’ notes G#/Ab and A#/Bb (illus.1 and 2). The development of

3 Pages 54-5 from Georg Andreas Sorge's Gesprächt zwischen einem musico theoretico und einem studioso musices (Lobenstein, 1748)
double holes on the oboe and recorder has an obvious application for ‘intoning’ enharmonic pairs. On both instruments they affect the most ambiguous pair, G#–Ab.\(^9\)

Bassoon fingering charts also distinguished enharmonic pairs.\(^7\) Towards the end of the century, however, keys began to be added whose purpose may have partially been to obscure these distinctions.\(^8\)

**Regular versus irregular temperaments**

As Telemann wrote of his tuning system (1743/4), ‘It establishes a continuous proportional equality between intervals . . .’ This implies something similar to a standard ‘regular’ mean-tone temperament, defined by Barbour as one ‘in which all the fifths save one are the same size’.\(^9\)

An interesting attribute of ‘regular’ mean-tones is the ease with which standard transpositions can be made, since intervals are identical in strategic keys. This would explain how German composers like Bach and Telemann were able to function in mean-tone while using Chor-Ton and Cammer-Ton simultaneously.\(^10\) ‘Transposing’ instruments were a part of life for German musicians at this time. Parts for transposing instruments were notated in different keys from the majority of the parts, because they were ‘pitched’ differently (being tuned to Chor-ton/Cammer-Ton). The ‘d’amore’ instruments and the violin piccolo also had transposed parts.\(^11\)

It is obvious that, however notes are notated or fingered, they should be at the same frequency for all the instruments of an ensemble. But the differences in key among transposing instruments were always either a major 2nd or a minor 3rd. Since in a regular mean-tone, parallel scales a major 2nd or minor 3rd apart would normally be inflected identically,\(^12\) their notes would have corresponded closely.\(^13\) Mean-tone tuning will therefore work with transposing instruments, as long as the keyboard instruments in such music are tuned in regular (rather than irregular) temperaments.\(^14\)

A model based on a regular temperament is relatively simple and easy to remember.\(^15\) Let us take ½-comma mean-tone as an example. Since most musicians nowadays use a Korg or similar tuning machine, the following table shows where its notes are placed in relation to equal temperament.\(^16\)

<table>
<thead>
<tr>
<th>Note</th>
<th>Cents from Equal Temperament</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0</td>
</tr>
<tr>
<td>C#</td>
<td>+5</td>
</tr>
<tr>
<td>D</td>
<td>+1</td>
</tr>
<tr>
<td>D#</td>
<td>+14</td>
</tr>
<tr>
<td>E</td>
<td>-2</td>
</tr>
<tr>
<td>F</td>
<td>+7</td>
</tr>
<tr>
<td>F#</td>
<td>+10</td>
</tr>
<tr>
<td>G</td>
<td>+3</td>
</tr>
<tr>
<td>G#</td>
<td>+16</td>
</tr>
<tr>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>A#</td>
<td>+9</td>
</tr>
<tr>
<td>B</td>
<td>-4</td>
</tr>
<tr>
<td>C</td>
<td>+5</td>
</tr>
<tr>
<td>Bb</td>
<td>+14</td>
</tr>
<tr>
<td>Cb</td>
<td>-8</td>
</tr>
<tr>
<td>Db</td>
<td>+14</td>
</tr>
<tr>
<td>Eb</td>
<td>+10</td>
</tr>
<tr>
<td>Fb</td>
<td>+16</td>
</tr>
</tbody>
</table>

Although a regular temperament might have been useful for the keyboard instruments, it is unlikely that other instrumentalists and singers adhered strictly to it, since the 3rds and 5ths would never have been completely pure. Irregular mean-tone systems, which favour selected keys at the expense of others, were no doubt also used together with non-keyboard instruments.\(^18\) There are clear expressive advantages to these tunings, in which modulations are more colourful.

But no system, regular or irregular, could possibly have been applied rigidly on the flexibly pitched instruments. The regular 55-part octave was no more than a convenient theoretical framework, and it can be used to advantage by present-day musicians with either a similarly tuned keyboard instrument or one tuned in an irregular temperament such as the well-known ‘Werckmeister III’ or ‘Tempérament ordinaire’.

**Reconciling the keyboard to the other instruments**

Discussing intonation, Hubert LeBlanc (p.55) commented that:

The divine artistry of Mr Blavet consists in adjusting [the tuning of his] flute by his manner of blowing. But students of the harpsichord praise the instrument for its intonation, not perceiving that it is in fact never truly in tune.

It is natural to refer to the keyboard instrument when intonation questions arise in an ensemble, since it is the only instrument with a fixed pitch. But fixed pitch has the defect of its virtue: when the music changes and demands tuning modifications, the keyboard cannot adapt as the other instruments can. It is a case of the immovable object and the irresistible force. There is little sense, for instance, in tuning the G# of a flute to a harpsichord with an Ab.

A number of sources (among them Sauveur, Tosi, Quantz, Telemann, Tartini, Sorge and Mozart) accepted
the fact that keyboards used different systems of tuning from other instruments.\textsuperscript{49} There are suggestions as to how the problem was solved. Huygens, Rameau (1726) and Sorge (1744, p.53; 1758) all assumed that the melody instruments should conform to the keyboard. On the other hand, Rameau (1737), Rousseau (1743) and de Béthizey considered it self-evident that (except for unison notes and final tonics) singers purposely ignored the temperament of the accompanying instruments. Quantz (1752, chap.17/vi/20) proposed a more diplomatic solution in which the fixed-pitch instrument also adapted to the other instruments.

In larger settings such as orchestras, a keyboard instrument is considerably less audible than the treble melody instruments. In the case of the harpsichord, the sound dies away quickly, while pure intervals are sustained by the other treble and bass instruments. De Béthizey and Quantz (1752, chap.16/7) suggest that singers and other players would thus do better to adjust to the violins and oboes rather than the harpsichord (compare also Tosi above).\textsuperscript{50} The problem is more acute for the other bass instruments, since they usually play in unison with a harpsichord or organ.\textsuperscript{51} There are a number of possible solutions.

The idea of a harpsichord or organ with split keys was mentioned by Tosi and Quantz; something similar was apparently used by Handel.\textsuperscript{52} With both D#/Eb and G#/Ab, the keyboard would have good major triads as far as B and Ab major, making it possible to venture into tonalities with as many as four sharps or flats and still keep the thirds relatively pure.\textsuperscript{53} For continuo playing, therefore, split keys clearly have a use.\textsuperscript{54}

Barbour (1951, p.191) suggests that, when key changes were limited, it was a historic practice to retune unsplit keyboard accidentals during a programme. It takes about as long to change a D# to an Eb on a harpsichord as to tune a section of violins.\textsuperscript{55}

Another solution is to use two harpsichords, one tuned (for instance) to sharps and the other to flats. Alternatively, one two-manual harpsichord can be used in this way.\textsuperscript{56}

Where frequent choices between enharmonics are necessary (i.e. when a wide range of keys cannot be avoided), another approach is suggested by several sources. Quantz's 'good temperament which allows either [synonymous flat/sharp] to be endurable' and Telemann's enharmonic pairs that are 'blended together' on keyboard instruments (1767) imply either the use of an irregular mean-tone or the splitting of the difference between the two or three trouble-making accidentals within the framework of a regular mean-tone system.\textsuperscript{57}

The latter compromise (which is necessarily rather colourless in character) might look on a Korg tuner like this:

\begin{verbatim}
C     +5 cents
C#    -8
D     +1
D#/Eb 0
E     -2
F     +7
F#    -6
G     +3
G#/Ab +1
A     0
Bb    +9
B     -4
C     +5
\end{verbatim}

This scale is based on $\frac{3}{2}$-comma mean-tone; C#, F# and Bb plus all the diatonic notes are left in their normal places (see previous table), and the difference between the two ambiguous flat/sharps is split.

\textbf{Some practical considerations}

Quantz gave some advice on practising intonation (1752, chap.17/vii/8). He advised (as did Leopold Mozart) the use of a monochord to players of melodic instruments.\textsuperscript{58}

The best manner of escape from [poor intonation] is the monochord, on which one can clearly learn the intervals. Every singer and instrumentalist should become familiar with its use. They would thereby learn to recognize minor semitones much earlier as well as the fact that notes marked with a flat must be a comma higher than those with a sharp in front of them. Without these insights one is obliged to depend entirely on the ear, which can however deceive one at times. Knowledge of the monochord is required especially of players of the violin and other stringed instruments, on which one cannot use the placement of the fingers as an exact guide, as one can on wind instruments.

In our time, we can add that we have all grown up in a prevailing atmosphere of approximate equal temperament, making the help of a reference beyond our ears even more necessary. There is a 'black box' on the market that functions much like a monochord; it is designed to play in any temperament the user wishes.\textsuperscript{59}

A player using mean-tone as a model is theoretically expected to have alternate flats and sharps available for every note, but in practice some accidentals are rarely used, since 18th-century music usually stays within the bounds of keys with four flats and sharps. One seldom
has to play the notes E♯, Fb, Gb, B♯, Bb etc. There are, then, three sets of enharmonic pairs that are usually ambiguous and need attention: Ab/G♭, Eb/D♯, and Db/C♯. The other notes (C, D, E, F, F♯, G, A, Bb, B) are normally always in the same place.

The less adaptable to different tonalities a temperament needs to be, the purer and richer it can be. Just intonation, the theoretical ideal, is practical in only one key; equal temperament works in all of them. When planning concert programmes, therefore, the choice of tonalities relates directly to the choice of keyboard temperament, and vice versa.

Conclusion

It should be clear by now why the concept of major and minor semitones is fundamental to 18th-century tuning practice, why it can cause problems between the keyboard and the other instruments, and how it logically leads to intonation models that resemble various temperaments known nowadays as 'mean-tone'. A closed system is artificial when applied to strings, winds and voices, but it can help players and singers understand how to work with the 'immovable object', a keyboard instrument with its fixed pitch, as well as provide them with a frame of reference with which to build a more expressive and 'harmonious' structure of intervals.

Bruce Haynes has been playing, making, teaching and writing about the Baroque oboe since the late 1960s.

1 Aside from his articles on temperament in New Grove, Mark Lindley has written an excellent historical survey of temperament and tuning in 'Stimmung und Temperatur,' Geschichte der Musiktheorie, vi: Hören, Messen und Rechnen in der Frühen Neuzeit (Berlin, 1987).

2 Patrizio Barbieri's excellent article 'Violin intonation: a historical survey,' Early Music, xix/1 (1991), pp.69–88, is a welcome exception. The present article will, I hope, complement it.

3 Fretted stringed instruments, whose intonation is a more specialized subject, are not treated in this study (see, however, LeBlanc (1740) in the appendix). Cf. M. Lindley, Lutes, Viols and Temperaments (Cambridge, 1984).

4 Other useful sources are cited and discussed in Barbieri.

5 See J. M. Barbour, Tuning and Temperament, a Historical Survey (East Lansing, Michigan, 1951), pp.1, 89.

6 In classic 3/4-comma mean-tone, 11 5ths are tuned one-quarter of a syntonic comma smaller than pure. This produces eight pure major 3rds. The placement of the twelfth 5th, known as the 'wolf', determines which tonalities are usable.


8 '... a son usage chés les Joueurs d'Instrumentes les moins habiles à cause de sa simplicité & de sa facilité.' Joseph Sauveur, Méthode générale (1707). The famous conversion of Rameau to a kind of equal temperament, recorded in his Génération harmonique (1737) was an interesting exception. See Lindley, 'Stimmung und Temperatur', pp.244–47.

9 The translation used here is by the oboist J. E. Galliard, who published an English version of Tosi's book in 1745 entitled Observations on the Florid Song. Tosi's book was still current enough in 1757 that it was translated by J. F. Agricola in Anleitung zur Singkunst. The words in brackets are mine.


12 See also Werckmeister (1691) in appendix. Barbieri (pp.70, 74) noted other indications of both pure-5th tuning and tempered open strings.

13 Cf. Leopold Mozart (1756) in appendix.

14 A violinst plays on an open string about 5 cents higher when playing forte than when playing piano. (This is the conclusion reached by the author and a Baroque violinist, in experiments using an electronic tuner.)

15 This inconsistency is the hobgoblin of a theoretician's "little mind" like Sorge (cf. Sorge (1744), p.33 in appendix). Boyden, 'Prelleur, Geminiani, and Just Intonation', p.202

16 See Boyden, 'Prelleur, Geminiani and Just Intonation', p.202. See also Boyden, 'Prelleur, Geminiani and Just Intonation', and Robert Bremner's Preface to J. G. C. Schetky's Six Quartetos, op.5, translated in full in N. Zaslav, 'The Compleat Orchestral Musician', EM (1979), pp.46–57. Bremner (a student of Geminiani) gives violin intonation exercises based on pure intervals. See also M. Lindley, 'Der Tartini-Schüler Michele Stratico,' Kongressbericht Bayreuth, Gioseffo Zarlino, 1588, Supplimenti musicali (Venice, 1981), chap.33–7, and Lindley, 'Stimmung und Temperatur', p.293. LeBlanc (1740), p.133ff. may also be discussing just intonation, to judge from his comments on the difficulty of modulations: "harpsichords are tuned with both major and minor semitones, which are nevertheless not exempt from problems when there is a change of key. This practice has been denounced despite its occasional benefits."

17 This is a well-known problem in choral practice, where intonation tends to be quite pure, leading the final tonic to a point remote from where it began. Sauveur also discusses this problem in his Méthode (1707), pp.206–7. A more complete discussion of the ramifications of playing in just intonation on a violin is presented in C. Moran, 'Temperament and Violin Intonation in Baroque Music' (unpublished paper, University of Montreal, 1986).

18 See Barbieri, pp.69–72.

19 Barbour, 'Violin Intonation', p.234. Barbour's article was written in response to Boyden's, and gives several convincing arguments for this statement (pp.232–4).

20 Many musical theorists also drew this line vaguely. See Lindley, 'Stimmung und Temperatur', p.293. As Barbieri put it (p.72), 'mean-tone can be considered a tempered just intonation . . .'

21 See Boyden, 'Prelleur, Geminiani and Just Intonation', p.215.

22 This is very close to the 'syntonic comma', which is 21.5062896 cents, and is incidentally the difference between the over-large major 3rd in Pythagorean tuning and a pure 3rd. See Lindley, 'Stimmung und Temperatur', p.591.

23 The placement of the twelfth 5th, known as the 'wolf', determines which tonalities are usable.

24 Smith was a respected astronomer. See Lindley, 'Stimmung und Temperatur', p.297.


and minor semitones, ½-comma mean-tone is the temperament that it most resembles.

Some writers, beginning in the early 17th century, conceived it in terms of the 55-part octave.

See W. A. Mozart (1785-7) in appendix. In Popoli di Tessagoli, 1746, bar 42, the voice has a Bb and an A# in the same bar; both the oboe and violin have A=G, though the piece is in C minor. The distinction between the two notes was obviously significant to Mozart.

See Busby (1811) in appendix. Sources that describe ¼-comma mean-tone, but which are not included in the appendix, include: Johann Mattheson, Der vollkommene Capellmeister (Hamburg, 1739), p.55; Johann Adolf Scheibe, Eine Abhandlung von den musicalischen Intervallen und Geschehnem (Hamburg, 1739); Daniel Gottlob Türk, Kurze Anweisung zum General-bassspielen (Leipzig and Halle, 1791).

This is reminiscent of Freilicon-Ponecin (1700) in the appendix.


Johann Christian Schickhardt, Principes de la flute (Amsterdam, c. 1720). Schickhardt also published 'L'Alphabet de la musique, a collection of sonatas for violin, traverso or recorder in 24 keys (1735).


Barbieri (p.82) notes, however, that Charles Delusse in L'Art de la Flûte traversière (c.1761) was apparently giving fingerings that produced sharps higher than flats (he cites Pierre Sechet). At the time, this was exceptional.


Both Quantz and Sorge indicated that woodwind players tuned their scales from the tonic note of the key in which they were playing rather than from an absolute pitch as given by a keyboard instrument. See Sorge (1758), p.9, par.14; Quantz (1752), chap.16/4. Fred Morgan recently made a beautiful recorder for me with a doubled third hole, making it possible to distinguish db more accurately from b.


See White, 'Early Bassoon Fingering Charts,' p.96 on Ozi (1787).

Barbour, Tuning and Temperament, p.xi. Many keyboard temperaments use more complex systems. In a regular mean-tone, any six keys related to each other by 5ths (Bb F C G D A, for instance), will contain appropriately tuned accidentals and identical scale intervals. In order to use other keys, accidentals have to be retuned. Chesnut believed Quantz was describing an irregular system for his harpsichord ('Mozart's Teaching of Intonation', p.260, citing Quantz (1752), chap.17/2/6/20), but in fact the discrepancy to which Quantz referred was between the harpsichord and other bass instruments. Thus it is quite possible that the 'bonne Temperature' that Quantz suggested for the harpsichord (chap.17/2/6/9) was a regular one.


Instruments built in consorts are normally tuned at the more compatible intervals of a 4th or 5th. Since in mean-tone conjunct 5ths are tuned similarly, a consort of instruments tuned in 5ths (F-C-F-C, G-D-G-D or even G-D-A) would be well in tune even when instruments were separately tuned starting on different notes. The 'damore' instruments, on the other hand (such as the voice-flute, oboe d'amore, flute d'amore and usually viola d'amore), are pitched a minor 3rd below their more standard counterparts. Looked at without consideration for how these instruments were used, certain notes that are low (from the individual player's point of view) might need to be high in the context of the rest of the group. Fingered Fl (IVv) on a flute or oboe d'amore, for instance (normally a low note), could as easily be a sounding Eb as a D#: fingered A=G (Vv) on a voice-flute (also very low, especially in the second octave, and a C on the normal F-treble) could be sounding Bb. Should these instruments be tuned differently from standard ones? There are numerous examples indicating that 'damore' instruments were often used principally for their ability to play in sharp keys. The basic key (i.e. six-fingered note) of an oboe d'amore or flute d'amore is sounding B major; that of a voice-flute is E. See Haynes, (1986), p.54. If such instruments were normally associated with sharp keys, it is unlikely that they would often have played a sounding Eb; the note would have normally been a D# and thus the fingered Fl (like the D#, inflected low) would have worked perfectly well.

Using ½-comma mean-tone in a range of six normal keys for the Cammer-Ton instruments (Eb Bb F C G D for instance), an organ at Chor-Ton a major 2nd higher would have been tuned with all the accidentals as flats to produce identical parallel intervals for the keys Db Ab Eb Bb F C. If Chor-Ton was a minor 3rd higher than Cammer-Ton, the same parallel intervals would have been obtained by tuning the organ to the keys C G D A E B, produced by tuning all the accidentals as sharps.

There would have been a slight difference in pitch. For the interval of a major 2nd, the difference would have been 4 cents (At d=410, 4 cents is about 1 Hz, which is negligible). The interval of a minor 3rd produces a pitch difference of about 5.5 cents, or about 1.5 Hz.

Although Neidhart (1732) and Sorge (1744, p.24) seem to be speculating on the use of irregular temperaments in these situations, Sorge (1748) strongly advocates what he calls a 'gleichschwebende Temperatur,' in which 11, not 12, 3rds are equal (pp.14, 34). A modern instance of 'transposition' is the use of portative organs designed to play alternately at d=440 and d=415 with movable keyboards. A semitone difference is much less practical in a regular mean-tone, such as ¼-comma, since an organ tuned to play the keys Eb Bb F C G D at d=440 would only be capable of playing the keys E B F# C D at d=415. If the keys Eb Bb F C G D were available at d=415, switching to d=440 would produce D A E B Fl.

The 3rd and the 7th, for instance, are always 7 and 9 cents below their placement in equal temperament.

Scales in the 18th century were traditionally tuned from C, not A (see Asselin, p.34, Chesnut, 'Mozart's Teaching of Intonation', p.268, and Boyden, History of Violin Playing, p.204). For string players, however, it is easier to tune to an open string. The table therefore gives A as 0.

Note that synonymous sharps/flats are always approximately a syntonic comma apart (i.e. between 21 and 22 cents—the actual figure contains decimal points that have been rounded off on one side or the other).

On this subject, see Heinichen (1728) and Rameau (1737) in appendix.

We should be less surprised by such a situation when we remember that from the nineteenth century to the present day, keyboard and non-keyboard instruments have characteristically been tuned according to different systems of intonation, the keyboard instruments being in equal temperament and the non-keyboard instruments usually in some form of quasi-Pythagorean tuning.' Chesnut, 'Mozart's Teaching of Intonation', p.257.

Organs are more audible because their notes do not decay quickly.

On this question see Quantz (1752), chap.17/2/6/20.

See Ellis (1750) in appendix. The keys that were split were D# and G#. Since it is in the regular temperaments that a choice is necessary between enharmonic equivalents, the use of split keys implies also the use of a regular temperament.

The practical limits would be E to Eb in major keys and E to F in minor keys.

Some history of the use of split keys can be found in Lindley, 'Stimmung und Temperatur', p.186; F. Hubbard, Three Centuries of Harpsichord Making (Cambridge, Mass, 1966), pp.35-6, 168; and Klop, p.12. As
might be expected, the two notes that seem to have been commonly split were D# and G#.

Barbour, *Tuning and Temperament*, p.191. But cf. LeBlanc (1740), who said ("On a harpsichord, one cannot correct [tuning] during a concert ...")(p.55) and "harpsichord or organ, which are tuned for a concert once and for all (and sometimes for a half year)" (p.133).

In this situation, ten of the 12 notes would normally be identical, and only D#/Eb and G#/Ab would be different. Sympathetic vibrations on the instrument would not, therefore, be significantly affected.

Rousseau suggested the same idea by dividing the wolf over the last three 5ths (thereby striking a mean between D#/Eb and G#/Ab) in the *Encyclopédie, ou Dictionnaire raisonné des sciences, arts et métiers*, ed. D. Diderot and J. Le Rond d'Alembert (1756). Barca's temperament also allows for irregular placement of chromatic notes and might therefore be similar to this one.

The oboist Michel Piguet of Basle, who has used a system similar to ½-comma mean-tone (with Rousseau's modification) for many years, has written a useful commentary on teaching historical intonation in 'Beispiele zur Intonationslehre im Unterricht', *Alte Musik; Praxis und Reflexion, Sonderband der Reihe 'Basler Jahrbuch für Historische Musikpraxis'*, (1983), pp.346–52.

The tuner is available from Widener Engineering, 203 Westbrook Drive, Austin TX 78746, USA. (Model 110—cheaper than a Korg, I believe—is recommended.)

On a woodwind instrument, only two enharmonic pairs need to be ambiguously tuned so the player has a choice: D#/Eb and G#/Ab. All four of these notes are regularly demanded when playing in standard Baroque keys. (Db is rarer, so tuning decisively to C♯ is usually desirable.) On a flute, G#/Ab can be adjusted with embouchure or alternate fingerings, but the fingering 123–456–7 (D#/Eb) gives a very decisive pitch because most of the tone holes are closed, there is relatively little leeway for adjusting breath pressure, and there is no alternate fingering. Hence the necessity of the added key.

G. C. Klop observed (in a lecture on harpsichord temperaments at Bruges in 1975) that tuning was usually discussed in 18th-century treatises under the heading of *composition*, since it was regarded as an expressive device.

Michel Corrette, 'Gamme du hautbois', p.51 in *Méthode raisonnée pour apprendre aisément à jouer de la Flûte Traversiere ... Nouvelle édition ... augmentée de la Gamme du Haut-bois ...* (1776). Paris, Bibliothèque Nationale (rés.337). Corrette shows F♯'s "à l'italienne" and "à la française"
APPENDIX: SOURCES

[1690s; manuscript]. Christiaan Huygens, Oeuvres complètes (The Hague, 1888–1950), xx, pp.73–4

Mais la voix ajuste tout cela, au moins quand on chante sans etre accompagné de quelqu’un de ces instrumens à tons fixes. But a singer adjusts all [these varieties of temperament], at least when singing without the accompaniment of an instrument with fixed pitch.

1691 Andreas Werckmeister, Musicalische Temperatur (Frankfurt-on-Main and Leipzig), p.3

Wenn alle Quinten rein gestimmt würden/wolte schon eine uneine Folge der Consonantie entstehen.' If the 5ths are tuned purely [on a violin], the result will be impure intonation.


J’ay remarqué que les défauts de ceux qui Jouent faux pro-viennent la plus part, de ce que des deux touches qui ensembles composent le semiton (par exemple le mi, & le fa; a & b; h & c; ou g & g; c & d; g & a & c.) Jamais il ne prennent le mi, ou la dièse # assez haut; ny le fa ou le b mol assez bas.

1700 Jean-Pierre Freillon-Poncein, La Véritable Manière d’apprendre à jouer en perfection du haut-bois, de la flûte et du flageolet (Paris), p.9

Je ne parle point icy de la difference qu’il y a des demy tons majeurs ou mineurs, parce que aux Instrumens où l’oreille conduit les sons, on peut les faire tous égaux; ainsi la trans-position sur toute sorte de demy ton se peut executer avec autant de justesse que sur le naturel.


Le système tempéré de 55 comma . . . est celui dont les Musi-ciens ordinaires se servent . . .


On a vû dans l’Hist. de 1709 que M. Sauveur qui a proposé un systeme tempéré de Musique, par lequel il divise l’Octave en 43 parties égales, croyait n’avoir que deux autres systemes raisonnables à combattre, l’un de M. Huguens qui divise l’Octave en 31, & l’autre du gros des Musiciens qui la divisent en 55. In the 1709 issue of the Histoire we saw that M. Sauveur proposed a tempered musical system that divides the octave in 43 equal parts, and that only two other systems offered any reasonable competition: one by M. Huguens [Huygens] that divides the octave in 31, and the other used by the majority of musicians, that divides it into 55 . . .

1723 Pier Francesco Tosi, Opinioni de’ cantori antichi e moderni, chap.1, par.15

[See quotation in article above.]
1726

Jean-Philippe Rameau, *Nouveau système de musique théorique* (Paris)

p.111:
[Singers need not follow the above tuning system] except when they are accompanied by instruments, to whose temperament they conform by virtue of their flexibility and the sensitivity of their ear.

p.110:
Les habiles Musiciens scavent profiter à propos de ces différents effets des Intervales, & font valoir par l'expression qu'ils en tirent, l'alteration qu'on pourroit y condamner.

1728


... in today's good temperaments (I am not referring to old organs) the keys with two or three flats or sharps in their signatures emerge, especially in the theatrical style, as the most beautiful and expressive. For this reason I would not even support the invention of the long-sought clavier in just intonation were it to become practicable. But that the affect of Love, Melancholy, Joy, etc, belongs to specific keys, I cannot accept.

1730

Peter Prelleur, *The Modern Musick-Master* (London), section on the violin, p.4

Note also that as G-sharp & A-flat, or A-sharp & B-flat, or also D-sharp & E-flat, etc, are not the same Notes you must not stop them with the same Finger. [See illus.5. Note that flat notes are higher than the corresponding sharp notes.]


1732; 2/1734

Johann Georg Neidhart, *Gänztlich erschöpfte mathematische Abtheilungen des diatonisch-chromatischen temperirten Canonis Monochordi* (Königsberg)

Wären denn die Hautbois, Flöten, u.d.g. ... nach derselben eingerichtet, so müsste nothwendig Chor- und Cammer-Ton durch und durch auf das reinste zusammen stimmen ... If oboes, flutes and the like ... were all tuned to [equal temperament], Chor- and Cammer-Ton would naturally blend together throughout in the purest way ...
Hubert LeBlanc, Défense de la basse de viole (Amsterdam)

p.54:
De tant de Tierces que ... qualifie être si aimables, vous [le Clavecin] & l'Orgue en avez les trois quarts de fausses. Une Oreille fine ne sauroit chez vous entendre le joueur (pour rendre justice à deux qu'il y a d'habiles), qu'en s'imposant silence sur le défaut de justesse dans l'Instrument, & au rapport que fait l'oreille de tant d'accords qui impatinent l'Auditeur délicat, plutôt que de le flatter.

p.55:
[On a harpsichord,] on n'a pas la faculté d'y retoucher [l'accorde] dans un Concert, au-lieu que sur les instrumens à Chevilles mobiles, on ajuste l'accord sur chaque Ton, où l'on va jouer, & non sur la selle à tous chevaux d'un Ami l'a donné.

L'Art divin de M. Blavet est de réparer sur la Flute, par le moyen de l'haleine modifiée. Ainsi les Ecolières de Clavecin, lorsqu'elles s'applaudissent qu'il est toujours d'accord, ne sentent pas qu'il n'y est jamais.

Of the many 3rds that ... are considered so reasonable, three-quarters of yours [the harpsichord's] and the organ's are false. A nice ear would only be able to listen to someone play you (to be fair to two who are capable) by ignoring the defect of the instrument's intonation and the discord that is heard in so many harmonies, that vex the fastidious listener rather than gratifying him.

p.104:
Celui qui croit que les différentes impressions qu'il reçoit des différences qu'occasionne le Tempérament en usage dans chaque Mode transposé, lui éleve le génie, & le portent à plus de variété, me permettra de lui dire qu'il se trompe; le gofit de variété se prend dans l'entrelacement des Modes, & nullement dans l'alteration des intervalles, qui ne peut que déplaire à l'Oreille, & la distraire par conséquent de ses fonctions.

To those who believe that the different impressions they receive are caused by the difference in temperament in each transposed key, giving each a special character and thereby providing more variety, permit me to tell them that they are mistaken; variety has its origin in the blending of keys and not in the modification of intervals, which can only displease the ear, thus distracting it from its [proper] work.
Mais la Basse de Viole est tirée de pareil par le changement dans moins ne sont pas exempts de jurons dans les changements alors sur l’Orgue du b après le choix du Ton dans lequel on entre, lorsqu’on passera ou se trouvent les demi-Tons des deux espèces, lesquels nean- de Tons a d’autres. On s’est désisté de cette pratique comme comme sur le Luth, anéanti le défaut d’avoir des Touches, car son accord facile à mouvoir. On commence à accorder par

qu’il s’attirent les demi-Tons, se prouve de ce qu’ils ne tiennent sur le Son due demi-Ton donné.

Mais sur la Viole la Cheville mobile point trop multipliée, comme sur le Luth, anéanti le défaut d’avoir des Touches, car elle le répare en accordant à chaque Ton sur lequel on va jouer.

Si l’on regarde l’Objection comme non résolue, parce qu’après le choix du Ton dans lequel on entre, lorsqu’on passera du b quarré au b mol, la difficulté reste entière à l’égard des demi-Tons Majeurs remplacés par les Mineurs.

Je réponds que cela prouve que la fausseté vient d’ailleurs que des demi-tons Majeurs & Mineurs, ils sont un objet trop peu considérable.

La preuve de leur peu d’influence est, qu’il y a des Clavecins où se trouvent les demi-Tons des deux espèces, lesquels néan- moins ne sont pas exempts des juremens dans les changements de Tons à d’autres. On s’est désisté de cette pratique comme d’un léger avantage.

L’Objection du demi-Ton tire tout son degré de considération du cas où il devient le Ton capital dans lequel on joue alors sur l’Orgue et le Clavecin, il est un jurement perpétuel. Mais la Basse de Viole est tirée de pari par le changement dans son accord facile à mouvoir. On commence à accorder par ut sur le Son due demi-Ton donné.

Au contraire dans le Discours Musical, le peu d’attention que s’attirent les demi-Tons, se prouve de ce qu’ils ne tiennent lieu que de particules de liaison conjonctives, ou de transition, telles que car, néanmoins, &c. Sur lesquelles l’esprit n’appuie pas, comme dans la chute sur un Ton, lorsque le sens finit.

Il faut donc tirer d’ailleurs la raison de décider.

Ce sera des Tons Majeurs & Mineurs transposés de leur ordre naturel dans l’Octave. Car les cinq Tons entiers qui en forment plus des deux tiers, ne gardent pas une distance égale de l’un à l’autre; & lorsqu’on change de Ton, il se fait un boule-versement général, les Tons les plus espaçés viennent à être remplacés par de plus voisins, ceux qui ont une moyenne espaces sont relevés de sentinelle par d’autres qui en ont une plus grande ou une moindre à garder, il s’enfuit des juremens exécrables sur les Instruments, qui n’ont pas le secours des Che-

villes mobiles, ou qui manquent pour les modérer d’une haleine aussi judicieusement employée que celle de Mr Blavet.

A ainsi chaque fois qu’on change de Ton, le déplacement des parties met tout sans-dessus dessous dans la première Octave, & les autres qui en font la répétition.

A gentleman who plays the gamba a little remarked that as the instrument has frets, it is inferior to the cello, which has none: this causes it, he says, to be unable to distinguish or govern the choice of major and minor semitones.

To answer this serious imputation, it should be pointed out that on the gamba the existence of frets is hardly the same as being split up into fixed semitones, as on a harpsichord or organ, which are tuned for a concert once and for all (and sometimes for a half-year).

For the gamba’s tuning pegs, not being overly complex as on the lute, overcome the defect of fretting by being tuneable in whatever key one plays.

But it may be objected that the problem is still unresolved, since even after choosing the key in which one is to play, the mode may change from major to minor, requiring minor semitones rather than major.

My answer is that this proves that bad intonation derives not from the major and minor semitones, since they are of themselves of little consequence.

The proof of their nominal influence can be seen in the fact that harpsichords are tuned with both major and minor semitones, which are nevertheless not exempt from problems when there is a change of key. This practice has been renounced despite its occasional benefits.

The problem in using semitones derives from the cases in which it becomes the tonic note in which one plays, and in the case of the organ and harpsichord it is a perpetual curse. The bass viol, however, escapes this difficulty because it can change its tuning easily. It tunes a scale from any given tonic, regard-

less of which semitone it may be.

During the act of playing music, on the other hand, the slight attention that is accorded the different semitones proves that they merely serve the purpose of conjunctive or transitive particles, such as ‘for’, ‘nevertheless’ etc. They hold the attention no more than the last fall of a note when a phrase comes to its end.

The cause must arise elsewhere.

It is the juxtaposition of the natural order of the major and minor semitones within the octave. For the five whole tones that comprise more than two-thirds of the octave are not placed at equal distances from each other, and, when the key changes, this produces a general confusion, as the larger intervals are replaced by smaller ones, and those that guarded a medium-sized interval are relieved of that function by others that were intended to serve for a smaller or larger one. Consequently, the most hideous oaths escape the instruments that are not provided with tuning pegs, or that are unable to moderate their pitch by means of breath pressure, employed as judiciously as is done by Mr Blavet.

Each time there is a modulation, in other words, the relationships of the semitones is jumbled in the first octave, and consequently the others that are tuned to it.
1743


p.716:  
Mein System hat keine Claviermassige Temperatur zum Grunde, sondern zeiget die Klange, so, wie sie auf uneingeschränkten Intrumenten, als Violoncelli, Violinen etc, wo nicht völlig, doch bey nahe, rein genommen werden können, welches denn die tägliche Erfahrung lehret.

My system is not based on any keyboard temperament; rather, it displays the sounds found on unrestricted instruments like the cello, violin etc, that can play purely (if not always entirely, nearly so), as day-to-day experience teaches.

p.718:  

It brings about a universal proportionate equality among the intervals... Only a dozen years ago, I myself still believed that the hearing of some of these harmonies would cause one to reach for the smelling salts. But experience has taken this error from me, and shown that C#-Eb and Ab-Cbb taste of the same spice.


La mécanique du tempérament introduit dans la modulation des tons si durs, par exemple le re et le sol diesis, qu’ils ne sont pas supportables à l’oreille... La voix ne se conforme jamais... à moins qu’elle n’y soit contrainte par l’unisson des instrumens.

In modulations, the mechanisms of temperament cause such unpleasant notes, for example D and G#, that they are impossible to listen to... Singers never conform to them... except when forced to do so at points where they are in unison with the instruments.

1744

Georg Andreas Sorge, Anweisung zur Stimmung und Temperatur sowohl der Orgelwerke, als auch anderer Instrumente, sonderlich aber des Claviers (Hamburg)

p.24:  
... die andere [temperament with unequal division of the comma] möchte sich zum musizieren im Cammer-Ton, wenn die Orgel im Chor-Ton steht, besser Schicken, denn da wird der Modus As dur oft, E dur aber wohl gar nicht gebraucht. Ingleichen kommt Es durgar oft, H duraber gar nicht vor. Wiedерum muss B dur oder auch D dur oftmals herhalten, da hergen Fis dur nicht leicht erscheinen wird.

[He gives two versions of an irregular temperament; he says that]... die Waldhörner aus dem Es wie auch die Oboen werden ganz wohl mit dieser Temperatur zufrieden seyn.'

... the other [temperament with unequal division of the comma] may work better when playing in Cammer-Ton with an organ in Chor-Ton, since the key of Ab major is often used but E major practically never.' Likewise, Eb major appears quite frequently but B major almost never. Again, Bb major or also D major will often appear, while on the contrary one rarely sees F# major.

[He gives two versions of an irregular temperament; he says that]... the horns in Eb and also the oboes will be quite satisfied with this temperament.

p.35:  
So dann fange man im f, an, und stimme solches nach Belieben in Chor- oder Cammer-Ton, nachdem das Clavier beschaffen ist, etwa nach einer Flute douce oder Traveriere [sic].

One begins then on f’ and tunes in Chor-Ton or Cammer-Ton (depending on in which the harpsichord is tuned) approximately to the pitch of a recorder or traverso.

p.53:  
Die Floten, sowohl die Traversen als die Flutes douces, sind bis dato mit einer gar schlechten Temperatur versehen, und hätten die Herren Pfeifenmacher hohe Ursache, sich um die Lehre der Canonic und Harmonic mehr als andere Musici zu bekümmern, oder doch ihre Instrumente so viel immer möglich nach einer wohl temperirten Orgel zu stimmen und einzurichten.

Flutes, both traversos and recorders, have been provided until now with a very bad temperament, and the gentlemen who make them have more need than other musicians to concern themselves with the acoustics of music, or at least to tune and regulate their instruments as closely as possible to a well-tempered organ. On traversos, the F, G# and B are generally the
Auf den Traversen fehlt es gemeiniglich am f, gis und b am meisten. Ich glaube aber, es sey gahr wohl möglich auch diesen Tonen ihr behöriges Recht zu thun. Mit den Flutes douces siehet es noch schlimmer aus, und sind auch noch übler zu zwingen als die Traversen. Doch halte dafür, dass sie in der Stimmung zu verbessern sind. Wenn nur die Pfeifenmacher erst Harmonici wären, hernach solte es sich auch schon mit ihnen geben.

Die Oboes sind auch noch nicht mit der besten Temperatur versehen. Sol ihnen geholfen werden, so muss ein Harmonicus, ein guter Oboist und ein Pfeifenmacher bey einer wohl temperirten Orgel zugleich Hand anlegen. Der Oboiste und Pfeifenmacher aber dürften nicht eigennützig sein, sondern müssen Raison annehmen und spitzige Ohren zum Werke bringen. Und solches ist auch von denen Floten zu verstehen.

Die brauchbaren und unentbehrlichen Geigen habens am besten, jedoch müssen ihre 3 Quinten behörigemassen temperate [sic] gestimmet werden, so dass sie ein klein weniges abwerts schweben, sonst kommen sie, wenn z.B. im g angefangen, und solches mit der Orgel volkommen rein gestimmet worden, mit a, und e, ein merkliches zu hoch, wenn sie nämliclch alle 3 Quinten ohne Schwebung rein stimmen wolten. Das übrige kommt auf ein gutes Gehör und reinen Griff an . . .

Sorge also advises singers to follow the keyboard temperament (p.55).

1748 Georg Andreas Sorge, Gespräch zwischen einem musico theoretico und einem studioso musices (Lobenstein)

p.21: Mit einem Wort: Die Silbermannische Art zu temperiren, kan bey heutiger Praxi nicht bestehen.

p.51: Besser gefällt mir das berühmten Herrn Capellmeister Telemanns Systema Intervallorum, als welcher die Octav in 55. geometrische Abschnitte (Commata) die von Stufe zu Stufe kleiner werden, theilet.


p.58: Oh! wie mancher Geiger fängt seine Partie anzuspielen, und hat nicht einmahl seine Geige behörig gestimmet, wo will denn hernach die Reinigkeit herkommen? . . o Blindheit, o! Unwissenheit! wie gross bist du noch in der musikalischen Welt an manchen Orten.

p.61: . . über Herrn Capellmeisters Telemanns Systema . . . Mich dünkt es sey gar schicklich, wenn man zu einer jeden Note worst offenders. But I believe that it should be quite possible to correct even these notes. The situation with recorders is worse yet, and they are even harder to control than traversos, though I believe they can be improved. If only flute-makers were also theoreticians, things would naturally go better.

The oboes are also not furnished with the best of temperaments. They could be helped if an acoustician, a good oboist, and a woodwind maker examined together a well-tempered organ. The oboist and woodwind-maker should not, however, be headstrong and obstinate, but Reason, together with sharp ears, should govern all. And the same goes for the flutes, of course.

The useful and indispensable fiddles are the best off; still, their three 5ths must be correctly [tuned], so they beat a little. Otherwise, if the 5ths are all tuned purely without beating, and (for example) the G is tuned exactly to the organ, the A and E will be noticeably too high [compared to the organ]. For the rest, everything depends on a good ear and accurate fingering . . .

In a word—Silbermann’s way of tempering cannot exist with modern practice."

The famous Herr Capellmeister Telemann’s Systema Intervalorum pleases me better, in which the octave is divided into 55 units, or commas, which become smaller from step to step.

. . . the [interval of a] ‘smallest second’ differs from a unison by the ninth part of a whole tone, or one comma. This same amount distinguishes also C$/Db$, D/Eb, D#/Eb, E/Fb, E#/F, F#/Gb, G#/Ab, A/Bb, B/Cb, B#/C and C/Db etc.

Oh! When so many fiddlers begin to play their parts without having even properly tuned their instruments, how will pure tuning ever be achieved? . . . Oh blindness! Oh ignorance! How great you remain in so many parts of the world of music.

. . . about Herr Capellmeister Telemann’s Systema . . . I would think that it would be more appropriate if each separate note
auch einen besonderen Klang oder Clavem bestimmt, und nicht einem Clavi zwey- bis dreyerley Noten zueignet, wie wir ietz in unsern Clavier thun müssen . . . Aufs Clavier wird sich dieses System nicht appliciren lassen;14 auf der Geige aber, und einigen Blase-Instrumenten, möchte es eher thunlich seyn; denen Sängern aber ist es am leichtesten.


I am indebted to Mr E. J. Hopkins, organist of the Temple, for furnishing me with a MS note made by Mr Leffler (d. 1819), organist of St Katherine's, then by the Tower, with Mr W. Russell, then organist of the Foundling, which describes the great peculiarity of this organ [Foundling Hospital, Glyn and Parker, opened by Handel in 1750 and played by him subsequently]. It had the usual 12 keys to the octave, but a means of altering the notes sounded by four of them. There was a slider with three rests above the draw stops on each side. When the sliders were at the central rest, the 12 notes were the usual 12 of the mean-tone temperament, $E\flat$, $F\flat$, $F$, $G$, $D$, $A$, $E$, $B$, $F\sharp$, $C\sharp$, $G\sharp$. If the left-hand slider were put full to the left, $E\flat$ must be a comma higher than $D\#$. If there were only one key on the flute, both $E\flat$ and $D\#$ would have to be played similarly, as on the harpsichord, where they are indicated with a sharp.


Geminiani recommended that beginners finger enharmonic twins at the same place on the neck of the violin, but said,

1752 Johann Joachim Quantz, Essai d'une méthode pour apprendre à jouer de la Flûte Traversière [in French and German] (Berlin; Eng. trans. 1966; 2/1987), chap.3 par.2, 3, 5, 8; chap.16, par. 4, 7; chap.17, sec. vi, par. 20; sec. vii, par.4, 8, 914

chap.3/5:
On verra par là, que les tons, étant indiqués par le b mol sont d'un Comma plus hauts, que quand ils sont marqués par un Diese.

chap.3/8:
Ce qui m'a porté à ajouter à la Flûte encore une Clef qui n'y a pas été auparavant, c'est la différence entre les Demitons majeurs & mineurs . . . Le Demiton majeur a cinq Comma; le Demiton mineur n'en a que quatre. Il faut par consequent qu'Es (mi b mol) soit d'un Comma plus haut que Dis (re Diese). S'il n'y avoit qu'une Clef sur la Flûte, il faudroit entonner l'un & l'autre, Es (mi b mol) & Dis (re Diese) de la même façon, comme on fait sur le Clavecin, où on les touche par une même touche; c'est à dire les deux intervalles sont temperés; desorte que ni Es (mi b mol) à $B$ (si b mol), comme la Quinte par en bas; ni Dis (re Diese) à $H$ (si), comme la Tierce en haut, n'accordent parfaitement bien. Pour marquer donc cette difference, &

From these tables you can see that the notes indicated with a flat are a comma higher than those indicated with a sharp.

What led me to add another key not previously used on the flute was the difference between major and minor semitones. . . . The major semitone has five commas, the minor only four. For this reason, $E\flat$ must be a comma higher than $D\#$. If there were only one key on the flute, both $E\flat$ and $D\#$ would have to be played similarly, as on the harpsichord, where they are played from the same key; so that neither $E\flat$ to $Bb$ (the ascending 5th) nor $D\#$ to $B$ (the descending major 3rd) would be well in tune. In order to make this difference clear, and to place the notes in their correct proportion, it was necessary to add another key. . . . It is true that this distinction is impossible to make on the harpsichord, where each pair of notes we wish to
entonner nettement les tons selon leur proportion, il était nécessaire d’ajouter encore une Clef. . . Il est vrai que cette différence ne peut pas être exprimée sur le Clavecin, où l’on touche tous ces tons qu’on distingue ici, sur une même touche, ayant recours à la Temperature ou Participacion. Cependant cette différence étant fondée dans la nature des tons, & pouvant être observée sans peine par les Chanteurs & les Joueurs d’instruments d’archet, il est juste de l’exprimer aussi sur la Flute, ce qui ne se peut sans l’autre Clef. La connaissance en est nécessaire à qui veut rendre fin, précis & net ce qui appartient à l’oreille dans la Musique. 16

chap.16/4:
Dans une pièce en mode Es (mi b mol) & As (la b mol), on peut accorder la Flute un peu plus bas qu’à tous les autres modes; les modes avec les b mol étant d’un comma plus hauts que ceux avec les diesés. 17

chap.16/7:
S’il se trouve que les Violons sont plus hauts que le Clavecin; ce qui peut aisément arriver, quand leurs Quintes sont accordées un peu trop haut, au lieu qu’elles l’ont l’être un peu plus bas, comme il faut que cela soit observé au Clavecin; ce qui cause en quatre Quintes qui sont ainsi accordées, une différence considérable: alors le joueur de Flute est obligé de se régler plutot aux Violons qu’au Clavecin, ceux-là se faisant entendre davantage que celui-ci. . . . cette faute ne se commet que par ceux qui traitent la Musique comme un métier, dans lequel ils ne trouvent pas un véritable plaisir, & non pas par des Musiciens raisonnables & expérimentés, qui aiment la Musique & qui jouent pour plaire à des oreilles délicates.

chap.17/vi/20:
Chaque joueur de Clavecin qui connoit la proportion des intervalles, saura aussi, que les Demi tons mineurs comme D (re) avec la dièse, & E (mi) avec le b mol, &c. diffèrent d’un Comma, & causent par conséquent sur cet instrument, où il n’y a pas des touches partagées, quelque inégalité dans l’intonation à l’égard des autres instrumens, qui donnent ces tons dans leur juste proportion. Cela est surtout sensible quand le Clavecin joue avec quelques uns de ces instrumens à l’Unisson. Or comme on ne peut pas toujours éviter ces tons-là, surtout aux modes où il y a beaucoup de dièses & de b mol; l’ Accomagnateur fait bien de les mettre au milieu ou dans la partie inférieure de l’accord, ou si un de ces tons fait la Tiers mineure, de l’omettre tout à fait. Car ce sont particulièrement les Tiers mineures, dont le ton est très imparfait & défectueux, lorsqu’elles se rencontrent avec la partie principale à l’Unisson dans les Octaves hautes. J’entends sous ces Tiers mineures principalement les tons C, D & E à deux lignes (ut, re & mi seconds de la Flute), quand il y a un b mol devant eux, ou pour dire brièvement, les tons Ces (ut b mol), Des (re b mol) & Es (mi b mol). Cependant j’y réfère aussi G & A à une ligne (sol & la premiers), & D & E à deux lignes (re & mi seconds), lor- qqu’ils sont précédés par un dièse; car étant des Tiers majeures, ils sont trop fort dans leur temperature & par con-

distinguish are produced with a single key, making it necessary to have recourse to tempering. But since this difference is based on the nature of the notes and can be produced without difficulty by singers and string players, it is reasonable to observe it on the flute as well (and this cannot be done without the extra key). Appreciation of this difference between flats and sharps is needed by anyone who wants to develop a refined, exact and accurate ear in music.

In pieces in Eb and Ab, the flute can be tuned a little lower than in all the other keys, the flat keys being a comma higher than the sharp.

If the violins should happen to be tuned higher than the harpsichord, which can easily happen if their 5ths are tuned a little wide rather than (as must be done on the harpsichord) a little narrow, the flute player is obliged to adjust more to the violins since they are more audible than the harpsichord. Tuning the four 5ths wide on the violin causes a considerable difference with the harpsichord . . . it is a mistake made only by those who consider music as a mere trade from which they derive no real satisfaction, not by thoughtful and experienced artists who love music and play in order to please refined ears.

Every harpsichordist who understands the proportion of intervals will also know that minor semitones like D–D♯ and E–Eb, etc, differ by a comma, and therefore cause on this instrument (unless the keys are split) certain intonation problems with other instruments that play these notes in their correct proportions. This is especially noticeable when the harpsichord plays with any of these instruments in unison. Now, since these notes cannot always be avoided, especially in keys with many sharps or flats, the accompanist does well to put them in the middle or lower part of the chord, or if such a note makes a minor third, to omit it altogether. For it is especially these minor 3rds that sound so imperfect and defective when played in unison with the principal part in the upper octaves. I am referring mainly to the minor 3rds when c′, d′ and e′ (the second-octave ut, re and mi on the flute) are preceded by a flat, or to put it more briefly, the notes db", db" and eb". I am also referring, however, to g′ and a′ (first-octave sol and la), and d" and e" (second octave re and mi) when preceded by a sharp, since as major 3rds, they are too wide in their temperament and therefore too high. It is true that this difference [in intonation] is not as clear when the harpsichord is played by itself, or when it accompanies a large ensemble. But when the notes are in unison with another instrument, the difference is quite audible, since the other
To tune the violin accurately, I believe one would not do badly to follow the same rule as for tuning the harpsichord, that is, with the 5ths a little narrow (and not entirely perfect, let alone a little wide, as commonly happens), so that the open strings will agree with the harpsichord. If one tries to tune all the 5ths purely or wide, the result will be that only one of the four strings will be in tune with the harpsichord. But if the A is tuned precisely to the harpsichord, the E slightly flat to the A, the D a little sharp to the A, and the G likewise to the D, the two instruments will be in tune together.

There are some players who have a very good ear and who can easily perceive false playing by others, but are unaware of committing the same mistake themselves, and would not know how to remedy it. The best manner of escape from this ignorance is the monochord, on which one can clearly learn the intervals. Every singer and instrumentalist should become familiar with its use. They would thereby learn to recognize minor semitones much earlier as well as the fact that notes marked with a flat must be a comma higher than those with a sharp in front of them. Without these insights one is obliged to depend entirely on the ear, which can however deceive one at times. Knowledge of the monochord is required especially of players of the violin and other stringed instruments, on which one cannot use the placement of the fingers as an exact guide, as one can on wind instruments.

If sub-semitones (to use their correct name) appear consecutively, in other words if a note lowered by a flat becomes transformed into the note just below it, raised by a sharp [or vice versa] . . . the note with a sharp is a comma lower than the one with a flat. [For example, G# should be a comma lower than Ab.] If these two notes are tied to each other (as in [ex.1]), one must draw back one’s finger a little for the sharp
Fig.6. il faut retirer le doigt un peu sur le dièse qui suit le b mol; 
autrement la Tierce majeure seroit trop haute contre la partie 
fondamentale.

Si au contraire le b mol suit après le dièse, v.Fig.7. il faut 
auprès de la note avec le b mol, avancer le doigt autant qu'on le 
retire dans l'exemple précédent . . . On observe la même chose 
tous les instruments, excepté au Clavecin, où l'on ne peut pas 
effectuer des Sous demi tons, & lequel pour cette raison doit 
avoir une bonne Temperature, afin qu'on puisse souffrir l'un & 
l'autre de ces tons. Sur les instruments à vent ce changement se 
fait par le moyen de l'embouchure, de façone que sur la Flute on 
hausse le ton en la tournant en dehors, & on le baisse en la 
tournant en dedans. Sur l'Hautbois [sic] & le Basson les tons se 
haussent, quand on avance l'anche plus dedans la bouche, & 
qu'on presse plus les levres ensemble; & ils deviennent plus 
bas, quand on retire l'anche & relache les lievres [sic].

Ex.1

Ex.2

1754   Jean Laurent de Béthizy, Exposition de la théorie et de la pratique de la musique (Paris), p.135

. . . comment la voix s'ajuste-t-elle au tempérament . . . d'un 
. . . instrument: Pour entonner la première note d'un air, elle 
se règle sur la note tonique du mode principal, telle qu'elle est 
rendue par l'instrument, & forme ensuite les differens interval-
les . . . sans égard à l'altération des notes que l'instrument fait 
etendre. . . . Lorsqu'un nouveau mode paroit, la voix est 
obligée de se conformer à la manière dont l'instrument rend la 
nouvelle tonique. . . . Si la voix & l'instrument forment ensem-
ble une tenue à l'unisson ou à l'octave, la voix est forcée de se 
conformer à l'instrument. . . . Quand la voix est accompagnée 
de plusieurs instruments, si l'un d'eux se fait mieux entendre 
que les autres, la voix se conduit, comme si elle n'était accom-
pagnée que de cette [sic] instrument. Si tous ou quelques-uns 
se font entendre aussi bien l'un que l'autre, la voix . . . ne 
s'ajuste au tempérament d'aucune [sic] d'eux, à moins que ce 
tempérament ne tienne le milieu entre les autres, mais se fait 
ailleurs un tempérament que lui est particulier.

1754   Giuseppe Tartini, Trattato di musica (Padua, R1966), pp.99-100

Di fatto il Basso organico rinchiude tutta l'armonia; e cantanti, 
e suonatori si accordano con l'organo per ben' intuonare. Ma 
organo, e clavicembalo (se non si moltiplichino i tasti a dismis-
ura) non hanno altro intervallo perfettamente accordato, se 
on la ottava; e quasi tutti gli altri intervalli di quinte, quarte, 
terze maggiori, e minore, tuoni, e semitoni sono accordati 
per discretivo temperamento, e non secondo la ragione, o sia 
following the flat; otherwise the major 3rd will be too high 
against the fundamental note.

But if, as in [ex.2], the flat follows the sharp, the finger must 
be advanced as much for the flat as it was drawn back in the 
preceding example . . . This same thing is done on all instru-
ments except the harpsichord, where the sub-semitones can-
ot be effected, causing it for this reason to have recourse to a 
good temperament which allows either note to be endurable.
On wind instruments, these changes are accomplished 
through embouchure corrections. On the flute, the pitch is 
raised by turning it outwards and lowered by turning it 
inwards. On the oboe and bassoon, the pitch is raised when 
the reed is advanced in the mouth and the lips are pressed together. 
It is lowered by withdrawing the reed and relaxing the lips.
forma dell'intervallo rispettivo. Dunque è impossibile l'uso della scala suddetta in precisione di ragioni, perché in tal necessario temperamento le ragioni restano alterate nella loro forma.

. . . Io nel mio Violino, dove suonando a doppia corda posso incontrar fisicamente la forma dell'intervallo, di cui è segno fisico dimostrativo il terzo suono, che deve risultare, ho il vantaggio per me, e per i miei scolari della sicura intonazione, e in conseguenza dell'uso reale della scala suddetta in precisione di ragioni. Bisogna però avvertire, che questa scale, benchè dimostrativamente dedotta, non è perfetta intieramente in ciascun possibile confronto delle note musicali costituenti . . .

1756

Leopold Mozart, *Versuch einer gründlichen Violinschule* (Augsburg)

p.66, note:
Auf dem Clavier sind Gis und As, Des und Cis, Fis und Ges, u.ff. eins. Das macht die Temperatur. Nach dem richtigen Verhältnisse aber sind alle die durch das (b) erniedrigten Töne um ein Komma höher als die durch das (#) erhöhten Noten.

p.69, note:
das (b) erniedrigten Töne um ein Komma höher als die durch das (#) erhöhten Noten. Z.B. Des ist höher als Cis; As höher als Gis, Ges höher als Fis, u.s.w. Hier muss das gute Gehör Richter seyn: Und es wäre freilich gut, wenn man die Lehrlinge zu dem Klangmasser (Monochordon) führte.

p.191:
Ich habe die Probe auf der Violin, dass beym Zusammenstreichen zweener Töne auch so gar bald die Terz, bald die Quint, bald die Octav u.s.f. von sich selbst auf eben dem nämlichen Instrumente dazu klinge. Dieses dienet nun zur untrüglichen Probe, womit sich jeder selbst prüfen kann, ob er die Töne rein und reichtig zu spielen weiss. Denn wenn zweee Töne, wie ich sie unten anzeigen werde, gut genommen und recht aus der Violin, so zu reden, heraus gezogen werden; so wird man zu gleicher Zeit die Unterstimme in einem gewissen betäubten und schnarrenden Laut gar deutlich hören: sind die Töne hingegen nicht rein gegriffen, und einer oder der andere nur um ein bisschen zu hoch oder zu tief; so ist auch die Unterstimme falsch.

1758


Sorge concludes that the comma described by Quantz is the same as Scheibe’s (1739) and Telemann’s (1742/3), as it is the only one that will fit exactly 55 times into an octave.

Betrachten wir dieses commatische System gegen das rational-gleich gestimmte Clavier, so finden wir einen beträchtlichen Unterschied . . .

Was nun hier von den Tonart C gesagt ist, das gilt bey allen übrigen Tonarten. Denn wir setzen voraus, dass ein Flotenist allemahl seine Flöte nach dem Grundtone derjenigen Tonart einstimmen müsse, woraus er spielt.
Hier scheint es nun, als wenn man zu wünschen Ursach hätte, dass das Clavier mit noch mehrern Tasten in der Octav möchte versehen werden. Allein wenn man erweget, dass der natürliche Sprengel einer Tonart so weit nicht gehe, dass die Abweichung ein ganzes Comma betrüge; und dass bey Aufführung eines Stückes es auch viel auf die Moderation des Flötisten ankomme: So wird man finden, dass es nicht ratsam sey, das Clavier mit noch mehrern Tasten zu versehen.

Wenn man auch bedenket, dass die Querflöte eben nicht 24 Tonarten nöthig habe, wie das Clavier, so kann man mit einer ungleichen Temperatur der Eubereinstimmung mit der Querflöte, in den meisten Tonarten, noch näher kommen, als mit der rational gleichen Temperatur.

Sorge gives an example for D major and compares it with Telemann's system; while it is close, it offers only D# and G#, etc, and so fails to solve the question of enharmonic equivalents. Sorge offers several other irregular temperaments, each adapted to a particular key, which, as he points out, obliges the flautist to limit strictly his choice of keys in a concert. He concludes with his own personal opinion that equal temperament would eliminate the need for enharmonic distinctions.

1767 Georg Philipp Telemann, *Letzte Beschäftigung G. Ph. Telemanns im 86. Lebensjahre, bestehend aus einer musikalische Klang- und Intervallen Tafel, in Unterhaltungen*, iii (Hamburg)

Man schmelzet beyde nahen Klänge [C#/Db] nach Veranlassung des Claviers in einen zusammen . . .

Dass des und és zween unterschiedene Klänge ausmachen, solches findet sich auch bey den Violinen, wo des mit dem 4ten, und és mit dem kleinen Finger gegriffen wird; desgleichen haben die Traversieren hierzu zwo besondere Klappen . . .


. . . in the . . . divisions of tones and semi-tones into infinitely minute parts, and yet always stopping on the exact fundamental, Signora Martinetz was more perfect than any singer I had ever heard: her cadences too, of this kind, were very learned, and truly pathetic and pleasing.


While not advocating equal temperament, Rousseau was very early in discussing the concept of ‘tendency notes’. In suggesting that B natural should be higher because it leads to C, he says:

Ceci, je le sais bien, est directement contraire aux calculs etablis et à l’opinion commune, qui donne le nom de semi-ton mineur au passage d’une note à son dièse ou à son bémol, et de semi-ton majeur au passage d’une note au bémol supérieur ou au dièse inférieur.

I know well that this is in direct contradiction to established reckoning and the general opinion, which gives to the passage of a note to its sharp or flat the name ‘minor semitone’, and to the passage of a note to its next-higher flat or next-lower sharp the name ‘major semitone’.

1777 F. de Castillon, ‘Flûte traversière à deux clés’, Diderot and d’Alembert, *Encyclopédie*, supplement

Castillon included an interesting comment that applies to the over-small interval between the low IV/IV# on all the woodwinds of the period (F/F# on traverso and oboe, Bb/B on recorder and bassoon):

. . . les flûtes de M. Quantz différent encore des autres par le tempérament. Ordinairement le fa des flûtes transversières est tant soit peu trop haut & le fa dièse est juste; dans les nôtres, au contraire, le fa est juste, & le fa dièse un peu trop bas. . . . Rarely, if ever, is music written in the key of F#,
ment, ou plutôt jamais, on ne compose une pièce en fa dièse, soit majeur, soit mineur; mais on en compose très-souvent en fa, majeur & mineur. Le fa dièse ne paroit donc guère comme fondamentale, & il vaut bien mieux l’altérer que le fa qui est la fondamentale d’un mode, non-seulement très-usité, mais encore un des plus beaux pour la flute; d’ailleurs, on peut forcer le fa dièse par le moyen de l’embouchure, mais le fa devient d’abord faux.

Wolfgang Amadeus Mozart

John Hind Chesnut (pp.263–71) has pointed out that from a close look at Thomas Attwood’s notes on his studies with W. A. Mozart in 1785–7, it is clear that Mozart’s normal concept of instrument tuning distinguishes the small and large half steps of a mean-tone temperament similar or identical to ½-comma. The usual discrepancy between keyboard and other instruments exists.


Barca wrote that to make the 5ths ½-comma smaller than pure was the

... temperamento per comune opinione perfettissimo, quale suole applicarsi alle quinte diatoniche...

... temperament considered generally as perfect, although it is usually applied [only] to the diatonic 5ths...

Tiberius Cavallo, ‘Of the Temperament of those Musical instruments, in which the Tones, Keys, or Frets, are Fixed, as in the Harpsichord, Organ, Guitar, &c,’ Philosophical Transactions of the Royal Society of London, lxxviii, p.238

When the harpsichord, organ &c is to serve for solo playing, and for a particular sort of music, it is proper to tune in the usual manner... when the instrument is to serve for accompanying other instruments or human voices, and especially when modulations and transpositions are to be practiced, then it must be tuned according to the temperament of equal harmony.


[Players of instruments with flexible tuning] when unembarrassed by the harpsichord... [should not temper their scales] but keep it as perfect as possible throughout; and a violin performer is sensible of violence and constraint when he accompanies a keyed instrument into these unfrequented paths.

Thomas Busby, Universal Dictionary of Music (London, 4th edn)

As late as 1813, Busby discusses major and minor semitones, and states that temperament is applied:

in order to remedy, in some degree, the false intervals of those instruments, the sounds of which are fixed; as the organ, harpsichord, pianoforte, &c.
'Quoted in Lindley, 'Stimmung und Temperatur', p.263

'It is interesting to compare this with Rameau's diametrically opposed later statement on the same subject. See Rameau (1737), p.104.

'Lindley, 'Stimmung und Temperatur', pp. 245-6 thinks Rameau is probably discussing %-comma mean-tone here.

'Quoted in Lindley, 'Stimmung und Temperatur', p.245

'Quoted in Lindley, 'Stimmung und Temperatur', p.246

'Michel Blavet (1700-1768) performed at the Concert Spirituel more frequently than any other performer, and was unanimously praised for his tone, intonation and technique. See N. Zaslaw, 'Blavet, Michel', New Grove.

'Telemann's system is discussed in Sorge (1748) and (1758). In (1758), pp.2-5, Sorge equates Quantz's temperament with that described by Scheibe and Telemann, and discusses the 'Comma tele-
mann', which Telemann himself says is half that of 'mean-tone'. (As noted above, in %-comma mean-tone—'mean-tone'in its strictest sense—the difference between flats and sharps is indeed about twice that in the 55-part octave.)

'Translation by Carlo Novi

"J. S. Bach's surviving cantatas do not bear out this observation. Cf. Neumann.

'The temperament is shown in Lindley, 'Stimmung und Temper-
atur', p.273 (20b).

'Translated in Barbour, Tuning and Temperament, p.196

'Cf. Telemann's own statement: 'my system is not based on any key-
board temperament . . .'

'The French version of the Essai is not, properly speaking, a trans-
lation. It appeared simultaneously with the German version and was prepared for the benefit of Quantz's patron, Frederick of Prussia, who had difficulty reading and speaking German. See N. Mitford, Frederick the Great (London, 1970/84), p.20, 205. G. A. Sorge, in 'Anmer-
kungen über Herr Quanzens ... #D und bE-Klappe auf der Quer-
flöte', equates Quantz's temperament with that advocated by Scheibe and Telemann.

'Quantz's invention was welcomed by Castillon and other writers on the flute of this period. See E. R. Reilly, 'Quantz and his Versuch; Three Studies' (New York, 1971), pp.55, 91, citing I. S. Petri, Anleitung zur praktischen Musik (Lauban, 1767/82) and J. G. Tromlitz, Aus-
führlicher und gründlicher Unterricht die Flöte zu spielen (Leipzig, 1791).

'See Castillon (1777).

'This is presumably on account of the stringed instruments with
which the flute is playing, whose basic pitch is entirely unfixed. Sorge
(1758), p.9 says that it is assumed that the flautist tunes his instrument

to the tonic of the piece he is playing.

'This sentence appears in the German version only.

'Cf. Lindley, 'Tartini-Schüler', on M. Stratico, a student of Tartini.

'It can be shown that for whichever of the standard commas we
choose, the perfect fifths in Leopold Mozart's system were theoretically
flatted by about one-sixth of that comma.' Chesnut, 'Mozart's Teaching of Intonation', p.260.


'Reprinted in Georg Philipp Telemann: Singen ist das fundament zur
Musik in allen Dingen, ed. W. Rackwitz (Leipzig, 1985), pp.266–73. This is a
continuation of Telemann's System of 1749.

'Cf. Quantz (1752)

'E. Halfpenny, 'A French Commentary on Quantz', ML, xxxvii
(1956), pp.61–6 contains a complete English translation.

'Translation from Halfpenny, 'A French Commentary', pp.65–6

'Chromatic notes may therefore be irregularly placed in Barca's

'system.

'It is not clear whether 'equal harmony' = 'equal temperament' or 'a
regular temperament.'